ANNAMALAI UNIVERSITY

FACULTY OF SCIENCE

DIVISION OF COMPUTER AND INFORMATION SCIENCE

M.Sc. Data Science

(2-Year)

Programme Code: SCIS22

Handbook

2019-2020

ANNAMALAI UNIVERSITY

REGULATIONS FOR THE TWO-YEAR POST GRADUATE PROGRAMMES UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

These Regulations are common to all the students admitted to the Two-Year Master's Programmes in the Faculties of Arts, Science, Indian Languages, Education, Marine Sciences, and Fine Arts from the academic year 2019-2020 onwards.

1. Definitions and Nomenclature

1.1 **University** refers to Annamalai University.

1.2 **Department** means any of the academic departments and academic centres at the University.

1.3 **Discipline** refers to the specialization or branch of knowledge taught and researched in higher education. For example, Botany is a discipline in the Natural Sciences, while Economics is a discipline in Social Sciences.

1.4 **Programme** encompasses the combination of courses and/or requirements leading to a Degree. For example, M.A., M.Sc.

1.5 **Course** is an individual subject in a programme. Each course may consist of Lectures/Tutorials/Laboratory work/Seminar/Project work/Experiential learning/ Report writing/viva-voce etc. Each course has a course title and is identified by a course code.

1.6 **Curriculum** encompasses the totality of student experiences that occur during the educational process.

1.7 **Syllabus** is an academic document that contains the complete information about an academic programme and defines responsibilities and outcomes. This includes course information, course objectives, policies, evaluation, grading, learning resources and course calendar.

1.8 **Academic Year** refers to the annual period of sessions of the University that comprises two consecutive semesters.

1.9 **Semester** is a half-year term that lasts for a minimum duration of 90 days. Each academic year is divided into two semesters.

1.10 **Choice Based Credit System** A mode of learning in higher education that enables a student to have the freedom to select his/her own choice of elective courses across various disciplines for completing the Degree programme.

1.11 **Core Course** is mandatory and an essential requirement to qualify for the Degree.

1.12 **Elective Course** is a course that a student can choose from a range of alternatives.

1.13 **Value-added Courses** are optional courses that complement the students' knowledge and skills and enhance their employability.

1.14 **Credit** refers to the quantum of course work in terms of number of class hours in a semester required for a programme. The credit value reflects the content and duration of a particular course in the curriculum.

1.15 **Credit Hour** refers to the number of class hours per week required for a course in a semester. It is used to calculate the credit value of a particular course.

1.16 **Programme Outcomes (POs)** are statements that describe crucial and essential knowledge, skills and attitudes that students are expected to achieve and can reliably manifest at the end of a programme.

1.17 **Programme Specific Outcomes (PSOs)** are statements that list what the graduate of a specific programme should be able to do at the end of the programme.

1.18 Learning Objectives also known as Course Objectives are statements that define the expected goal of a course in terms of demonstrable skills or knowledge that will be acquired by a student as a result of instruction.

1.19 Course Outcomes (COs) are statements that describe what students should be able to achieve/demonstrate at the end of a course. They allow follow-up and measurement of learning objectives.

1.20 Grade Point Average (GPA) is the average of the grades acquired in various courses that a student has taken in a semester. The formula for computing GPA is given in section 11.3

1.21 Cumulative Grade Point Average (CGPA) is a measure of overall cumulative performance of a student over all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters.

1.22 Letter Grade is an index of the performance of a student in a particular course. Grades are denoted by the letters S, A, B, C, D, E, RA, and W.

2. Programme Offered and Eligibility Criteria

2.1 The Department of Computer and Informations Science offers a Two Year M.Sc. Data Science Programme. A pass in any Bachelor's degree programme of minimum 3 years duration with Mathematics or Statistics as any of the core/ancillary course at Graduate level or an examination accepted by the syndicate as equivalent are eligible for admission.

2.2 Reservation of seats for candidates belonging to ST/SCA/SC/MBC/DNC/BC/BC (Muslim) communities and Differently-abled will be made as per the rules and regulations of the Government of Tamil Nadu.

2.3 In the case of SC/ST and Differently - abled candidates, a pass is the minimum qualification for all the above Programmes.

3. Programme Duration

3.1 The Two Year Master's Programmes consist of two academic years.

3.2 Each academic year is divided into two semesters, the first being from July to November and the second from December to April.

3.3 Each semester will have 90 working days (18 weeks).

4. Programme Structure

4.1 The Two Year Master's Programme consists of Core Courses, Elective Courses (Departmental & Interdepartmental), and Project.

4.2 Core courses

4.2.1 These are a set of compulsory courses essential for each programme.

4.2.2 The core courses include both Theory (Core Theory) and Practical (Core Practical) courses.

4.3 Elective courses

4.3.1 **Departmental Electives (DEs)** are the Electives that students can choose from a range of Electives offered within the Department.

4.3.2 **Interdepartmental Electives (IDEs)** are Electives that students can choose from amongst the courses offered by other departments of the same faculty as well as by the departments of other faculties.

4.3.3 Students shall take a combination of both DEs and IDEs.

4.4 Experiential Learning

4.4.1 Experiential learning provides opportunities to students to connect principles of the discipline with real-life situations.

4.4.2 In-plant training/field trips/internships/industrial visits (as applicable) fall under this category.

4.4.3 Experiential learning is categorised as Core.

4.5 Project

4.5.1 Each student shall undertake a Project in the final semester.

4.5.2 The Head of the Department shall assign a Research Supervisor to the student.

4.5.3 The Research Supervisor shall assign a topic for research and monitor the progress of the student periodically.

4.5.4 Students who wish to undertake project work in recognised institutions/industry shall obtain prior permission from the University. The Research Supervisor will be from the host institute, while the Co-Supervisor shall be a faculty in the parent department.

4.6 Value added Courses (VACs)

4.6.1 Students may also opt to take Value added Courses beyond the minimum credits required for award of the Degree. VACs are outside the normal credit paradigm.

4.6.2 These courses impart employable and life skills. VACs are listed in the University website and in the Handbook on Interdepartmental Electives and VACs.

4.6.3 Each VAC carries 2 credits with 30 hours of instruction, of which 60% (18 hours) shall be Theory and 40% (12 hours) Practical.

4.6.4 Classes for a VAC are conducted beyond the regular class hours and preferably in the II and III Semesters.

4.7 Online Courses

4.7.1 The Heads of Departments shall facilitate enrolment of students in Massive Open Online Courses (MOOCs) platform such as SWAYAM to provide academic flexibility and enhance the academic career of students.

4.7.2 Students who successfully complete a course in the MOOCs platform shall be exempted from one elective course of the programme.

4.8 Credit Distribution

The credit distribution is organised as follows:

	Credits
Core Courses	65-75
Elective Courses	15
Project	6-8
Total (Minimum requirement for award of Degree)	**90-95***

**Each Department shall fix the minimum required credits for award of the Degree within the prescribed range of 90-95 credits.*

4.9 Credit Hours

Each course is assigned credits and credit hours on the following basis:

1 Credit is defined as

1 Lecture period of one hour per week over a semester

1 Tutorial period of one hour per week over a semester

1 Practical/Project period of two or three hours (depending on the discipline) per week over a semester.

5 Attendance

5.1 Each faculty handling a course shall be responsible for the maintenance of *Attendance and Assessment Record* for candidates who have registered for the course.

5.2 The Record shall contain details of the students' attendance, marks obtained in the Continuous Internal Assessment (CIA) Tests, Assignments and Seminars. In addition the Record shall also contain the organisation of lesson plan of the Course Instructor.

5.3 The record shall be submitted to the Head of the Department once a month for monitoring the attendance and syllabus coverage.

5.4 At the end of the semester, the record shall be duly signed by the Course Instructor and the Head of the Department and placed in safe custody for any future verification.

5.5 The Course Instructor shall intimate to the Head of the Department at least seven calendar days before the last instruction day in the semester about the attendance particulars of all students.

5.6 Each student shall have a minimum of 75% attendance in all the courses of the particular semester failing which he or she will not be permitted to write the End-Semester Examination. The student has to redo the semester in the next year.

5.7 Relaxation of attendance requirement up to 10% may be granted for valid reasons such as illness, representing the University in extracurricular activities and participation in NCC/NSS/YRC/RRC.

6 Mentor-Mentee System

6.1 To help the students in planning their course of study and for general advice on the academic programme, the Head of the Department will attach certain number of students to a member of the faculty who shall function as a Mentor throughout their period of study.

6.2 The Mentors will guide their mentees with the curriculum, monitor their progress, and provide intellectual and emotional support.

6.3 The Mentors shall also help their mentees to choose appropriate electives and value-added courses, apply for scholarships, undertake projects, prepare for competitive examinations such as NET/SET, GATE etc., attend campus interviews and participate in extracurricular activities.

7 Examinations

7.1 The examination system of the University is designed to systematically test the student's progress in class, laboratory and field work through Continuous Internal Assessment (CIA) Tests and End-Semester Examination (ESE).

7.2 There will be two CIA Tests and one ESE in each semester.

7.3 The Question Papers will be framed to test different levels of learning based on Bloom's taxonomy viz. Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation/Creativity.

7.4 Continuous Internal Assessment Tests

7.4.1 The CIA Tests shall be a combination of a variety of tools such as class tests, assignments, seminars, and viva-voce that would be suitable to the course. This requires an element of openness.

7.4.2 The students are to be informed in advance about the assessment procedures.

7.4.3 The pattern of question paper will be decided by the respective faculty.

7.4.4 CIA Test-I will cover the syllabus of the first two units while CIA Test-II will cover the last three units.

7.4.5 CIA Tests will be for two to three hours duration depending on the quantum of syllabus.

7.4.6 A student cannot repeat the CIA Test-I and CIA Test-II. However, if for any valid reason, the student is unable to attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

7.5 End Semester Examinations (ESE)

7.5.1 The ESE for the first/third semester will be conducted in November and for the second/fourth semester in May.

7.5.2 A candidate who does not pass the examination in any course(s) of the first, second and third semesters will be permitted to reappear in such course(s) that will be held in April and November in the subsequent semester/year.

7.5.3 The ESE will be of three hours duration and will cover the entire syllabus of the course.

8 Evaluation

8.1 Marks Distribution

8.1.1. Each course, both Theory and Practical as well as Project/Internship/Field work/In-plant training shall be evaluated for a maximum of 100 marks.

8.1.2. For the theory courses, CIA Tests will carry 25% and the ESE 75% of the marks.

8.1.3. For the Practical courses, the CIA Tests will constitute 40% and the ESE 60% of the marks.

8.2. Assessment of CIA Tests

8.2.1 For the CIA Tests, the assessment will be done by the Course Instructor

8.2.2 For the Theory Courses, the break-up of marks shall be as follows:

	Marks
Test-I & Test-II	15
Seminar	05
Assignment	05
Total	25

8.2.3 For the Practical Courses (wherever applicable), the break-up of marks shall be as follows:

	Marks
Test-I	15
Test-II	15
Viva-voce and Record	10
Total	40

8.3 Assessment of End-Semester Examinations

8.3.1 Evaluation for the ESE is done by both External and Internal examiners (Double Evaluation).

8.3.2 In case of a discrepancy of more than 10% between the two examiners in awarding marks, third evaluation will be resorted to.

8.4 Assessment of Project/Dissertation

8.4.1 The Project Report/Dissertation shall be submitted as per the guidelines laid down by the University.

8.4.2 The Project Work/Dissertation shall carry a maximum of 100 marks.

8.4.3 CIA for Project will consist of a Review of literature survey, experimentation/field work, attendance etc.

8.4.4 The Project Report evaluation and viva-voce will be conducted by a committee constituted by the Head of the Department.

8.4.5 The Project Evaluation Committee will comprise the Head of the Department, Project Supervisor, and a senior faculty.

8.4.6 The marks shall be distributed as follows:

Continuous Internal Assessment (25 Marks)		**End Semester Examination (75 Marks)**	
Review-I 10	Review-II: 15	Project / Dissertation Evaluation	Viva-voce
		50	25

8.5 Assessment of Value-added Courses

8.5.1 Assessment of VACs shall be internal.

8.5.2 Two CIA Tests shall be conducted during the semester by the Department(s) offering VAC.

8.5.3 A committee consisting of the Head of the Department, faculty handling the course and a senior faculty member shall monitor the evaluation process.

8.5.4 The grades obtained in VACs will not be included for calculating the GPA.

8.6 Passing Minimum

8.6.1 A minimum of 50% marks in each course is prescribed for a pass.

8.6.2 While a minimum of 40% marks in each course is essential for the End Semester Examinations, there is no passing minimum for CIA Tests.

8.6.3 A student is declared to have passed in each course if he/she secures not less than 40% marks in the End Semester Examination and not less than 50% marks in aggregate taking CIA and End Semester Examination marks together.

8.6.4 A candidate who has not secured a minimum of 50% of marks in a course (CIA + End Semester) shall reappear for the course in the next semester/year.

9. Conferment of the Master's Degree

A candidate who has secured a minimum of 50% marks in all courses prescribed in the programme and earned the minimum required credits shall be considered to have passed the Master's Programme.

10. Marks and Grading

10.1 The performance of students in each course is evaluated in terms Grade Point (GP).

10.2 The sum total performance in each semester is rated by Grade Point Average (GPA) while Cumulative Grade Point Average (CGPA) indicates the Average Grade Point obtained for all the courses completed from the first semester to the current semester.

10.3 The GPA is calculated by the formula

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{n} C_i}$$

where, $\boldsymbol{C_i}$ is the Credit earned for the Course $\boldsymbol{i}$ in any semester;

$\boldsymbol{G_i}$ is the Grade Point obtained by the student for the Course $\boldsymbol{i}$ and

$\boldsymbol{n}$ is the number of Courses passed in that semester.

CGPA is the Weighted Average Grade Point of all the Courses passed starting from the first semester to the current semester.

$$CGPA = \frac{\sum_{i=1}^{m} \sum_{i=1}^{n} C_i G_i}{\sum_{i=1}^{m} \sum_{i=1}^{n} C_i}$$

where, $\boldsymbol{C_i}$ is the Credit earned for the Course $\boldsymbol{i}$ in any semester;

$\boldsymbol{G_i}$ is the Grade Point obtained by the student for the Course $\boldsymbol{i}$ and

$\boldsymbol{n}$ is the number of Courses passed in that semester.

$\boldsymbol{m}$ is the number of semesters

10.4 Evaluation of the performance of the student will be rated as shown in the Table.

Letter Grade	Grade Points	Marks %
S	10	90 and above
A	9	80-89
B	8	70-79
C	7	60-69
D	6	55-59
E	5	50-54
RA	0	Less than 50
W	0	Withdrawn from the examination

10.5 Classification of Results. The successful candidates are classified as follows:

10.5.1 For **First Class with Distinction:** Candidates who have passed all the courses prescribed in the Programme *in the first attempt* with a CGPA of 8.25 or above within the programme duration. Candidates who have withdrawn from the End Semester Examinations are still eligible for First Class with Distinction (*See Section 12 for details*).

10.5.2 For **First Class:** Candidates who have passed all the courses with a CGPA of 6.5 or above.

10.5.3 For **Second Class:** Candidates who have passed all the courses with a CGPA between 5.0 and less than 6.5.

10.5.4 Candidates who obtain highest marks in all examinations at the first appearance alone will be considered for University Rank.

10.6 Course-Wise Letter Grades

10.6.1 The percentage of marks obtained by a candidate in a course will be indicated in a letter grade.

10.6.2 A student is considered to have completed a course successfully and earned the credits if he/she secures an overall letter grade other than RA.

10.6.3 A course successfully completed cannot be repeated for the purpose of improving the Grade Point.

10.6.4 A letter grade RA indicates that the candidate shall reappear for that course. The RA Grade once awarded stays in the grade card of the student and is not deleted even when he/she completes the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd/Even semester in which the candidate has appeared for clearance of the arrears.

10.6.5 If a student secures RA grade in the Project Work/Field Work/Practical Work/Dissertation, he/she shall improve it and resubmit if it involves only rewriting/ incorporating the clarifications suggested by the evaluators or he/she can re-register and carry out the same in the subsequent semesters for evaluation.

11. Provision for Withdrawal from the End Semester Examination

11.1 The letter grade W indicates that a candidate has withdrawn from the examination.

11.2 A candidate is permitted to withdraw from appearing for the ESE for valid reasons. However, such permission is granted only once during the entire duration of the programme.

11.3 The application for withdrawal shall be made ten days prior to the commencement of the examination and duly approved by the Controller of Examinations. Notwithstanding the mandatory prerequisite of ten days notice, due consideration will be given under extraordinary circumstances.

11.4 Withdrawal is not granted for arrear examinations of courses in previous semesters and for the final semester examinations.

11.5 Candidates who have been granted permission to withdraw from the examination shall reappear for the courses in the subsequent semester/year.

11.6 Withdrawal shall not be taken into account as an appearance for the examination when considering the eligibility of the candidate to qualify for First Class with Distinction.

12. Academic misconduct

Any action that results in an unfair academic advantage/interference with the functioning of the academic community constitutes academic misconduct. This includes but is not limited to cheating, plagiarism, altering academic documents, fabrication/falsification of data, submitting the work of another student, interfering with other students' work, removing/defacing library or computer resources, stealing other students' notes/assignments, and electronically interfering with other students'/University's intellectual property. Since many of these acts may be committed unintentionally due to lack of awareness, students shall be sensitised on issues of academic integrity and ethics.

13. Transitory Regulations

Wherever there has been a change of syllabi, examinations based on the existing syllabus will be conducted for two consecutive years after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that, the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendation of the Head of the Department concerned.

14. *Notwithstanding anything contained in the above pages as Rules and Regulations governing the Two Year Master's Programmes at Annamalai University, the Syndicate is vested with the powers to revise them from time to time on the recommendations of the Academic Council.*

Annamalai University

Division of Computer and Informations Science

M.Sc. Data Science (Two Year) Programme

Programme Code: SCIS22

Programme Structure
(For students admitted from the academic year 2019-2020)

Course Code	Course Title	Hours/ Week		C	Marks		
		L	P		CIA	ESE	Total
	FIRST SEMESTER						
19PDSC11	Core 1: Statistical Methods	5		5	25	75	100
19PDSC12	Core 2: Introduction to Data Science	5		5	25	75	100
19PDSC13	Core 3: Advanced Data Base Management Systems	4		4	25	75	100
19PDSC14	Core 4: Advanced Java Programming	4		4	25	75	100
19PDSC15	Core 5: Advanced Web Technology	4		4	25	75	100
19PDSP16	Core 6: RDBMS – Lab		4	2	40	60	100
19PDSP17	Core 7: Advanced Web Technology – Lab		4	2	40	60	100
	Total credits			26			
	SECOND SEMESTER						
19PDSC21	Core 8: Distributed Operating System	4		4	25	75	100
19PDSC22	Core 9: Dot Net Programming	5		5	25	75	100
19PDSC23	Core 10: Data Science with R Programming	5		5	25	75	100
19PDSE24	Elective I (IDE)	3		3	25	75	100
19PDSE25	Elective II (DE)	3		3	25	75	100
19PDSP26	Core 11: Dot Net Programming Lab		4	2	40	60	100
19PDSP27	Core 12: R Programming for Data Analytics – Lab		4	2	40	60	100
	Total credits			24			
	THIRD SEMESTER						
19PDSC31	Core 13: Cryptography and Network Security	5		5	25	75	100
19PDSC32	Core 14: Data Analytics using Python	5		5	25	75	100
19PDSC33	Core 15: Machine Learning	4		4	25	75	100
19PDSE34	Elective III (IDE)	3		3	25	75	100
19PDSE35	Elective IV (DE)	3		3	25	75	100
19PDSP36	Core 16: Data Analytics using Python Programming – Lab		4	2	40	60	100
19PDSP37	Core 17: Machine Learning – Lab		4	2	40	60	100
	Total credits			24			
	FOURTH SEMESTER						
19PDSC41	Core 18: Big Data Analytics	4		4	25	75	100
19PDSC42	Core 19: Software Project Management	4		4	25	75	100
19PDSE43	Elective V (DE)	3		3	25	75	100

19PDSC44	Project Work / Inplant training		08	08	50	150	200
	Total credits			19			
	TOTAL CREDITS			93			
	Value Added Courses						
	Online courses (SWAYAM, MOOC AND NPTEL)						

L- Lectures; P- Practical; C- Credits; CIA- Continuous Internal Assessment; ESE- End-Semester Examination

Note:

1. **Students shall take both Department Electives (DEs) and Interdepartmental Electives (IDEs) from a range of choices available.**
2. **Students may opt for any Value-added Courses listed in the University website.**

DEPARTMENT ELECTIVE COURSES

COURSE CODE	COURSE TITLE	L	P	C	CIA	ESE	Total
19PDSE25	Introduction to Data mining	3	-	3	25	75	100
19PDSE25	Web Database and Information System	3	-	3	25	75	100
19PDSE25	Green Computing	3	-	3	25	75	100
19PDSE35	Image and Video Analytics	3	-	3	25	75	100
19PDSE35	Data Science Ethics	3	-	3	25	75	100
19PDSE35	Cloud Computing	3	-	3	25	75	100
19PDSE42	Distributed and Parallel Computing	3	-	3	25	75	100
19PDSE42	Healthcare Data Analytics	3	-	3	25	75	100
19PDSE42	Business Intelligence	3	-	3	25	75	100

INTER-DEPARTMENT ELECTIVE COURSES

COURSE CODE	COURSE TITLE	L	P	C	CIA	ESE	Total
Department of Statistics							
19STSE215.4	Fundamentals of Business Statistics	3	-	3	25	75	100
19STSE215.5	Time Series Analysis and Forecasting	3	-	3	25	75	100
19STSE215.6	Multivariate Data Analytics	3	-	3	25	75	100
Department of Business Administration							
19ABUS315.1	Management Decision Analysis	3	-	3	25	75	100
19ABUS315.2	Soft Skills Development	3	-	3	25	75	100
19ABUS315.3	Financial Risk Analysis and Management	3	-	3	25	75	100

Programme Outcomes (Po)

On completion of Two Year M.Sc. Data Science, students will be able to

PO1: Domain knowledge: Demonstrate knowledge of basic concepts, principles and applications of the specific science discipline.

PO2: Resource Utilisation. Cultivate the skills to acquire and use appropriate learning resources including library, e-learning resources, ICT tools to enhance knowledge-base and stay abreast of recent developments.

PO3: Analytical and Technical Skills: Ability to handle/use appropriate tools/techniques/equipment with an understanding of the standard operating procedures, safety aspects/limitations.

PO4: Critical thinking and Problem solving: Identify and critically analyse pertinent problems in the relevant discipline using appropriate tools and techniques as well as approaches to arrive at viable conclusions/solutions.

PO5: Project Management: Demonstrate knowledge and scientific understanding to identify research problems, design experiments, use appropriate methodologies, analyse and interpret data and provide solutions. Exhibit organisational skills and the ability to manage time and resources.

PO6: Individual and team work: Exhibit the potential to effectively accomplish tasks independently and as a member or leader in diverse teams, and in multidisciplinary settings.

PO7: Effective Communication: Communicate effectively in spoken and written form as well as through electronic media with the scientific community as well as with society at large. Demonstrate the ability to write dissertations, reports, make effective presentations and documentation.

PO8: Environment and Society: Analyse the impact of scientific and technological advances on the environment and society and the need for sustainable development.

PO9: Ethics: Commitment to professional ethics and responsibilities.

PO10: Life-long learning: Ability to engage in life-long learning in the context of the rapid developments in the discipline.

Programme Specific Outcomes (Pso)

At the end of the programme, the student will be able to

PSO1: Take leading roles in industry, academia, entrepreneurship and applications.

PSO2: Analyze the data and apply statistical with machine learning concepts, and interpret the results obtained in their operational context.

PSO3: Scientific, ethical and socially responsible approach for conducting and contributing to research in their specific area of study and to international trends in and related to their field of study.

PSO4: Implement the concepts of Statistics, optimization techniques, Data Repository, Data Analytics on real world problems, and to take a decision on the problem.

PSO5: Identify the appropriate mathematical and statistical techniques to solve the problems and give right solution to the industry and scientific communities, and the society.

PSO6: Develop programming skills in recent data analysis software to implement the above concepts.

PSO7: Handle the projects related to electronic commerce, software development related to on-line applications and can achieve organizational goals and objectives.

PSO8: Control, and maintain the communication system networks, and they should be cope up with the data analyzing techniques.

SYLLABUS

SEMESTER-I

19PDSC11: Core Course 01 – Statistical Methods **Credits:5 Hours:5**

Learning Objectives (LO):

Obtain knowledge on sampling, tests of hypothesis, and statistical tests like t-test, F-test, Goodness of Fit, and Confidence interval.
Train the students to use time series models like autoregressive model and autocorrelation, and Markov models; and gain knowledge on model fitting.

Unit-1:

Descriptive statistics: Classical and axiomatic definitions of Probability and consequences. Law of total probability, Conditional probability, Bayes' theorem and applications. Discrete and continuous random variables.

Unit-2:

Distribution functions and their properties: Standard discrete and continuous probability distributions - Bernoulli, Uniform, Binomial, Poisson, Geometric, Rectangular, Exponential, Normal. Random vectors, Joint and marginal distributions, Conditional distributions, Distributions of functions of random variables. Mathematical expectation and conditional expectation. Central limit theorem.

Unit -3:

Testing: Hypothesis testing, Estimation and sampling techniques, Sampling distributions of sample mean, sample variance, t, chi-square and F tests of significance.

Unit-4:

Non-parametric tests: Goodness of fit, Test of independence, sign, run, Wilcoxon, Mann-Whitney, Wald-Wolfowitz.

Unit-5:

Multivariate Distance: Mean vector, co-variance matrix, Generalized variance, Hotling's T^2 Mahalanobis test, Battacharya Diatance, Test for equality of Mean vector and Co-variance matrices of two populations, Elements of Decision Theory and Bayesian approach.

Text Books:

1. Statistical Methods 3rd Edition by Rudolf Freund and William J. Wilson, Academic Press, 2010.

Supplementary Books:

1. Statistical Methods by S. P. Gupta, Sultan Chand & Sons Publications, 2012.
2. Statistical Methods by Y P Aggarwal, Sterling Publishers Pvt.Ltd, 2010.

Course Outcomes (COs):

CO1:	The students should have knowledge on assimilate the data and fit-in appropriate time series model.
CO2:	The students should have develop the software for the models at implementation level.
CO3:	The students should have the capability of developing statistical packages, which computes descriptive statistics.
CO4:	The students should have compares means and variances of the data; and fits the time series models for the given data.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓		✓			✓			✓	✓	✓	✓		✓	✓	✓
CO2	✓		✓	✓	✓						✓	✓	✓	✓	✓		✓	✓
CO3	✓	✓	✓		✓						✓		✓	✓			✓	✓
CO4	✓										✓							

19PDSC12: Core Course 02 – Introduction To Data Science

Credits:5
Hours:5

Learning Objectives (LO):

To develop fundamental knowledge of concepts underlying data science and give a hands-on experience with real-world data analysis.

Unit-1:

Introduction: What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed, Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Introduction to R.

Unit-2:

Data Analysis and Basic Tools: Exploratory Data Analysis (EDA) and the Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA - The Data Science Process - Case Study: Real Direct (online real estate firm), Three Basic Machine Learning Algorithms - Linear Regression - k-Nearest Neighbors (k-NN) - k-means - Feature Generation and Feature Selection (Extracting Meaning From Data).

Unit-3:

Feature Extraction: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests.

Unit-4:

Recommendation Systems: Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine.

Unit-5:

Dimensionality Reduction: Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system

Text Book:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline. O'Reilly Edition, 2014.

Supplementary Books:

1. Jure Leskovek, Anand Rajaraman and Jerey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.

Course Outcomes (COs):

CO1:	Know basic notions and definitions in data analysis, machine learning.
CO2:	Know standard methods of data analysis and information retrieval.
CO3:	Be able to formulate the problem of knowledge extraction as combinations of data filtration, analysis and exploration methods.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	
CO3	✓		✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	

19PDSC13: Core Course 03 – Advanced Database Management Systems

Credits:4
Hours:4

Learning Objectives (LO):

To Acquire Knowledge of Database Models.
To understand distributed database architecture.
To learn the concepts of spatial database.
To familiar with temporal database.

Unit-1:

Relational and parallel Database Design: Basics, Entity Types, Relationship Types, ER Model, ER-to-Relational Mapping algorithm. Normalization: Functional Dependency, 1NF, 2NF, 3NF, BCNF,4NF and 5NF. Architecture,I/O Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism.

Unit-2:

Distributed and Object based Databases: Architecture, Distributed data storage, Distributed transactions, Commit protocols, Concurrency control, Query Processing. Complex Data Types, Structured Types and Inheritance, Table Inheritance, array and Multiset, Object Identity and Reference Types, Object Oriented versus Object Relational.

Unit-3:

Spatial Database: Spatial Database Characteristics, Spatial Data Model, Spatial Database Queries, Techniques of Spatial Database Query, Logic based Databases: Introduction, Overview, Propositional Calculus, Predicate Calculus, Deductive Database Systems, Recursive Query Processing.

Unit-4:

XML Databases: XML Hierarchical data model, XML Documents, DTD, XML Schema, XML Querying, XHTML, Illustrative Experiments

Unit-5:

Temporal Databases: Introduction, Intervals, Packing and Unpacking Relations, Generalizing the relational Operators, Database Design, Integrity Constraints, Multimedia Databases: Multimedia Sources, Multimedia Database Queries, Multimedia Database Applications.

Text Book :

1. Abraham Silberschatz, Henry F Korth , S Sudarshan, “Database System Comcepts”, 6th edition , McGraw-Hill International Edition , 2011

2. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education Reprint 2016.

Supplementary Books:

1. Ramez Elmasri, Shamkant B Navathe, "Fundamental of Database Systems", Pearson, 7th edition 2016.
2. Thomas Connolly, Carolyn Begg., "Database Systems a practical approach to Design, Implementation and Management ", Pearson Education, 2014.

Course Outcomes (COs):

On successful completion of the course, the students will be able to

CO1:	Know about the Various data models.
CO2:	Works on Database Architecture
CO3:	Analyze data patterns
CO4:	Handle object oriented databases.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓				✓		✓		✓		✓	✓		✓		✓	✓	
CO2	✓	✓	✓				✓			✓		✓		✓		✓	✓	
CO3	✓			✓		✓		✓		✓		✓	✓	✓		✓		
CO4		✓		✓		✓	✓	✓	✓			✓		✓		✓	✓	

19PDSC14: Core Course 04 – Advanced Java Programming **Credits:4 Hours:4**

Learning Objectives (LO):

To deepen student's programming skills by analyzing the real world problem in a programmer's point of view and implement the concepts in real time projects

To enable the students to learn the ethical, historical, environmental and technological aspects of Advanced Java Programming and how it impacts the social and economic development of society.

UNIT-1:

Design Patterns: Introduction to Design patterns - Catalogue for Design Pattern - Factory Method Pattern, Prototype Pattern, Singleton Pattern- Adapter Pattern- Proxy Pattern-Decorator Pattern-Command Pattern- Template Pattern- Mediator Pattern-Collection Framework – Array List class – Linked List class – Array List vs. Linked List - List Iterator interface - Hash Set class- Linked Hash Set class-Tree Set class Priority Queue class - Map interface-Hash Map class- Linked Hash Map class –Tree Map class - Comparable interface -Comparator interface-Comparable vs. Comparator

UNIT-2:

Applet Fundamentals- Applet Class - Applet lifecycle- Steps for Developing Applet Programs- Passing Values through Parameters- Graphics in Applets- GUI Application - Dialog Boxes - Creating Windows - Layout Managers – AWT Component classes – Swing component classes-

Borders – Event handling with AWT components - AWT Graphics classes - File Choosers - Color Choosers – Tree – Table –Tabbed panels–Progressive bar - Sliders.

UNIT-3:

JDBC **-**Introduction - JDBC Architecture - JDBC Classes and Interfaces – Database Access with MySQL -Steps in Developing JDBC application - Creating a New Database and Table with JDBC - Working with Database Metadata; Java Networking Basics of Networking - Networking in Java-Socket Program using TCP/IP - Socket Program using UDP- URL and Inet address classes.

UNIT–4:

Servlet: Advantages over Applets - Servlet Alternatives - Servlet Strengths - Servlet Architecture - Servlet Life Cycle – Generic Servlet, Http Servlet - First Servlet - Invoking Servlet - Passing Parameters to Servlets - Retrieving Parameters - Server-Side Include – Cookies- JSP Engines - Working with JSP - JSP and Servlet - Anatomy of a JSP Page- Database Connectivity using Servlets and JSP.

UNIT-5:

Lambda Expressions- Method Reference- Functional Interface- Streams API, Filters- Optional Class- Nashorn- Base 64 Encode Decode- JShell(RPEL)- Collection Factory Methods- Private Interface Methods- Inner Class Diamond Operator- Multiresolution Image API.

Textbooks

Bert Bates, Karthy Sierra , Eric Freeman, Elisabeth Robson, “Head First Design Patterns”, O’REILLY Media Publishers.(1st-Unit).

1. Herbert Schildt, “Java: A Beginner Guide”, Oracle Pres-Seventh Edition. (2nd and 3rd Unit).
2. Murach’s, “Java Servlets and JSP”, 2nd Edition, Mike Murach & Associates Publishers; 3rd Edition. (4th Unit).
3. Warburton Richard, “Java 8 Lambdas”, Shroff Publishers & Distributors Pvt Ltd. (5th Unit).

Supplementary Books:

1. Paul Deitel and Harvey Deitel, “Java: How to Program”, Prentice Hall Publishers; 9th Edition.
2. Jan Graba, “An Introduction to Network Programming with Java-Java 7 Compatible”, 3rd Edition, Springer.

Course Outcomes:

On successful completion of the course, the students will be able to

CO1:	Learn the Internet Programming, using Java Applets and create a full set of UI widgets using Abstract Windowing Toolkit (AWT) & Swings
CO2:	Learn to access database through Java programs, using Java Data Base Connectivity (JDBC)
CO3:	Create dynamic web pages using Servlets and JSP
CO4:	Invoke the remote methods and multitier application using Remote Method Invocation (RMI) and EJB

Course Outcomes (COs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓		✓	✓	✓
CO2			✓	✓			✓	✓		✓	✓	✓	✓	✓		✓	✓	✓
CO3	✓	✓		✓		✓	✓	✓			✓	✓					✓	✓
CO4			✓	✓		✓		✓	✓			✓	✓			✓	✓	✓

19PDSC15:	Core Course 05 – Advanced Web Technology	Credits:4 Hours:4

Learning Objectives (LO):

Explore the backbone of web page creation by developing .NET skill.
Enrich knowledge about HTML control and web control classes
Provide depth knowledge about ADO.NET
Understand the need of usability, evaluation methods for web services.

Unit-1:

OVERVIEW OF ASP.NET - The .NET framework – Learning the .NET languages : Data types – Declaring variables- Scope and Accessibility- Variable operations- Object Based manipulation- Conditional Structures- Loop Structures- Functions and Subroutines. Types, Objects and Namespaces : The Basics about Classes- Value types and Reference types- Advanced class programming- Understanding name spaces and assemblies. Setting Up ASP.NET and IIS .

Unit-2:

Developing ASP.NET Applications - ASP.NET Applications: ASP.NET applications– Code behind- The Global.asax application file- Understanding ASP.NET Classes- ASP.NET Configuration. Web Form fundamentals: A simple page applet- Improving the currency converter- HTML control classes- The page class- Accessing HTML server controls. Web controls: Web Control Classes – Auto PostBack and Web Control events- Accessing web controls. Using Visual Studio.NET: Starting a Visual Studio.NET Project- Web form Designer- Writing code- Visual studio.NET debugging. Validation and Rich Controls: Validation- A simple Validation example- Understanding regular expressions- A validated customer form. State management - Tracing, Logging, and Error Handling.

Unit-3:

Working with Data - Overview of ADO.NET - ADO.NET and data management- Characteristics of ADO.NET-ADO.NET object model. ADO.NET data access : SQL basics– Select , Update, Insert, Delete statements- Accessing data- Creating a connection- Using a command with a DataReader - Accessing Disconnected data - Selecting multiple tables – Updating Disconnected data. Data binding: Single value Data Binding- Repeated value data binding- Data binding with data bases. Data list – Data grid – Repeater – Files, Streams and Email – Using XML

Unit-4:

Web Services - Web services Architecture : Internet programming then and now- WSDL–SOAP- Communicating with a web service-Web service discovery and UDDI. Creating Web services : Web service basics- The StockQuote web service – Documenting the web service- Testing the web service- Web service Data types- ASP.NET intrinsic objects. Using web services: Consuming a web service- Using the proxy class- An example with TerraService.

Unit-5:

Advanced ASP.NET - Component Based Programming: Creating a simple component – Properties and state- Database components- Using COM components. Custom controls: User Controls- Deriving Custom controls. Caching and Performance Tuning: Designing and scalability– Profiling- Catching- Output catching- Data catching. Implementing security: Determining security requirements- The ASP.NET security model- Forms authentication- Windows authentication.

Text Book:

1. Mathew Mac Donald, “ASP.NET Complete Reference”, TMH 2005.

Supplementary Books:

1. Crouch Matt J, “ASP.NET and VB.NET Web Programming”, Addison Wesley 2002.

2. J.Liberty, D.Hurwitz, “Programming ASP.NET”, Third Edition, O’REILLY, 2006.

Course Outcomes (COs):

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

CO1:	Design a web page with Web form fundamentals and web control classes
CO2:	Recognize the importance of validation control, cookies and session
CO3:	Apply the knowledge of ASP.NET object, ADO.NET data access and SQL to develop a client server model.
CO4:	Recognize the difference between Data list and Data grid controls in accessing data.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓			✓			✓
CO2				✓			✓	✓	✓	✓		✓	✓	✓		✓		
CO3	✓	✓	✓	✓		✓	✓	✓		✓		✓		✓	✓	✓	✓	✓
CO4			✓				✓	✓			✓	✓	✓	✓	✓	✓		✓

19PDSP16: Core Course 06 – Rdbms Lab **Credits:2 Hours:4**

Learning Objectives (LO):

Keep abreast of current developments to continue their own professional development.
To engage themselves in lifelong learning of Database management systems theories and technologies this enables them to purse higher studies.
To interact professionally with colleagues or clients located abroad and the ability to overcome challenges that arises from geographic distance, cultural differences, and multiple languages in the context of computing.
Develop team spirit, effective work habits, and professional attitude in written and oral forms, towards the development of database applications.

List of Exercises

Cycle-I:

(Simple SQL)

1. Employee Management System Using SQL Commands.
2. Students Management System Using SQL Commands.
3. Bank Management System Using SQL Commands.
4. Index Creation.
5. Implementation of SQL queries for route database.
6. Implementation of SQL queries for route database - part I.
7. Implementation of SQL queries for route database - Part II.
8. Creating view using SQL commands.
9. Creation of Table Partition.
10. Default trigger procedure and drop command
11. Report creation.

Cycle-II:

(PL/SQL)

12. Factorial of number
13. Checking whether a number is prime or not
14. Fibonacci series
15. Reversing the string
16. Swapping of two numbers
17. Odd or even number
18. Duplication of records

Course Outcomes (COs):

CO1:	In drawing the ER, EER, and UML Diagrams.
CO2:	In analyzing the business requirements and producing a viable model for the implementation of the database.
CO3:	In converting the entity-relationship diagrams into relational tables.
CO4:	To develop appropriate Databases to a given problem that integrates ethical, social, legal, and economic concerns.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓		✓	✓	✓		✓		✓	✓		✓		✓	✓	
CO2	✓		✓	✓		✓		✓		✓		✓		✓		✓	✓	
CO3		✓		✓				✓				✓	✓	✓		✓		
CO4			✓	✓		✓		✓	✓	✓		✓		✓		✓	✓	

19PDSP17: Core Course 07 - Advanced Web Technology – Lab **Credits:2 Hours:4**

Learning Objectives (LO):

To understand the concept of web technologies.
To creating web pages by using HTML Tags.
To understand the importance of cascade style sheets in creating a web application.
To understand the importance of Java Script in creating a web Application
To understand the use of XML in Document type Definition.
To know about PHP scripts and create adaptive web pages.

LIST OF EXERCISES

- Write a HTML Program for using Image, Link and Formatting tags.
- Write a HTML Program to using table tag of your class Time table.
- Write a Forms in Html
- Write a HTML program to illustrate Frame tag..
- Write a HTML program to describe the cascade style sheet.
- Write a program to Document Type Definition in XML.
- Write a program For Validation using JavaScript.
- Write a Calculator program in Java script.
- Write a program for Multiplication table using Java script.
- Connection in My sql with php
- Insert record in mysql with php
- Create, Insert, Delete, Edit in mysql with php

Course Outcomes (COs):

On successful completion of the course, the students will be able to

CO1:	Develop to build a complete website using HTML
CO2:	Create web pages using DHTML and Cascading Style Sheets.
CO3:	Able to include JavaScript for form validations and email validations.
CO4:	Develop a simple web application using server side PHP programing and Database Connectivity using MySQL.
CO5:	Able to create a complete Web Application with all the required modules.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓			✓	✓						✓	✓				✓	✓
CO2	✓	✓		✓			✓			✓		✓	✓	✓		✓	✓	✓
CO3	✓		✓		✓	✓						✓	✓	✓		✓	✓	✓
CO4	✓	✓	✓				✓				✓	✓					✓	✓

SEMESTER II

19PDSC21: Core Course 08 – Distributed Operating System **Credits:4 Hours:4**

Learning Objectives (LO):

To study distributed operating system concepts
To understand hardware, software and communication in distributed OS
To learn the distributed resource management components.
Practices to learn concepts of OS and Program the principles of Operating Systems

UNIT-1:

Introduction – Operating System Definition – Functions of Operating System – Types of Advanced Operating System – Design Approaches – Synchronization Mechanisms – concepts of a Process – Critical Section Problem – Process Deadlock – Models of Deadlock – Conditions for Deadlock – System with single-unit requests, Consumable Resources , Reusable Resources.

UNIT- 2:

Distributed Operating Systems: Introduction- Issues – Communication Primitives – Inherent Limitations –Lamport's Logical Clock , Vector Clock, Global State , Cuts – Termination Detection – Distributed Mutual Exclusion – Non Token Based Algorithms – Lamport's Algorithm - Token Based Algorithms –Distributed Deadlock Detection – Distributed Deadlock Detection Algorithms – Agreement Protocols

UNIT- 3:

Distributed Resource Management – Distributed File Systems – Architecture – Mechanisms – Design Issues – Distributed shared Memory – Architecture – Algorithm – Protocols – Design Issues – Distributed Scheduling – Issues – Components – Algorithms.

UNIT- 4:

Failure Recovery and Fault Tolerance – Concepts – Failure Classifications – Approaches to Recovery – Recovery in Concurrent Systems – Synchronous and Asynchronous Check pointing

and Recovery –Check pointing in Distributed Database Systems – Fault Tolerance Issues – Two-Phase and Nonblocking Commit Protocols – Voting Protocols – Dynamic Voting Protocols.

UNIT-5:

Multiprocessor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory management – Reliability/Fault Tolerance – Database Operating Systems – concepts – Features of Android OS, Ubuntu, Google Chrome OS and Linux operating systems.

Text Books:

1. Mukesh Singhal N.G.Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill 2000.
2. Distributed Operating System – Andrew S. Tanenbaum, PHI.

Supplementary Books:

1. Abraham Silberschatz, Peter B.Galvin, G.Gagne, "Operating Concepts", 6th Edition Addison Wesley publications 2003.
2. Andrew S.Tanenbaum, "Modern Operating Systems", 2nd Edition Addison Wesley 2001

Course Outcomes (COs):

CO1:	Clear understanding on several resource management techniques like distributed shared memory and other resources
CO2:	Knowledge on mutual exclusion and Deadlock detection of Distributed operating system.
CO3:	Able to design and implement algorithms of distributed shared memory and commit protocols
CO4:	Able to design and implement fault tolerant distributed systems.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓		✓		✓			✓			✓				✓	✓	
CO2	✓		✓		✓							✓	✓	✓	✓	✓		
CO3	✓						✓					✓			✓			✓
CO4	✓	✓			✓						✓	✓	✓	✓		✓		

19PDSC22: Core Course 09 – Dot Net Programming **Credits:5 Hours:5**

Learning Objectives (LO):

To explore the backbone of web page creation by developing .NET skill.
To Familiar with Application, session and view state management
To Provide depth knowledge about ADO.NET
To Understand the need of usability, evaluation methods for web services
To acquire knowledge on the usage of recent platforms in developing web applications

Unit-1:

The .NET Framework - Learning the .NET languages - Introduction - Net revolution - .Net framework and its architecture – CLR – What is Assembly – Components of Assembly – DLL hell and Assembly Versioning- O Objects and Namespaces - Setting Up ASP.NET and IIS

Unit –2:

Developing VB.NET Applications - Introduction to VB.Net, The .Net Frame work and Common language runtime, Building VB. Net Application, VB IDE, forms, properties, events, VB language-console application and 46 windows application, data type, declaring variable, scope of variable, operators and statements - Windows Applications-forms, adding controls to forms, handling events, MsgBox, Input Box, multiple forms, handling mouse and Keyboard events, object oriented programmingcreating and using classes and objects, Handling Exceptions- on Error Goto

Unit- 3:

Developing - ASP.NET Applications - ASP.NET Applications – Understanding ASP.NET Controls - Overview of ASP.NET framework, Web Form fundamentals - Web control classes – Using Visual Stdio.NET - Validation and Rich Controls -State management – Tracing, Logging, and Error Handling.

Unit- 4:

Developing C#.NET Applications - Introducing C# - overview of C# - Literals,Variables- Data Types, -Operators, -checked and unchecked operators – Expressions – Branching -Looping-*Object Oriented Aspects Of C#:* Class – Objects - Constructors and its types- inheritance, properties, indexers, index overloading – polymorphism - sealed class and methods - interface, - abstract class, operator overloading, - delegates, events, errors and exception - Threading.

Unit-5:

ADO.NET - Overview of ADO.NET - ADO.NET data access – Connected and Disconnected Database, Create Connection using ADO.NET Object Model, Connection Class, Command Class Data binding – Data list – Data grid – Repeater – Files, Streams and Email – Using XML.

Text Books:

1. Struts: The Complete Reference,James Holmes 2nd Edition 2007 McGraw Hill Professional

2. Mathew Mac Donald, “ASP.NET Complete Reference”, TMH 2005

3. Herbert Schildt, “The Complete Reference: C# 4.0”, Tata McGraw Hill, 2012.
4. Christian Nagel et al. “Professional C# 2012 with .NET 4.5”, Wiley India, 2012

5. ASP.NET Unleashed, C# programming – Wrox publication

6. Visual Basic. NET Black Book, by Steven Holzner

Supplementary Books:

1. Jesse Liberty , ‘Programming C#, “ , 4th Edition, O'Reilly Media.

2. Mario Szpuszta, Matthew MacDonald , “Pro ASP.NET 4 in C# 2010: Includes Silverlight

2,“Apress, Third Edition

3. J.Liberty, D.Hurwitz, “Programming ASP.NET”, Third Edition, O’REILLY, 2006.

4. Visual Basic. Net programming in easy steps by Tim Anderson,

Course Outcomes (COs):

CO1:	Learn major programming paradigms and techniques involved in design and implementation of modern programming languages.
CO2:	Learn about Microsoft .NET framework
CO3:	By the end students can develop, implement and creating Applications with C#. VB.NET and ASP.NET

CO4:	Creating ASP.Net applications using standard .net controls.
CO5:	An ability to use current techniques, skills, and tools necessary for computing practice.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1			✓		✓		✓		✓	✓			✓					✓
CO2			✓		✓		✓			✓	✓	✓		✓	✓			
CO3	✓			✓		✓		✓		✓		✓	✓	✓		✓	✓	✓
CO4		✓		✓		✓		✓	✓		✓	✓		✓		✓	✓	✓
CO5	✓		✓		✓	✓		✓	✓					✓				

19PDSC23: Core Course 10 – Data Science With R Programming **Credits:5 Hours:5**

Learning Objectives (LO):

To provide an overview of a new language R used for data science and to introduce students to the R programming environment and related eco-system and thus provide them with an in demand skill-set, in both the research and business environments.

To demonstrate usage of as standard Programming Language.

To familiarize students with how various statistics like mean median etc. can be collected for data exploration in R and enable students to use R

Unit-1:

Overview and Preliminaries

Basic Features of R - Design of R System-Limitations of R – Installation – R studio - Getting started with R interface - Entering Input - R Objects – Attributes - Creating Vectors - Mixing Objects – Matrices – Lists – Factors - Data Frames.

Unit-2:

Input, Output, Reading and Subsetting

Reading Data Files - Reading in Larger Datasets - Calculating Memory Requirements - File Connections - Reading Lines of a Text File - Reading From a URL Connection - Subsetting a Vector - Subsetting a Matrix - Subsetting Lists - Subsetting Nested Elements of a List - Extracting Multiple Elements of a List - Partial Matching. Date, Time and Managing Data Frames Operations on Dates and Times - Data Frames - dplyr Package - Installing the dplyr package – select – filter – arrange – rename – mutate - group_by - pipeline operater.

Unit-3:

Control Structures and Loop Functions

if-else - for Loops - Nested for loops - while Loops - repeat Loops - next, break - Looping on the Command Line - lapply() - sapply() - split() - Splitting a Data Frame – tapply - apply() - Col/Row Sums and Means - mapply() - Vectorizing a Function.

Unit-4:

Statistics functions - Debugging, Profiling

Mean - Median - variance of the population - Estimated standard deviation - Standard scores – Sort – Rank – summary function - Debugging Tools in R - traceback() - debug() - recover() - Using system.time() - Timing Longer Expressions - The R Profiler - Using summaryRprof().

Unit-5:

Simulation and Graphs

Generating Random Numbers - Setting random number seed - Simulating Linear Model - Loading and Processing Raw Data – Creating a Graph - density plots - dot plots, bar charts - line charts - pie charts - box plots - Scatter plots.

Text Book:

1. Roger D. Peng, "R Programming for Data Science", Lean Publishing, (2015), ISBN: 9781365056826, 1365056821.

Supplementary Books:

1. Winston Chang, "R Graphics Cookbook", O'Reilly Media, Inc., (2012), ISBN: 9781449363086.
2. Using R for Introductory Statistics by John Verzani, CRC Press, 2004.

Course Outcomes (COs):

CO1:	Install and use R for simple programming tasks.
CO2:	Extend the functionality of R by using add-on packages and extract data from files and other sources and perform various data manipulation tasks on them.
CO3:	Code statistical functions in R and use R Graphics and Tables to visualize results of various statistical operations on data.
CO4:	Apply the knowledge of R gained to data Analytics for real life applications. to conduct analytics on large real life datasets.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		✓	✓	✓	✓		✓	✓		✓		✓	✓	✓	✓	✓		
CO2	✓		✓	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO3		✓		✓	✓	✓	✓			✓		✓	✓	✓	✓	✓		
CO4		✓		✓		✓		✓				✓	✓	✓	✓	✓	✓	

19PDSP26: Core Course 11 - Dot Net Programming Lab **Credits:2 Hours:4**

Learning Objectives (LO):

To impart basic knowledge of different control statements and array associated with C # programming.
To learn various C# elements and OOPS concepts.
To learn interface, delegates, event and error handling concepts in C#.
To impart knowledge on networking including socket programming and reflection.
To acquire a working knowledge of windows and web based applications.

LIST OF EXERCISE

1. Finding Prime number using Classes and Objects
2. Separating Odd/Even Number into Different Arrays
3. String Manipulations
4. Jagged Array manipulation
5. Implementing 'ref' and 'out' keywords
6. Implementing 'Params ' keyword
7. Boxing and Unboxing
8. Constructor Overloading
9. Implementing property
10. Implementing indexer
11. Implementing Multiple inheritance using Interface
12. Implementing Abstract Class
13. Exception Handling Using Try, Catch, and Finally
14. Demonstrating multicast Delegates
15. Implementing the Concept of Reflection
16. Socket Programming
17. Simple Calculator-A Window Application
18. Student Profile-A Window Application
19. Palindrome-A Web Application
20. Formatting Text-A Web Application

Course Outcomes (COs):

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

CO1:	Develop correct, well-documented C# programs using control statements.
CO2:	Develop object oriented programming using C# classes and objects.
CO3:	Handle the exception and event-driven programs.
CO4:	Perform network based programming including chat applications.
CO5:	Develop windows and web based applications.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓		✓	✓	✓		✓	✓		✓		✓			✓	✓
CO2			✓	✓	✓	✓	✓	✓		✓		✓		✓		✓	✓	
CO3		✓		✓		✓		✓		✓					✓			✓
CO4			✓	✓		✓		✓	✓			✓	✓			✓		
CO5	✓					✓		✓	✓				✓				✓	✓

19PDSP27: **Core Course 12 – R Programming For Data Analytics - Lab** **Credits:2 Hours:4**

Learning Objectives (LO):

To understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, array, recursion and function calls.
To learn how to use basic mathematical problems are evaluated and be able to manipulate text files and file operations.
To understand the process and will acquire skills necessary to effectively attempt a programming problem and implement it with a specific programming language - R.

List of Exercises

Cycle – I

1. R Program to check if a Number is Positive, Negative or Zero.

2. R program to check prime numbers.
3. R Program to check Armstrong Number.
4. R Program to Find Hash of File.
5. R Program to Root search.

Cycle – II

6. Factorial of number
7. Fibonacci series
8. Reversing the string
9. Swapping of two numbers
10. Odd or even number
11. Duplication of records
12. Convert Decimal into Binary using Recursion.

Course Outcomes (COs):

CO1:	Understand and summarize different File handling operations in R.
CO2:	Design and develop Client Server network applications using R.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		✓	✓	✓	✓		✓	✓		✓		✓	✓	✓	✓	✓		
CO2	✓		✓	✓		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	

SEMESTER – III

19PDSC31: **Core Course 13 – Cryptography And Network Security** **Credits:5 Hours:5**

Learning Objectives (LO):

To understand Cryptography Theories, Algorithms and Systems.
To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
To know about the malicious software & firewalls.

Unit- 1:

Introduction - Security trends – Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies – Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

Unit- 2:

Symmetric Encryption and Message Confidentiality - Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Stream Ciphers and RC4 , Chipher Block Modes of Operation, Location of Encryption Devices, Key Distribution. Public-key Cryptography and Message Authentication: Approaches to Message Authentication, Secure Hash Functions and HMAC, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.

Unit- 3:

Authentication Applications - Kerberos, x.509 Authentication Service, Public-Key Infrastructure. Electronic Mail Security: Pretty Good Privacy (PGP), S/MIME.

Unit- 4:

IP Security - IP Security Over view, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations. Web Security: Web Security Considerations, Secure Socket Layer(SSL) and Transport Layer Security(TLS), Secure Electronic Transaction(SET).Network Management Security: Basic Concepts of SNMP, SNMPv1 Community Facility, SNMPv3.

Unit- 5:

Intruders - Intruders, Intrusion Detection, Password Management. **Malicious Software:** Virus and Related Threats, Virus Countermeasures, Distributed Denial of Service Attacks. **Firewalls:** Firewall Design Principles, Trusted Systems, Common Criteria for Information Technology Security Evaluation.

Text books:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007, Reprint 2015.
2. Stallings William, "Cryptography and Network Security - Principles and Practice 2017.
3. William Stallings, "Network Security Essentials Applications and Standards "Third Edition, Pearson Education, 2008.

Supplementary Books:

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms And Protocols", Wiley Publications, 2003.
2. Charles Pfleeger, "Security In Computing", 4th Edition, Prentice Hall Of India, 2006.
3. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
4. Charlie Kaufman And Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication In Public World", PHI 2002.
5. Bruce Schneier And Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
6. Douglas R Simson "Cryptography – Theory And Practice", First Edition, CRC Press, 1995.
7. Http://Nptel.Ac.In/.

Course Outcomes (COs):

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

CO1:	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities
CO2:	Apply the different cryptographic operations of symmetric cryptographic algorithms
CO3:	Apply the different cryptographic operations of public key cryptography
CO4:	Apply the various Authentication schemes to simulate different applications.
CO5:	Understand various Security practices and System security standards

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓				✓		✓		✓			✓		✓			✓	
CO2			✓		✓		✓			✓			✓	✓		✓	✓	

CO3	✓			✓				✓		✓	✓		✓		✓			
CO4		✓		✓				✓	✓		✓	✓	✓			✓		
CO5	✓			✓				✓	✓		✓	✓	✓		✓	✓		

19PDSC32: Core Course 14 – Data Analytics Using Python **Credits:5 Hours:5**

Learning Objectives (LO):

To introduce the programming concepts and techniques.
To introduce the Python language syntax.
To learn control statements, loops, functions, and lists.
To write programs for a wide variety problems in maths, science, finance, and games.
To analyze and design programs.

Unit-1:

Algorithmic Problem Solving: Algorithms, Building Blocks Of Algorithms (Statements, State, Control Flow, Functions), Notation (Pseudo Code, Flow Chart, Programming Language), Algorithmic Problem Solving. Simple Strategies For Developing Algorithms (Iteration, Recursion). Illustrative Problems: Find Minimum In A List, Insert A Card In A List Of Sorted Cards, Guess An Integer Number In A Range, Towers Of Hanoi.

Unit-2:

Python Introduction: Python Interpreter And Interactive Mode; Values And Types: Int, Float, Boolean, String, And List; Variables, Expressions, Statements, Tuple Assignment, Precedence Of Operators, Comments; Modules And Functions, Function Definition And Use, Flow Of Execution, Parameters And Arguments; Illustrative Programs: Exchange The Values Of Two Variables, Circulate The Values Of N Variables, Distance Between Two Points.

Unit -3:

Conditionals: Boolean Values And Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); Iteration: State, While, For, Break, Continue, Pass; Fruitful Functions: Return Values, Parameters, Local And Global Scope, Function Composition, Recursion; Strings: String Slices Immutability, String Functions And Methods, String Module; Lists As Arrays. Illustrative Programs: Square Root, Gcd, Exponentiation, Sum An Array Of Numbers, Linear Search, Binary Search.

Unit -4:

Lists: List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters; Tuples: Tuple Assignment, Tuple As Return Value; Dictionaries: Operations And Methods; Advanced List Processing – List Comprehension; Illustrative Programs: Selection Sort, Insertion Sort, Mergesort, Histogram.

Unit-5:

Files And Exception: Text Files, Reading And Writing Files, Format Operator; Command Line Arguments, Errors And Exceptions, Handling Exceptions, Modules, Packages; Illustrative Programs: Word Count, Copy File.

Text Book:

1. Introduction to Programming Using Python, First Edition by Y. Daniel Liang,2013, Prentice Hall.

Supplementary Books:

1. Ljubomir Perkovic, “Introduction to Computing Using Python: An Application Development Focus”, John Wiley & Sons, 2012.
2. Dawson, Michael. Python Programming for the Absolute Beginner (3rd ed.). Boston, MA: Course Technology, 2010.

Course Outcomes (COs):

CO1:	Analyze and design strategies for solving basic programming problems.
CO2:	primitive data types, selection statements, loops, functions to write programs.
CO3:	Use Develop programs to solve a variety of problems in math, science, business, and games.
CO4:	Use the step-wise refinement approach.
CO5:	Use lists to store, process, and sort data.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓		✓
CO2	✓	✓										✓	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓			✓				✓		✓				✓
CO4	✓	✓									✓	✓		✓	✓	✓		✓
CO5	✓	✓		✓	✓													

19PDSC33: Core Course 15– Machine Learning **Credits:4 Hours:4**

Learning Objectives (LO):

To Learn about Machine Intelligence and Machine Learning applications
To implement and apply machine learning algorithms to real-world applications.
To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
To understand how to perform evaluation of learning algorithms and model selection.

UNIT-1:

INTRODUCTION- Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT-2:

NEURAL NETWORKS AND GENETIC ALGORITHMS :Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT-3:

BAYESIAN AND COMPUTATIONAL LEARNING : Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT-4:

INSTANT BASED LEARNING : K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT-5:

ADVANCED LEARNING: Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.

Text Book:

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

Supplementary Books:

1. EthemAlpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3. Michael Affenzeller, Stephan Winkler, Stefan Wagner, Andreas Beham, "Genetic Algorithms and Genetic Programming", CRC Press Taylor and Francis Group.

Course Outcomes (COs):

On completion of the course students will be expected to:

CO1:	Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
CO2:	Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
CO3:	Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-
CO4:	Be able to design and implement various machine learning algorithms in a range of real-world applications.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1					✓	✓			✓	✓		✓		✓			✓	
CO2			✓	✓		✓		✓		✓	✓	✓		✓		✓	✓	
CO3	✓			✓	✓	✓		✓				✓			✓			✓
CO4	✓	✓	✓	✓		✓		✓	✓	✓			✓			✓		✓

19PDSP36: Core Course 16 – Data Analytics Using Python Programming Lab **Credits:2 Hours:4**

Learning Objectives (LO):

To understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, array, recursion and function calls.
To learn how to use basic mathematical problems are evaluated and be able to manipulate text files and file operations.
To understand the process and will acquire skills necessary to effectively attempt a programming problem and implement it with a specific programming language - Python.
.

LIST OF EXERCISES

- Write a Python program to sum all the items in a list.

- Write a Python program to get the largest number from a list.
- Write a Python program to remove duplicates from a list.
- Write a Python program to generate and print a list of first and last 5 elements where the values are square of numbers between 1 and 30 (both included)
- Write a Python program to split a list into different variables.
- Write a Python program to print a nested lists (each list on a new line) using the print() function.
- Write a Python program to create a list with infinite elements.
- Write a Python program to access dictionary keys element by index.
- Write a Python program to remove duplicates from a list of lists.

Course Outcomes (COs):

CO1:	Understand and summarize different File handling operations in Python.
CO2:	Design and develop Client Server network applications using Python.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓	✓	✓		✓	✓		✓	✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓				✓		✓		✓		✓	✓	

19PDSP37: Core Course 17 - Machine Learning Lab **Credits:2 Hours:4**

Learning Objectives (LO):

To expose the students in emerging technologies in the areas of machine learning.
To make use of Data sets in implementing the machine learning algorithms
To implement the machine learning concepts and algorithms.
To develop a basic understanding of the principles of machine learning
To derive practical solutions using predictive analytics.
To Understand which techniques are more appropriate for which problems.
.

LIST OF EXERCISES

- Reading and writing into .csv files
- Implement the Find –S algorithm.
- Implement the Candidate-Elimination algorithm.
- Classify a sample using ID3 algorithm.
- Build an artificial neural network by implementing backpropagation algorithm.
- Construct the naïve Bayesian classifier for classification.
- Construct a naïve Bayesian classifier and evaluate the classifier with accuracy, precision, and recall metrics
- Applying EM algorithm for clustering using K-means algorithm.
- Implement the k-Nearest Neighbour algorithm to classify the data set.
- Implement the non-parametric Locally Weighted Regression algorithm.

Course Outcomes (COs):

On successful completion of the course, the students will be able to

CO1:	Understand components of a machine learning algorithm.
CO2:	Apply machine learning tools to build and evaluate predictors
CO3:	Comprehend how machine learning uses computer algorithms to search for patterns in data.
CO4:	Familiarize in using data patterns to make decisions and predictions with real-world examples.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓	✓	✓	✓		
CO2	✓					✓	✓					✓				✓		
CO3	✓	✓	✓		✓						✓	✓				✓		
CO4	✓				✓		✓	✓			✓	✓	✓			✓		

SEMESTER – IV

19PDSC41: Core Course 18– Big Data Analytics **Credits:4 Hours:4**

Learning Objectives (LO):

This course will enable students to:

To learn the concepts of big data analytics

To understand the methodologies of big data analysis.

To study mathematical and statistical concepts related to big data analysis.

To practice with modern computing big data technologies

To provide better understanding for applications of associated computing techniques and technologies like Hadoop and map reduce

Unit-1:

Introduction to Big Data: Introduction to Big Data Platform – Traits of Big data -Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

Unit-2:

Data Analysis: Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Neural Networks: Learning And Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods.

Unit-3:

Mining Data Streams: Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

Unit-4

Frequent Itemsets and Clustering: Mining Frequent Itemsets - Market Based Model – Apriori Algorithm – Handling Large Data Sets in Main Memory – Limited Pass Algorithm – Counting Frequent Itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means – Clustering High Dimensional Data – CLIQUE And PROCLUS – Frequent Pattern based Clustering Methods – Clustering in Non-Euclidean Space – Clustering for Streams and Parallelism.

Unit-5

Hadoop and R for Visualization: Backgroundd and fundamentals-moving data in and out of Hadoop-data serialization-applying MapReduce patterns to big data- streaming big data-integrating R and Hadoop for statistics and more-predictive analytics with Mahout- Hacking with Hive-Programming pipelines with pig – HBase-MySQL-NoSQL- RHadoop.

Text Books:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

Supplementary Books:

1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.

2. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.

3. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

4. Jiawei Han, MichelineKamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, second edition, 2006.

5. Alex Holmes, "Hadoop in Pracice",2012 by Manning Publications,2012.

6. Ohri A, "R for Business Analytics", Springer, 2012.

7. Prabhanjan Narayanachar Tattar, "R Statistical Application Development by Example Beginner's Guide" , packt publishing,2013.

Course Outcomes (COs):

On successful completion of the course, the students will be able to

CO1:	Identify the characteristics of datasets for various applications.
CO2:	Select environment for the applications.
CO3:	Solve problems associated with big data characteristics.
CO4:	Integrate mathematical and statistical tools with modern technologies like Hadoop and Mapreduce
CO5:	Provide better solutions and develop applications to the problem associated with big data

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓	✓	✓	✓		✓	✓		✓		✓	✓	✓		✓	✓	✓
CO2	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓		✓	✓	✓

CO3		✓		✓				✓		✓		✓				✓	✓	✓
CO4		✓		✓		✓		✓			✓	✓				✓	✓	✓
CO5	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓			✓	✓	✓

19PDSC42: Core Course 19– Software Project Management **Credits:5 Hours:5**

Learning Objectives (LO):

This course will enable students to:

Understand the framework of project management
Learn to monitor and control the project
Know the sound knowledge in Agile method
Know the team, cost, quality and resource management
Identify and control the risk in the projects

Unit-1:

Project Management Framework: Introduction: Project - Project management - Relationship among Project, Program and Portfolio management - Project and operations management- Role of project manager - Project management body of knowledge - Enterprise Environmental factors. Project life cycle and Organization: Overview of project life cycle - Projects vs Operational Work - Stakeholders - Organizational influences on project management. **The Standard for Project Management of a Project**: Project management processes for a project: Common project management process interactions - Projects management process groups - Initiating process group - planning process group - Executing process group - Monitoring and controlling process group - Closing process group.

Unit-2:

Choosing Methodologies and Technologies – Software Processes and Process Models – Choice of Process Models – The Waterfall Model– Prototyping – other ways of categorizing prototype - **Agile Methods** – Extreme Programming Selecting the Most Appropriate Process Model- Need of Agile - Iterative vs Incremental-Agile Manifesto and Mindset – Lean, Scrum and Kanban methods-uncertainty, Risk, and lifecycle selection-Scrum Elements overview-5 levels of planning-Scrum Process overview-Agile Team-roles and responsibilities- Epic-feature-User Stories-PBI-The Sprint.

Unit-3:

The Project Management Knowledge Areas: Project integration management: Develop project charter - Develop project management plan - Direct and manage project execution - Monitor and control project work - Perform integrated change control - Close project or phase. Project scope management: Collect requirements - Define Scope - Create WBS - Verify Scope - Control Scope. Project team management: Define activities - Sequence activities - Estimate activity resources - Estimate Activity Durations - Develop Schedule - Control Schedule.

Unit-4:

Project cost management: Estimate costs - Determine budget - Control costs. Project Quality Management: Plan quality - perform quality assurance - Perform quality control. Project Human Resource Management: Develop human resource plan - Acquire project team - Develop project team - Manage project team. Project Communications Management: Identify stakeholders - Plan communications - Distribute information - Manage stakeholder expectations - report performance.

Unit-5:

Project Risk Management: Plan risk management - Identify risks - Perform qualitative risk analysis - Perform quantitative risk analysis - plan risk responses - Monitor and control risks. Project Procurement Management: Plan - Conduct - Administer - Close procurements.

Text Books:

1. "A guide to the Project management Body of Knowledge (PMBOK Guide)" Fouth Edition, Project Management Institute, Pennsylvania, 2008
2. BOB Huges, Mike Cotterell, Rajib Mall “Software Project Management”, McGraw Hill, Fifth Edition,2011.
3. Emerson, "Agile Handbook," Philosophie

Supplementary Books:

1. Futrell, “Quality Software Project Management”, Pearson Education India.
2. Royce, “Software Project Management”, Pearson Education India.
3. C.Ravindranath Pandian, “Applied Software Risk Management-A Guide for Software Project Managers”, Auerbach Publications, 2015.
4. Benjamin A. Lieberman, “The Art of Software Modeling”, Auerbach Publications, 2010.

Course Outcomes (COs):

CO1:	Analyze the scope, cost, timing, and quality of the project, at all times focused on project success as defined by project stakeholders.
CO2:	Align the project to the organization's strategic plans and business justification throughout its lifecycle.
CO3:	Identify project goals, constraints, deliverables, performance criteria, control needs, and resource requirements in consultation with stakeholders.
CO4:	Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project
CO5:	Adapt projects in response to issues that arise internally and externally.+

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓	✓		✓	✓			✓			✓	✓	✓			✓	✓
CO2	✓		✓					✓		✓		✓		✓		✓	✓	
CO3	✓			✓	✓	✓		✓				✓	✓	✓	✓		✓	✓
CO4	✓		✓			✓		✓		✓	✓		✓			✓		✓
CO5	✓	✓		✓		✓		✓		✓	✓		✓			✓		✓

ELECTIVES

19PDSE24: 11 – Fundamentals of Business Statistics

Credits: 3
Hours:3

Learning Objectives (LO):

Students will understand the importance of data-driven business decisions and the basic role of probability in business decision making.

To understand the importance of business sampling methods, and be able to describe different business sampling methods.

Unit-1:

Introduction: Demographic data collection, View Videos of Data Analytics Business Applications, Types of Data and Data Sources. Sample vs. Population. Sampling Ideas. Introduction to Sample Project.

Unit-2:

Numerical Data: Tabular and Graphical Summary for Categorical Data. Pie Chart, Bar Chart, Pareto Chart. Cross Tabs for Categorical Data. Misuse of Graphs and Ethical Issues, Describing Numerical Data. Freq./Rel. Freq./Cum. Freq. Distribution. Histograms: Shape, Center and Spread. Numerical Measures of Center and Variation.

Unit-3:

Describing Spread with Measures of Position: Percentiles and Quartiles. Five-number summary and BoxWhisker Plots. Identifying Outliers, zscores, Empirical Rule, Scatter-plots and Correlation for Two Numerical Variables. Lurking Variables and Causation. Simple Linear Regression Model. Model Assumptions. ANOVA table and R^2 . Standard error. Regression Residual Analysis.

Unit-4:

Basic Probability Concepts and Rules: Joint, Marginal and Conditional Probability in Contingency Tables, Random Variables. Mean and Variance of Discrete R.V. Properties of Expected Values and Variance, Bernoulli Trials and Binomial Distribution. Probability Calculations, Area Concept of Probability. Introduction to the Normal Distribution, Applications of the Normal Distribution, Sampling Distribution of Sample Proportion. Probability Calculations, Sampling Distribution of Sample Mean. Central Limit Theorem, Probability Calculations on Sampling Distributions.

Unit-5:

Hypothesis Tests: Confidence Interval for Population Mean with Sigma Unknown. Working with t tables. Interpreting Confidence Intervals, Behavior of Confidence Intervals. Sample Size Determination, Hypothesis Test for a Single Population Proportion. Use of P-values, Hypothesis Test for Population Mean with Sigma Unknown. Significance Levels and Critical Values, Hypothesis Tests using Confidence Intervals. Type I and II Errors. Power. Limitations of Hypothesis Tests, Two Sample t-test and Confidence Interval for the Difference of two Population Means, Inference for Contingency Tables. $\chi 2$ Test for Homogeneity or Independence.

Text Book:

1. Business Statistics, 2nd edition by Sharpe, Deveaux, and Velleman, Pearson Publications, 2012.

Supplementary Books:

1. Complete Business Statistics, Seventh Edition by Amir Aczel and Jayavel Souderpandian, TATA McGraw Hill Edition, 2012.
2. A Guide to Business Statistics by David M. McEvoy, Wiley Edition, 2018.

Course Outcomes (COs):

CO1:	Apply knowledge to solve simple tasks using computer tools.
CO2:	Independently calculate basic statistical parameters (mean, measures of dispersion, correlation coefficient, indexes).
CO3:	Choose a statistical method for solving practical problems.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1			✓		✓	✓			✓	✓	✓	✓	✓	✓		✓		
CO2				✓	✓	✓		✓		✓		✓		✓		✓	✓	
CO3	✓			✓		✓		✓		✓	✓	✓	✓		✓		✓	✓

19PDSE24: 12 – Time Series Analysis and Forecasting

Credits: 3
Hours:3

Learning Objectives (LO):

Compute and interpret a correlogram and a sample spectrum
Derive the properties of ARIMA and state-space models
Choose an appropriate ARIMA model for a given set of data and fit the model using an appropriate package
Compute forecasts for a variety of linear methods and models.

Unit-1:

Economic Time Series: Different components, illustration, additive and multiplicative models, determination of trend, seasonal and cyclical fluctuations.

Unit-2:

Time Series Analysis: Time-series as discrete parameter stochastic process, auto covariance and autocorrelation functions and their properties. Exploratory time Series analysis, tests for trend and seasonality, exponential and moving average smoothing.

Unit-3:

Stationary Processes: (1) moving average (MA), (2) auto regressive (AR), (3) ARMA and (4) AR integrated MA (ARIMA) models. Box-Jenkins models, choice of AR and MA periods.

Unit-4:

Estimation: Discussion (without proof) of estimation of mean, auto covariance and autocorrelation functions under large sample theory, estimation of ARIMA model parameters.

Unit-5:

Spectral Analysis: of weakly stationary process, periodogram and correlogram analyses, computations based on Fourier transform, non stationary process, introduction to forecasting.

Text Books:

1. Brockwell & Davis (2016) Introduction to Time Series and Forecasting, 3rd edition, Springer

Supplementary Books:

1. Cryer & Chan (2008) Time Series Analysis with Applications in R, Springer Prado & West (2010)
2. Time Series: Modeling, Computation, and Inference Chapman & Hall Petris, Petrone, Campagnoli (2009) Dynamic Linear Models with R, Springer.
3. Shumway & Stoffer (2011) Time Series Analysis and its applications, with examples in R , 3rd edition, Springer.

Course Outcomes (COs):

CO1:	Understand the fundamental advantage and necessity of forecasting in various situations.

CO2:	Know how to choose an appropriate forecasting method in a particular environment.
CO3:	Know how to apply various forecasting methods, which includes obtaining the relevant data and carrying out the necessary computation.
CO4:	Improve forecast with better statistical models based on statistical analysis.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1			✓		✓	✓			✓	✓			✓	✓		✓		
CO2				✓	✓	✓		✓		✓		✓		✓		✓	✓	
CO3	✓			✓		✓		✓		✓	✓	✓	✓		✓		✓	✓
CO4	✓		✓	✓	✓	✓		✓		✓	✓		✓			✓		✓

19PDSE24 13 – Multivariate Data Analytics

Credits: 3
Hours:3

Learning Objectives (LO):

Obtain knowledge on sampling, tests of hypothesis, and statistical tests like Multiple Regression and Canonical correlation.

Train the students to use time series models like vector and matrices, Distance Measures and Factor Analysis.

Unit-1:

Basic concepts: Variate, Measurement Scale, Statistical significance and power, missing data, outlier detection and handling, transformations to achieve normality, linearity, homoscedasticity, non-metric data with dummy variables.

Unit-2:

Multiple Regression and Canonical Correlation: Basics of Multiple Regression, Prediction using independent variables, decision process for multiple regression analysis, estimating the regression model and assessing overall model fit.

Basics of Canonical Correlation: Variate of dependent variable, First and Second order Canonical functions estimation, Relationship of Canonical correlation to other multivariate techniques, Deriving Canonical function, interpreting Canonical variate.

Unit-3:

Basics of vector and matrices (only problems): Random sample, Mean vector, Co-variance matrix. Multivariate normal distribution: normal density function and its properties.

Test for Mean vectors (only problems): Hotelling's T^2 test, Test for two papulation mean vectors, Test for several papulation mean vectors. Test for equality of mean vector with equal and unequal covariance.

Unit-4:

Test for Covariance matrices (only problems): Test for equality of two papulation Co-variance matrices, Equality of several papulation Covariance matrices.

Distance Measures (only problems): Mahalanobis D^2 measure, Manhattan distance, Bhattacharyya distance, Discriminant analysis – two-class problems and L-class problems.

Unit-5:

Principal component analysis (only problems): Sample variability with one sample principal component, Sample variability with two sample principal component, Principal component with standardized data, Principal component from correlation matrix.

Factor Analysis (only problems): Orthogonal factor analysis, Factor analysis of consumer–preference data, Factor analysis of stock price data, Factor analysis of Olympic decathlon data. Test for two common factors. Factor loading and rotation.

Text book:

1. Richard A. Johnson, Dean W. Wichern, "Applied Multivariate Statistical Analysis", Sixth edition, Pearson press, 2007.

Supplementary Books:

1. Joseph F. Hair, Jr.,William C. Black Barry J. Babin, Rolph E. Anderson, "Multivariate Data Analysis", Seventh Edition, Pearson press, 2013.
2. Michael Milton, Head First Data Analysis. Shroff Publishers, 2013.
3. Keinosuke Fukunaga, "Introduction to Statistical Pattern Recognition", Second Edition, Academic Press, 1990.

Course Outcomes (COs):

CO1:	The students should have knowledge on assimilate the data and fit-in appropriate time series model.
CO2:	The students should have develop the software for the models at implementation level.
CO3:	The students should have the capability of developing statistical packages, which computes descriptive statistics.
CO4:	The students should have compares means and variances of the data; and fits the time series models for the given data.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓		✓			✓			✓	✓	✓	✓		✓	✓	✓
CO2	✓		✓	✓	✓						✓	✓	✓	✓	✓		✓	✓
CO3	✓	✓	✓		✓						✓		✓	✓			✓	✓
CO4	✓										✓							

19PDSE25 21 – Introduction to Data Mining

Credits: 3
Hours:3

Learning Objectives (LO):

To identify the scope and necessity of Data Mining and Warehousing.
To understand various tools of Data Mining
To develop ability to design various algorithms based on data mining tools.

Unit-1:

Introduction: Data Mining Concept, Origin, Process, Applications, Techniques, Challenges Data Preprocessing: Data types, Quality, Descriptive data summarization – central tendency and dispersion measure, Data cleaning, Data integration and transform.

Unit-2:

Data reduction Association Rule Mining: Market-basket analysis basics, Naïve algorithm, Apriori algorithm, Direct Hashing and Pruning (DHP), Software for Association Rule Mining

Classification and Prediction: Decision Tree, Classification by decision tree induction, Bayesian classification, Rule-based classification, Prediction – Linear and Nonlinear Regression, Classification software.

Unit-3:

Cluster Analysis: Types of data in cluster analysis, Partitioning methods, Hierarchical methods, Density-based methods, Quality and Validity of clustering methods Cluster analysis software Web.

Unit-4:

Data Mining: Web content mining, Web usage mining, Web structure mining, Hubs and Authorities, HITS algorithm, Web mining software Text Mining, Support Vector Machine.

Unit-5:

Data Mining Application and Information Privacy: Applications and trends in data mining such as Web, finance, telecommunication, biology and medicine, science and engineering retail industry, Social impacts of data mining, information privacy and data security, IT Act overview.

Text Books:

1. Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques" Morgan Kaufmann Publishers, 2000.

Supplementary Books:

1. Hanand J and M. Kamber, "Data Mining: Concepts and Techniques", Second Edition, Morgan Kaufman, 2006.
2. Ian.H.Witten & Eibe Frank, "Data Mining – Practical Machine Learning Tools and Techniques, Morgan Kaufmann Publishers, 2006.

Course Outcomes (COs):

CO1:	Understand the concepts of data mining.
CO2:	Analyze the feasibility of data mining solution.
CO3:	Apply basic statistical analysis to evaluate the results of data mining models.
CO4:	Develop data mining application to solve problems.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓		✓	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓
CO2	✓	✓		✓		✓		✓		✓				✓		✓	✓	
CO3	✓		✓	✓		✓		✓		✓	✓		✓		✓			✓
CO4	✓		✓		✓	✓	✓	✓		✓	✓		✓			✓		✓

19PDSE25: 22 - Web Database and Information System

Credits: 3
Hours:3

Learning Objectives (LO):

Understand how n-tiered architectures can be used to implement secure, scalable systems
Design and develop database-driven websites and applications
Understanding XML as a messaging and data exchange mechanism
Understand Web "semantic systems," such as auctions, recommendation systems, and search ranking.

Understand critical components of the modern Web infrastructure: DNS, Content Delivery Networks, etc.

Unit-1:

Introduction: Web Overview, Introduction to Apache, MySQL, Networking : TCP/IP, HTTP, Introduction to PHP, Dynamic Page Generation, Sessions and Personalization.

Unit-2:

Web Analytics: Basics – Traditional Ways – Expectations – Data Collection – Clickstream Data – Weblogs – Beacons – JavaScript Tags – Packet Sniffing – Outcomes data – Competitive data – Search Engine Data.

Unit-3:

Qualitative Analysis: Customer Centricity – Site Visits – Surveys – Questionnaires – Website Surveys – Post visits – Creating and Running- Benefits of surveys – Critical components of successful strategy.

Unit-4:

Web Analytic concepts: URLS – Cookies – Time on site – Page views – Understand standard reports – Website content quality – Navigation reports (top pages, top destinations, site overlay). – Search Analytics – Internal search, SEO and PPC – Measuring Email and Multichannel Marketing - Competitive intelligence and Web 2.0 Analytics – Segmentation – Connectable reports.

Unit-5

Goals and Funnels: Filters - Ecommerce Tracking - Real Time Reports - Customer Data Alert - Adwords Linking - Adsense Linking -Attribution Modeling - Segmentation - Campaign Tracking - Multi-Channel Attribution.

Textbook:

1. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science Of Customer Centricity ", 1st edition, Sybex, 2009.

Supplementary Books:

1. Michael Beasley, "Practical Web Analytics for User Experience: How Analytics can help you Understand your Users", Morgan Kaufmann, 2013.
2. Magy Seif El-Nasr, Anders Drachen, Alessandro Canossa, eds., "Game Analytics: Maximizing the Value of Player Data", Springer, 2013.
3. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Content, and Usage Data", 2nd Edition, Springer, 2011.
4. Justin Cutroni, "Google Analytics", O'Reilly, 2010.

Eric Fettman, Shiraz Asif, Feras Alhlou , "Google Analytics Breakthrough", John Wiley & sons, 2016.

Course Outcomes (COs):

Students will be able to:

CO1:	Know the concepts and terminologies related to web analytics.
CO2:	Explore various parameters used for web analytics and their impact.
CO3:	Explore the use of tools and techniques of web analytics.
CO4:	Get experience on websites, web data insights and conversions.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓	✓		✓	✓				✓		✓			✓			
CO2	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓			✓		✓		✓			✓	✓	✓	✓			✓	✓
CO4	✓		✓		✓			✓		✓		✓		✓	✓			✓

19PDSE25: 23 - Green Computing

Credits : 3
Hours:3

Learning Objectives (LO):

To learn the fundamentals of Green Computing.
To analyze the Green computing Grid Framework.
To understand the issues related with Green compliance.
To study and develop various case studies.

Unit-1:

Fundamentals

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

Unit-2:

Green Assets and Modeling

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

Unit-3:

Grid Framework

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

Unit-4:

Green Compliance

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

Unit-5:

Case Studies

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

Text Books:

1. Bhuvan Unhelkar, —Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, —Green Home computing for dummies, August 2012.

Supplementary Books:

1. Alin Gales, Michael Schaefer, Mike Ebbers, —Green Data Center: steps for the Journey, Shroff/IBM rebook, 2011.
2. John Lamb, —The Greening of IT, Pearson Education, 2009.
3. Jason Harris, —Green Computing and Green IT- Best Practices on regulations & industry, Lulu.com, 2008
4. Carl speshocky, —Empowering Green Initiatives with IT, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), —Green computing: Large Scale energy efficiency, CRC Press

Course Outcomes (COs):

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

CO1:	Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
CO2:	Enhance the skill in energy saving practices in their use of hardware.
CO3:	Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
CO4:	Understand the ways to minimize equipment disposal requirements.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓		✓	✓				✓		✓			✓			
CO2		✓		✓		✓		✓		✓		✓		✓	✓		✓	✓
CO3	✓			✓		✓					✓		✓	✓			✓	✓
CO4	✓		✓		✓			✓				✓		✓	✓			✓

19PDSE34: 31 - Management Decision Analysis

Credits : 3
Hours:3

Learning Objectives (LO):

To understand the statistical concepts and take managerial decisions
To learn the time series models and problem formation terminals for management decision making by applying time series models.

Unit-1:

Introduction: Concepts with methodologies for data analysis, Probability and significance as a measure of uncertainty; Discrete and continuous random variables with practical applications, Introduction to sampling and statistical inference.

Unit-2:

Principles and Analysis: Introduction to various Multivariate Data Analysis like Linear and Multiple regression models with different forecasting techniques, Conjoint Analysis, Canonical Correlation, Cluster Analysis.

Unit-3:

Time Series Analysis: Multidimensional Scaling, Structural Equation Modeling, ARCH, GARCH, PC-GARCH, E-GARCH, O-GARCH, AGARCH.

Unit-4:

Problem formulation techniques and concepts: **M**ultiple **O**bjective **D**ecision **M**aking (MODM), **M**ultiple **C**riteria **D**ecision **M**aking (MCDM); Decisions under uncertainty, oncept of Fuzzy logic and its use in MODM and MCDM. Different methodology of optimization and decision making like **D**ata **E**nvelopment **A**nalysis (DEA), **A**nalytical **H**ierarchy **P**rocess (AHP); Statistical Decision Trees and its Applications.

Unit-5:

Utility analysis: Utility analysis and its significance to MCDM and MODM, Concepts of heuristic approaches with introduction to **G**enetic **A**lgorithm (GA), **T**abu **S**earch (TS), **A**rtificial **I**mmune **S**ystem (AIS), **P**article **S**warm **O**ptimization (PSO), **A**nt **C**olony **O**ptimization (ACO), **S**imulated **A**nnealing (SA).

Textbook:

1. Cooper, W. W., Seiford, L. W. and Tone K., (2000), Data Envelopment Analysis: A Comprehensive Text with Models, Applications, References and DEA Solver Software, Kluwer Academic Publishers, ISBN: 0-792- 8693-0.

Supplementary Books:

1. Hair, J. F., Anderson, R. E., Tatham, R. L. and Black, W. C., (2006), Multivariate Data Analysis, Pearson Education, ISBN: 81-7758-573-8. 4. Walpole, R. E., Myers, R. H., Myers, S. L. and Ye, K., (2007), Probability & Statistics for Engineers & Scientists, Pearson Education, ISBN: 81-317- 1552-3.
2. Winston, W. L., (2003), Operations Research: Applications and Algorithms, Cengage Learning, ISBN: 81-315-0190-6. 6. Zeleny, M., (1982), Multiple Criteria Decision Making, McGraw Hill Book Company, ISBN: 0-07-072795-3.

Course Outcomes (COs):

CO1:	Make decision on the managerial problem
CO2:	Apply the statistical methods for real time problems
CO3:	Solve the Complicated problem with the help of decision making optimization strategies.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓			✓	✓	✓	✓			✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓		✓				✓	✓	✓		✓	✓	
CO3	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓		✓			

19PDSE34: 32 Soft Skills Development

Credits : 3
Hours:3

Learning Objectives (LO):

To develop the soft skill among the students.

To impart the student knowledge in developing the positive attitude and art of speaking and writing.

To indulge the students to improve the body language group discussion and time management.

Unit-1:

Soft skills and developing positive Attitude

Soft skills: introduction – what are soft skills? - selling your soft skills - attribute regarded as soft skills – soft skills – social- soft skills- thinking – soft skills –Negotiating –exhibiting your soft skills- indentifying your soft skills- improving your soft skills - soft skills training –train yourself-top 60 soft skills.

Developing positive attitude: introduction – meaning - features of attitudes- attitude and behavior formation of attitudes– change of attitudes – what can you do to change attitude?-ways of changing attitude in a person – attitude in a workplace – the power of positive attitude-developing positive attitude-example of positive attitude- example of negative attitude-over coming negative attitude- negative attitude and its result.

Unit-2:

Art of speaking and writing

Art of speaking: Introduction-what make communication important? - Defining communication-special features of communication –communication process- channel of communication-importance of communication - tips for effective communication - tips for powerful presentation-art of public speaking - importance of public speaking.

Art of writing: Introduction – importance of writing –creative writing - writing tips- drawbacks of writing communication.

Unit-3:

Body language

Introduction – body talk – voluntary and involuntary body language-forms of body language-parts of body language - origin of body language - uses of body language - body language in building interpersonal relations – body language in building industrial relations-reason to study body language-improving your body language – types of body language-Gender differences-female interest and body language - shaking hands with women - interpreting body language-developing confidence with correct body language.

Unit-4:

Group discussion

Introduction – meaning of GD – why group discussion? - characters tested in a GD – tips on GD – types of GD - skills required in a GD - consequences of GD - behavior of a GD - essential elements of GD - different characters in GD - traits tested in a GD - GD etiquette - areas to be concentrated while preparing for a GD - imitating a GD - techniques to initiate a GD - Non-verbal communication in GD – movement and gestures to be avoided in a GD-topics for GD.

Interview skills

Introduction – why an interview?.- types of interview - interview panel-types of questions asked-reason for selecting a candidate –reason for rejecting a candidate – on the day of interview– on the interview table – attending job fair-common mistakes that you would't want to do-questions the candidate should not ask during the interview –post- interview etiquette-how does one follow up?-telephonic interview –dress code at interview – typical questions asked – interview mistakes –quick tips- how to present well in interview –tips to make a good impression in an interview – job interview-basic tips-how to search for job effectively – interview quotations.

Unit-5:

Time management

Introduction- the 80:20 rule- take a good look at the CO1ple around you- examine your work-sense of time management – time is money – features of time- three secretes of time management - time management matrix- analysis of time matrix-effective scheduling – grouping of activities – five steps to successful time management –difficulties in time management- evils of not planning - time management is a myth – overcoming procrastination – ways of find free time- time management tips for students – interesting facts about time- ideal way of spending a day- time wasters – time savers – realizing the value of time-time circle planner.

Text Book:

1. Alex K., "Soft Skills: Know yourself and know the world" S.Chand & company Pvt Lts, Third revised Edition, 2014.

Supplementary Books:

1. Gopalaswamy Ramesh, and Mahadevan Ramesh, " The ACE of Soft Skills, Attitude, Communication and Etiquette for Success", Pearson; First edition, 2013.
2. Barun K. Mitra, "Personality Development and Soft Skills", Oxford university press, New Delhi, 2011.
3. Rao M.S, "Soft Skills - Enhancing Employability: Connecting Campus with Corporate", I K International Publishing House Pvt. Ltd, 2011
4. Sanjay Kumar and Pushp Lata, "Communication Skills", Oxford university press, New Delhi, 2011.

Course Outcomes (COs):

CO1:	The students community enrich the knowledge in the field of soft skills
CO2:	They can able to cope up with recent development in business world
CO3:	The students will have the powerful knowledge in attitude and personality

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓			✓	✓			✓	✓	✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓		✓	✓	
CO3		✓		✓		✓		✓		✓	✓	✓	✓		✓	✓	✓	✓

19PDSE34: 33 - Financial Risk Analytics And Management

Credits : 3
Hours:3

Learning Objectives (LO):

To identify the different risks involved in Finance arena.
To understand and solve the different risks pertaining to stock market and its instruments.
To analyze the legal issues affecting the business.

Unit-1:

Introduction to Risk -Understanding Risk- Nature of Risk, Source of Risk, Need for risk

management, Benefits of Risk Management, Risk Management approaches. Risk Classification- credit risk, market risk, operational risk and other risk

Unit-2:

Risk Measurements -Measurement of Risk – credit risk measurement, market risk measurement, interest rate risk measurement, Asset liability management, measurement of operational risk

Unit-3:

Risk Management- Risk management- Managing credit risk, managing operational risk, managing market risk, insurance

Unit-4:

Risk in Instruments -Tools for risk management – Derivatives, combinations of derivative instruments, Neutral and volatile strategies, credit derivatives, credit ratings, swaps

Unit-5:

Regulation and Other Issues: Other issues in risk management – Regulatory framework, Basel committee, legal issues, accounting issues, tax issues, MIS and reporting, integrated risk management

Text Book:

Dun, Bradstreet, "Financial Risk Management", TMH, 2006.

Supplementary Books:

John C Hull, "Risk management and Financial Institutions", Pearson, 2015.

Aswath Damodharan, "Strategic Risk Taking", Pearson, 2008.

Course Outcomes (COs):

Students will be able to:

CO1:	Identify and categorize the various risks faced by an organization.
CO2:	Explore the tools and practices needed to assess and evaluate financial risks.
CO3:	Explore risk management practices in an industry.
CO4:	Identify and solve legal issues that impact financial and other risk affecting business.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓			✓		✓	✓	✓	✓	✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓		✓		✓			✓	✓		✓	✓	
CO3		✓		✓		✓		✓		✓	✓	✓	✓		✓	✓	✓	✓
CO4	✓		✓		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓

19PDSE35: 41 - Image and Video Analytics

Credits : 3
Hours:3

Learning Objectives (LO):

To teach the fundamentals of digital image processing, image and video analysis.
To understand the real time use of image and video analytics.
To demonstrate real time image and video analytics applications and others.

Unit-1:

Digital image representation: Visual Perception- Sampling and Quantization- Basic Relations between Pixels- Mathematical Tools Used in Digital Image Processing: Fundamental Operations – Vector and Metric Operations- Image Transforms (DFT, DCT, DWT, Hadamard).

Unit-2:

Fundamentals of spatial filtering: spatial correlation and convolution-smoothing blurring-sharpening- edge detection - Basics of filtering in the frequency domain: smoothing-blurring-sharpening--Histograms and basic statistical models of image.

Unit-3:

Colour models and Transformations: Image and Video segmentation-Image and video demonising- Image and Video enhancement- Image and Video compression.

Unit-4:

Object detection and recognition in image and video-Texture models Image and Video. Classification models- Object tracking in Video.

Unit-5:

Applications and Case studies: Industrial- Retail- Transportation & Travel- Remote sensing-Video Analytics in WSN: IoT Video Analytics Architectures.

Textbook:

1. R.C. Gonzalez and R.E. Woods.” Digital Image Processing”. 3rd Edition. Addison, Wesley, 2007.

Supplementary Books:

1. W. Härdle, M. Müller, S. Sperlich, A. Werwatz, “Nonparametric and Semi parametric Models”, Springer, 2004.
2. Rick Szelisk, “Computer Vision: Algorithms and Applications”, Springer 2011.
3. Jean-Yves Dufour, “Intelligent Video Surveillance Systems”, Wiley, 2013.
4. Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012.
5. AsierPerallos, Unai Hernandez-Jayo, Enrique Onieva, Ignacio Julio García Zuazola, “Intelligent Transport Systems: Technologies and Applications”, Wiley, 2015.
6. Basudeb Bhatta, “Analysis of Urban Growth and Sprawl from Remote Sensing Data”, Springer, 2010.

Course Outcomes (COs):

Students will be able to:

CO1:	Describe the fundamental principles of image and video analysis and have an idea of their application.
CO2:	Apply image and video analysis in real world problems.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓		✓	✓	

19PDSE35: 42 - Data Science Ethics

Credits : 3
Hours:3

Learning Objectives (LO):

identify and articulate some basic ethical and policy-based frameworks
understand the relationship between data, ethics, and society
be able to critically assess their own work and education in the area of data science

Unit-1:

Introduction: Overview of ethical issues in data-driven organizations, Overview of data science as an ethical practice, Introduction to the unique ethical challenges of 'big data', Ethical Theory - Philosophical frameworks for assessing fairness, Moving towards contemporary theories of fairness.

Unit-2:

Research ethics for data science: Ethical side effects of the publish or perish system: p-hacking and small sample size, The misapplication of informed consent in dataveillance practices, Techniques of data ethics, Getting from data to individuals: Internet traces and Geofingerprints.

Unit-3:

Discrimination and algorithms: The ethics of price discrimination, Criminal justice by algorithm, The philosophical challenge of thinking in categories, How humans explain their social worlds through perceptions and statistics, Social processes and the impact of categorical life.

Unit-4:

Data ethics for researchers: Health Research, Educational Research, The ethics of data scraping and storage, Mosaic data, found data, and designed data.

Unit-5:

Privacy and Surveillance: Special topics in surveillance: Adtech, Special topics in surveillance: Employment, Differential privacy, Guidance for acting ethically with data.

Text Book:

1. Ethics and Data Science by DJ Patil, Hilary Mason, Mike Loukides, Publisher: O'Reilly Media, Inc., 2018.

Supplementary Books:

1. Rousseau, Jean-Jacques. (1754) Discourse on the origin and basis of inequality among men. [Many print versions of this text have been published. Available in full here: https://www.aub.edu.lb/fas/cvsp/Documents/DiscourseonInequality.pdf879500092.pdf]
2. Voorhoeve, Alex. (2009) Interview with Frances Kamm in Conversations on Ethics. Oxford University Press. Accessed online: http://personal.lse.ac.uk/voorhoev/frances%20kamm%20chapter.pdf

Course Outcomes (COs):

CO1:	Know the ethics of data science.
CO2:	Apply data representation and techniques to solve real-world problems.
CO3:	Explore the different performance issues and tasks in parallel and distributed computing.

CO4:	Develop parallel algorithms for solving real–world problems.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓	✓		✓	✓	
CO3		✓		✓		✓		✓		✓	✓	✓	✓		✓	✓	✓	✓
CO4		✓		✓		✓		✓		✓	✓	✓	✓		✓	✓	✓	✓

19PDSE35: 43 - Cloud Computing

Credits : 3
Hours:3

Learning Objectives (LO):

To learn how to use Cloud Services.
To implement Virtualization
To implement Task Scheduling algorithms.
Apply Map-Reduce concept to applications.
To build Private Cloud.

Unit-1:

Introduction: Basics, applications, intranet and cloud, examples: Amazon, Google, Microsoft, IBM– advantages and disadvantages of cloud computing, Google app engine, Microsoft Azure, Amazon(EC2, S3,SQS),open stack, cloud computing services

Unit-2:

Hardware and architecture: clients-security-network-services. Accessing the cloud: platforms-web applications-web APIs- web browsers. Cloud storage: overview-providers. Standards: application-client-infrastructure-service.

Unit-3:

Software as Service: overview-driving forces-company offerings-industries. Software plus services: Overview-mobile device integration-providers-Microsoft Online.

Unit-4:

Developing Applications: Google-Microsoft-Intuit Quick Base-Cast Iron Cloud-Bungee Connect-Development (App engine, Azure, open stack etc.)- trouble shooting and application management.

Unit-5:

Local clouds and thin clients: Virtualization-server solutions-thin clients. Cloud Migration: cloud services for individuals-enterprise cloud- methods for migration-analyzing cloud services.

Text Book:

1. Anthony T.Velte, Toby Velte ,"Cloud Computing a practical approach" , Mcgraw Hill, 2010.

Supplementary Books:

1. Janakiram M.S.V, "Demystifying the Cloud – An introduction to Cloud Computing", version 1.1, 2010.
2. Mark C. Chu-Carroll, "Code in the Cloud- Programming Google App Engine", The Pragmatic Bookshelf Raleigh, North Carolina Dallas, Texas, 2011.

Course Outcomes (COs):

CO1:	Acquire Knowledge on the features and development of Cloud Computing.
CO2:	Define the principles of virtualization.
CO3:	Use various performance criteria to evaluate the quality of the cloud architecture.
CO4:	Identify the Service-Oriented Architecture for Distributed Computing workflow.
CO5:	Create combinatorial auctions for cloud resources and design scheduling algorithms for computing clouds

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓	✓	✓		✓	✓		✓	✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓				✓		✓		✓		✓	✓	
CO3		✓		✓		✓		✓		✓		✓	✓		✓		✓	✓
CO4		✓		✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓	✓

19PDSE42: 51 - Distributed and Parallel Computing

Credits : 3
Hours:3

Learning Objectives (LO):

To learn core ideas behind parallel and distributed computing.
To explore the methodologies adopted for concurrent and distributed environment.
To understand the networking aspects of parallel and distributed computing.
To provide an overview of the computational aspects of parallel and distributed computing.
To learn parallel and distributed computing models.

Unit-1:

Parallel and Distributed Computing — Introduction- Benefits and Needs- Parallel and Distributed Systems- Programming Environment- Theoretical Foundations- Parallel Algorithms— Introduction- Parallel Models and Algorithms- Sorting- Matrix Multiplication- Convex Hull- Pointer Based Data Structures.

Unit-2:

Synchronization: Process Parallel Languages- Architecture of Parallel and Distributed Systems- Consistency and Replication- Security- Parallel Operating Systems.

Unit-3:

Management of Resources in Parallel Systems: Tools for Parallel Computing- Parallel Database Systems and Multimedia Object Servers.

Unit-4:

Networking Aspects of Distributed and Parallel Computing - Process- Parallel and Distributed Scientific Computing.

Unit-5:

High-Performance Computing: Molecular Sciences- Communication- Multimedia Applications for Parallel and Distributed Systems- Distributed File Systems.

Textbook

1. Jacek Błażewicz, et al., "Handbook on parallel and distributed processing", Springer Science & Business Media, 2013.

Supplementary Books:

1. Andrew S. Tanenbaum, and Maarten Van Steen, "Distributed Systems: Principles and Paradigms". Prentice-Hall, 2007.
2. George F.Coulouris, Jean Dollimore, and Tim Kindberg, "Distributed systems: concepts and design", Pearson Education, 2005.
3. Gregor Kosec and Roman Trobec, "Parallel Scientific Computing: Theory, Algorithms, and Applications of Mesh Based and Meshless Methods", Springer, 2015.

Course Outcomes (COs):

Students will be able to:

CO1:	Explore the methodologies adopted for concurrent and distributed environment.
CO2:	Analyse the networking aspects of Distributed and Parallel Computing.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1		✓		✓		✓		✓		✓		✓	✓		✓		✓	✓
CO2		✓		✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓	✓

19PDSE42: 52 - Healthcare Data Analytics

Credits : 3
Hours:3

Learning Objectives (LO):

To explore the various forms of electronic health care information.
To learn the techniques adopted to analyse health care data.
To understand the predictive models for clinical data

Unit -1:

Introduction: Introduction to Healthcare Data Analytics- Electronic Health Records– Components of EHR- Coding Systems- Benefits of EHR- Barrier to Adopting HER Challenges-Phenotyping Algorithms.

Unit -2:

Analysis: Biomedical Image Analysis- Mining of Sensor Data in Healthcare- Biomedical Signal Analysis- Genomic Data Analysis for Personalized Medicine.

Unit -3:

Analytics: Natural Language Processing and Data Mining for Clinical Text- Mining the Biomedical- Social Media Analytics for Healthcare.

Unit -4:

Advanced Data Analytics: Advanced Data Analytics for Healthcare– Review of Clinical Prediction Models- Temporal Data Mining for Healthcare Data- Visual Analytics for Healthcare- Predictive

Models for Integrating Clinical and Genomic Data- Information Retrieval for Healthcare- Privacy-Preserving Data Publishing Methods in Healthcare.

Unit -5:

Applications: Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data.

Textbook:

1. Chandan K. Reddy and Charu C Aggarwal, “Healthcare data analytics”, Taylor & Francis, 2015

Supplementary Books:

1. Hui Yang and Eva K. Lee, “Healthcare Analytics: From Data to Knowledge to Healthcare Improvement, Wiley, 2016.

Course Outcomes (COs):

Students will be able to:

CO1:	Analyse health care data using appropriate analytical techniques.
CO2:	Apply analytics for decision making in healthcare services.
CO3:	Apply data mining to integrate health data from multiple sources and develop efficient clinical decision support systems.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓	✓	✓		✓	✓		✓	✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓				✓		✓		✓		✓	✓	
CO3		✓		✓		✓		✓		✓		✓	✓		✓		✓	✓

19PDSE42: 53- Business Intelligence

Credits : 3
Hours:3

Learning Objectives (LO):

The student should be made to:

Be exposed with the basic rudiments of business intelligence system
understand the modelling aspects behind Business Intelligence
understand of the business intelligence life cycle and the techniques used in it
Be exposed with different data analysis tools and techniques

Unit -1:

Business Intelligence: Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence.

Unit -2:

Knowledge Delivery: The business intelligence user types, Standard reports, Interactive Analysis and Adhoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message.

Unit -3:

Efficiency: Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis

Unit – 4:

Business Intelligence Applications: Marketing models – Logistic and Production models – Case studies.

Unit – 5:

Future of Business Intelligence: Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology.

Text Books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson 2013.

Supplementary Books:

1. Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, 2003.
2. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009.
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager‟s Guide”, Second Edition, 2012.
4. Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a Killer App”, McGraw-Hill, 2007.
5. Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, “The Data Warehouse Lifecycle Toolkit”, Wiley Publication Inc.,2007.

Course Outcomes (COs):

CO1:	Link data mining with business intelligence.
CO2:	Apply various modelling techniques.
CO3:	Explain the data analysis and knowledge delivery stages.
CO4:	Apply business intelligence methods to various situations.

Outcome Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	✓		✓	✓	✓		✓	✓		✓	✓	✓		✓			✓	✓
CO2	✓	✓	✓	✓		✓				✓		✓		✓		✓	✓	

CO3		✓		✓		✓		✓		✓		✓	✓		✓		✓	✓
CO4		✓		✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓	✓