KANNUR UNIVERSITY

(Abstract)

Modified Regulation, Scheme and Syllabus of Post Graduate Diploma Programme in Data Science and Analytics (PGDDS) - w.e.f the academic year 2022-23- Implemented-Orders issued.

ACADEMIC C SECTION

Acad/C5/PGDDS/2020 Dated: 12.05.2022

Read:-1. U.O No. Acad/C5/PGDDS/2020 Dated 08.04.2021.

2. U.O No. Acad/C5/PGDDS/2020 Dated 31.03.2022.

3. Minutes of the meeting of Department Council, Department of Information Technology, Mangattuparamba Campus held on 07.01.2022, 24.02.2022 & 25.03.2022.

4. Letter No. DIT/PGDDSA Regulations/2022 Dated 30.03.2022, from the HoD, Department of I T

ORDER

1. As per paper read (1), the Regulation, Scheme and Syllabus of the Post Graduate Diploma Programme in Data Science and Analytics (PGDDS) under Department of Information Technology, Kannur University, Mangattuparamba campus was implemented w.e.f 2020 admission and certain modification were effected to the same, as per the paper read (2) above.

2. As per paper read (3) above, the meeting of the Department Council, Department of Information Technology, Mangattuparamba Campus, held on 07.01.2022, 24.02.2022 & 25.03.2022 resolved to approve the updated Regulation/Syllabus of the Post Graduate Diploma in Data Science and Analytics (PGDDS) programme with effect from the academic year 2022-23 with the following modifications.

a) Modification of Elective courses

b) Modification of the Syllabus for Core Course PGDDSC02, PGDDSC03 and PGDDSC05.

c) Modification in the Eligibility Criteria by permitting B.Tech/B.E and 4 year B.A/B.Sc Honours Degree (with mathematics course at Plus Two Level) to apply for admission to the course.

3. As per paper read (4), the Head, Department of Information Technology, forwarded the updated Regulation/Syllabus of the aforementioned programme, for approval from the University, w.e.f the academic year 2022-23 .

4. The Vice-Chancellor, after considering the matter in detail and in exercise of the powers of the Academic Council conferred under section 11 (1) Chapter III of Kannur University Act 1996 accorded sanction to implement the modified Regulation/Syllabus of the Post Graduate Diploma in Data Science and Analytics (PGDDS) programme under the Department of Information Technology, Mangattuparamba Campus, Kannur University, with effect from the academic year 2022-23, subject to reporting to the Academic Council.

5. The modified Regulation, Scheme and Syllabus of Post Graduate Diploma in Data Science and Analytics (PGDDS) programme, implemented with effect from the academic year 2022-23 are appended and uploaded in the University website-www.kannuruniversity.ac.in.

6. The U.O read as paper (1) & (2) above stands modified to this extent.

Orders are therefore issued accordingly.

Sd/-

BALACHANDRAN V K

DEPUTY REGISTRAR (ACAD)

For REGISTRAR

To: 1. The Head, Department of IT
Mangattuparamba Campus
2.Course Co-Ordinator, Department of I.T, Dr. P.K Rajan Memorial Campus

Copy To: 1.The Examination Branch (through PA to CE)
2.PS to VC/PA to PVC/PA to R/PA to FO
3. The web Manager (For uploading in the web site)
4. DR/AR I& II Academic / EXC-I Section
5. SF/DF/FC.

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY
CIVIL STATION P.O.
KANNUR
Pin-670 002
THAVAKKARA

KANNUR UNIVERSITY

POST GRADUATE DIPLOMA IN DATA SCIENCE & ANALYTICS

(Credit Based Semester System)

Regulations, Curricula, Syllabus and Scheme of Evaluation

(With Effect from 2022-23 admission)

1. Introduction

Data Science and Artificial Intelligence are two prominent domains that are going to rule the entire world in the future decades. Currently, these domains are being used in many real-life applications like Business, Commerce& Banking, GIS, Health, Climate change, Automobile, Crime analysis, etc. The key ideas of Artificial Intelligence and Data Science are mainly used for identifying and making predictions on unseen information hidden in the enormous data available in real-world applications. Using these techniques, one can identify and analyze those relevant data and make predictions of the future of data. Prediction can be made by analyzing in the form of patterns hidden in the original data, and further, it can be utilized for the benefit of society by applying various mathematical and statistical tools that are available. Since one has to deal with a huge amount of data and information, ordinary database applications cannot deal with them easily. The significance of Big Data analysis and Machine Learning comes here. The Deep Learning mechanism as part of Machine Learning provides the capability of identifying the unseen information that normally one cannot identify/retrieve through the conventional SQL query processing. Data mining and data warehousing techniques are the important mechanism for storing and managing the mass amount of data that comes in different styles and format which replicates the real-world scenario and provide a rich set of tools and techniques for extracting the most relevant information for making the prediction of the data with the help of Artificial Intelligence that conventional database management system cannot do.

The future job market needs people who possess technical knowledge and programming skills in dealing with these techniques, and many conventional programming techniques are getting obsolete with the advent of these new methods. The conventional courses are presently dealing with foundation courses and specialized mainly in the standard programming concepts. A few

institutions may be offering one or two electives during their course of study without dealing with practical aspects of the domains that will not be sufficient for them to fetch a job in the current industry.

Kannur University is offering a specialized Data Science course by the joint venture of three departments like Information Technology, Mathematical Science, and Statistical Science in a single umbrella to build up practically talented manpower capable of handling solutions to such complex real-world problems. In the present scenario, there are two types of professionals to be evolved for handling Data Science related problems as Data Analysts and Data Scientists. The practical aspects of analyzing and interpreting the data are done by the Data Analyst and Data Scientist who carry out building mathematical and statistical models for dealing with complex data by the Data Analyst. We are confident that the joint venture of these three departments will achieve this target without any ambiguity. Another important highlight of this course is that we give more stress on the development of practical skills to the students in the related domain rather than conventionalevaluation system followed for other PG courses in the University. The course is offered in the pattern of 60-40. The 60% of the evaluation is in continuous assessment and 40% in external evaluation patterns. Another important aspect of the course is that Information Technology, Mathematics, and Statistics departments are situated in a single building neighbor to each other will make the smooth and fruitful running of the course.

Initially, the Department of Information Technology will initiate a one-year Post-Graduate diploma course from the academic year (2020-2021) with inputs from MCA/ M.Sc. Computer Science/M.Sc. Information Technology/ M.Sc. Bioinformatics /M.Tech. /M.Sc. Mathematics/M.Sc. Statistics/ M.Sc. Applied Mathematics/ MSc. Physics/M.Sc. Electronics/M.Sc. Geology/M.Sc. Geography/M.Sc. Biostatistics/M.Sc. Applied Statistics/M.A Economics/ B.Tech (All branches)/ B.E (All branches)/ MBA/ 4 year B.A/B.Sc (with mathematics course at Plus 2 Level) honors degree. After establishing and stabilizing this PG program the University can think of starting a full-fledged PG program for Data Science.

1.1 Objective of the Course

The Post Graduate Diploma in Data Science & Analytics is a one-year program offered by the School of Information Science & Technology in collaboration with the Department of Mathematical Science, and Statistical Science is an excellent blend of knowledge and practice in the field of Data Science and its industrial applications. The program is targeted for creating qualified Data Science professionals. The program also offers ten weeks of industry-oriented hands-on, real-life analytical projects for students to get equipped with strong analytical and programming backgrounds, which makes them highly competitive and employable on completion of the program.

1.2 Outcome of the Course

Upon completing the course, the participants will learn the concept of Data Analytics using open-source statistical tools like R, Python, Hadoop, Tableau, and some excellent visualization tools and techniques. They will be capable of implementing the industry-oriented Data Analytics Project.

1.3 Duration of the Course

Duration of the Post Graduate Diploma in Data Science shall be one (01) year- full-time course divided into 2 semesters. Each semester should have 18 weeks. The maximum time limit for completing the course is four semesters (two years)

1.4 Number of Seats:

This course has an intake of **25** seats per semester and filling of seats according to the rotation matrix-maintained time-to-time by the Department of Information Technology/Kannur University norms. The rotation matrix of the seats to the course will be announced at the time of notification of the program. The course will run only if a minimum of 80% of the total seats are filled.

1.5 Course Structure

This course contains a total of seven modules in the first semester and two modules in the second semester followed by 300 hours of real-time project work using any of the topics studied to earn the Diploma. All these components are mandatory for the completion of the

course. The course comprises 30 Hours (5 × 6 Hours) per week comprising 18 weeks of teaching and learning activities.

1.6 Eligibility

MCA/ M.Sc Computer Science/M.Sc. Information Technology/ M.Sc. Bioinformatics/M. Tech.(Computer Science, Electrical & Electronics and Allied branches)/M.Sc. Mathematics/M.Sc. Statistics/ M.Sc. Applied Mathematics/ MSc. Physics/M.Sc. Electronics/M.Sc. Geology/M.Sc. Geography/ M.Sc. Biostatistics/M.Sc. Applied Statistics/M.A Economics/ B.Tech (All branches)/ B.E (All branches)/ MBA/ 4 year B.A/ B.Sc. (with mathematics course at Plus 2 Level) honours degree of this University or any other University / Institution, recognized by this University as equivalent thereto, with a minimum aggregate of 55% marks or equivalent grade.(For SEBC and Physically Challenged candidates the aggregate marks required is 50%. For SC and ST, a minimum pass in the degree examination)

1.7 Selection Criteria of the candidates

The selection of the course shall be based on a common admission test conducted by Kannur University. The test will be the duration of two hours comprising 100 × 4 marks multiple-choice questions from Computer Science, Mathematics, Statistics and Aptitude & Mental ability in under a graduate level. The pattern of the question paper shall be as follows:

Sl.	Subjects	No. of Questions
1	Mathematics	25× 4 = 100
2	Statistics	25× 4 = 100
3	Computer Science	25× 4 = 100
4	Aptitude & Mental ability	25× 4 = 100
	Total	100× 4 = 400
	Each Right answer will be awarded 4 Marks **Each Wrong answer will be awarded -1 Mark**	

1.8 Course Fee Structure

Sl.	Fee Details	Amount in Rs./-
1	Registration fee (**Application Fee**)	1,000/-
	For SC/ST	500/-
2	Admission Fee	555/-
3	Tuition Fee (**Per Semester**)	14,000/-
4	Laboratory Fee (**Per Semester**)	6,000/-
5	Library Fee	325/-
6	Student Welfare fund*	360/-
7	Special fee	125/-
8	Caution Deposit (**Refundable**)*	1,000/-
9	Student Affiliation Fee	440/-
10	Sports Affiliation Fee	220/-
11	University Union Fee	110/-
12	University Development Fund	60/-
13	Department Development Fund*	1000/-

(* To be paid to the HOD account)

1.9 Placement

This program is scheduled under an industrial collaboration and the experts from different industries and academia have agreed to handle different sessions to the course to build thorough practical knowledge to the students and provide placement assistance to students who successfully qualify the course with the mandate required for the industry.

2 Program Structure

2.1 Attendance

The minimum attendance required for each course shall be 75% of the total number of classes conducted for each semester. Those who secure the minimum attendance in a semester alone will be allowed to register for the End Semester Examination. The Vice-Chancellor will grant condonation of attendance to a maximum of 10 days in a semester subject to a maximum of two spells within a program. The benefit of condonation of attendance will be granted to the students on health grounds, for participating in University Union activities, meetings of the university bodies, and participation in extracurricular activities on the production of genuine supporting documents with the recommendation of the Head of the Department concerned. A student who is not eligible for condonation shall repeat the course with the subsequent batch.

2.2 Credits

One credit of the course is defined as a minimum of one-hour lecture or a minimum of 2 hours lab/tutorial per week for 18 weeks in a Semester. The minimum number of credits required to complete the Post Graduate Diploma in Data Science & Analytics (PGDDSA) program is 42.

2.2 Seminar

Each student should select a relevant topic and prepare a seminar report, under the guidance of a faculty member. Students should prepare an abstract of the topic and distribute it to every faculty member at least two weeks ahead of the seminar. The presentation shall be for a minimum of 30 minutes in duration. Presentation and seminar report will be evaluated by a group of at least two faculty members (Mark distribution:50%for report and 50% for presentation and discussion).

2.3 Assignments

Each student shall be required to submit a minimum of three assignments for each course. The details such as the number of assignments, mark distribution, and the weightage for each assignment will be announced by the faculty in charge of the course at the beginning of the semester.

2.4 Tests

A minimum of two class tests will be conducted for each course. The details such as the number of tests, mark distribution, and weightage for each test will be announced by the faculty in charge of the course at the beginning of the semester.

2.5 Seminar / Viva-voce / Case studies / Lab assignments

The faculty in charge of the course shall design the evaluation pattern based on one or more of these components and will be announced at the beginning of the semester.

2.6 Evaluation

Evaluation of the students shall be done by the faculty member who handles the course based on continuous evaluation and End Semester Examination. The proportion of the distribution of marks, including CE (Continuous Evaluation) and ESE (End Semester Examination) shall be 60-40.

2.6.1 Continuous Evaluation (CE)

Continuous Evaluation (CE) of a course shall be based on periodic written tests, assignments, and Seminar / Viva-voce / Case studies/Project work/Attending workshops/Participating and presenting papers in Conferences/Publishing articles in Journals/Proceeding, etc. in respect of each course.

Components of Continuous Evaluation (Theory)

Sl.	Component	Marks
Sl.	**Component**	**Marks**
1	Seminar	10
2	Assignments	10
3	Internal tests	20
4	Implementation and viva	20
	Total	**60**

Components of Continuous Evaluation (Practical)

Sl.	Component	Marks
1	Record Work/Lab Assignments	10

2	Implementing the experiment in the Lab	35
3	Viva-voce	15
	Total	**60**

2.6.2 Evaluation of Practical courses

The details regarding the CE as well as ESE for each practical course will be specified as part of the syllabus for the course.

2.7 End-Semester Evaluation (ESE)

All odd semester examinations will be conducted by the Head of the Department and even semester examinations will be conducted by the Controller of Examination, Kannur University. To conduct the end-semester examination, the Head of the department shall submit a confidential panel of examiners not less than ten experts from the outside of the Kannur University duly approved by the department council for the approval of the Vice-Chancellor. All teachers who engage in classes on the course except industrial experts will be members of the Board of Examiners (BoE) with the Head of the Department as the chairman of the BoE. All the faculty in charge of the course shall prepare and submit three (03) unique sets of question papers for their course in odd semester well in advance to the Head of the department for the conduct of End Semester Examination of the respective batch. The Head of the department shall conduct a scrutiny meeting of the above question papers submitted by the concerned faculty by inviting at least two external experts from the list approved by the Vice-Chancellor. The even semester examination question papers for the elective courses shall be set by the Controller of Examination by selecting the external experts of the question paper setters approved by the Vice-Chancellor. The Head of the department shall submit the detailed syllabus, model question papers of the elective courses offered in the even semester to the Controller of Examination along with the panel of experts duly approved by the Vice-Chancellor for setting the question papers to those electives soon after the commencement of the course.

2.7.1 Pattern of question papers and evaluation criteria for (ESE)

Pattern of Questions: Questions shall be set to assess knowledge acquired, standard application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. The duration of the examination is two (02) hours only. Question paper for end semester theory examination shall consist of two parts

Part A

(Short essay type)

Answer all Questions.

Each question carries four marks.

1.

2

3

4

5 (5 × 4 = 20 Marks)

Part B

(Essay type)

Answer any two questions.

Each question carries 10 Marks.

6.

7.

8. (2 × 10 = 20 Marks)

2.8 Project

Project work has to be undertaken by all students enrolled in the program. The project can be software-related or establishing mathematical/statistical models evolved for the development of data science & analytics following software development lifecycle or an R&D-related project. The hours allotted for project work may be clustered into a single slot so that students can do their work at a center or location for a continuous period of time. The Major project work should be carried out in the Department /Institution or in an Industry / R & D organization of national

repute. Project work shall be carried out under the supervision of a Teacher. If the project is carried out in an Industry / R & D organization outside the campus, then a co-guide shall be selected from the concerned organization. If the project work is of interdisciplinary nature, a co-guide shall be taken from the other department concerned. Every student should do the project individually and no grouping is allowed. The candidates are required to get the synopsis and the guide approved by the department before the commencement of the project. A co-guide should be a postgraduate in CS/Application/IT/Mathematics/Statistics or allied subject or a person of eminence in the area in which the student has chosen the project. At the end of the semester, the candidate shall submit the Project report (two bound copies and one soft copy) duly approved by the guide and co-guide for End Semester Evaluation. The project report shall be prepared according to the guidelines appended along with these regulations/Guidelines approved by the University.

2.8.1 Evaluation of Project:

i. A Departmental committee duly constituted by the Head of the Department will review the project periodically.

ii. **Continuous Assessment of project work:** There shall be three internal presentations before the committee (Minimum two members, including the guide). The assessment is based on presentation, interim report, and viva voce. The total mark for CA shall be divided among the three presentations in the ratio **20%:30%:50%.** Each internal presentation shall be evaluated based on the following components:

	COMPONENTS	% OF MARKS
i	Understanding of the problem/concepts	25%
ii	Adhering to methodology	20%
iii	Quality of presentation and demonstration (Demonstration is optional	15%
iv	Quantum of work/effort	30%
v	Organization and content of	10%

	Project report	

iii. End Semester Assessment of Project: A board of two examiners appointed by the University shall conduct an ESE evaluation. The evaluation shall be based on the report, presentation of the work, demonstration of the work and a detailed viva voce based on the work carried out. A candidate will not be permitted to attend the Project evaluation without duly certified project reports. Also, a project will be evaluated only if the candidate attends the ESE presentation and Viva-voce on the scheduled date and time. A board shall evaluate a maximum of eight (08) candidates in a day. The End Semester evaluation shall consist of the following components:

	COMPONENTS	% OF MARKS
i	Understanding of the problem/requirements/ concepts related to the project	15
ii	Adhering to methodology (Software engineering phases or research methodology) and the candidate's understanding of the components of the methodology	15
iii	Quality of Modeling of the problem and solution/ database design / form design / reports / testing (For research projects - relevance /novelty of the work(s)/ use of data/ proposal of new models /analysis of algorithms/ comparison and analysis of results /findings)	20
iv	Quality of presentation / demonstration	15
v	Quantum of work/effort - assessed through the content of the report, presentation, and viva	25
vi	Organization and content of the report	10

iv. A student shall pass in the Project course if she/he secures a separate minimum of 50 % for the external and 50% for ESE and CA put together.

v. If a candidate fails in the evaluation of the Project, he/she has to repeat the project

course along with the next batch and undergo both CA and ESE. Unlike theory/practical courses, the CA mark will not be retained.

vi. There shall be no improvement chance for the marks obtained in the Project course.

2.8.2 Guideline for preparing project Report

i. Arrangement of contents:

The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & Title Page
2. Plagiarism Report
3. Bonafide Certificate
4. Abstract
5. Table of Contents
6. List of Tables
7. List of Figures
8. List of Symbols, Abbreviations, and Nomenclature
9. Chapters

The chapters may be broadly divided into 3 parts (i) Introductory chapter, (ii) Chapters developing the main theme of the project work (iii) implementation details (if any), and Conclusion. The main text will be divided into several chapters and each chapter may be further divided into several divisions and sub-divisions. Each chapter should be given an appropriate title.

Tables and figures in a chapter should be placed in the immediate vicinity of the reference where they are cited.

Footnotes should be used sparingly. They should be typed single space and placed directly underneath on the very same page, which refers to the material they annotate.

10. Appendices

11. References

The tables and figures shall be introduced at appropriate places.

ii. Page Dimension and binding specifications:

The dimension of the project report should be in A4 size. The project report should be bound using a flexible cover of thick white art paper. The cover should be printed in black letters and the text for printing should be identical.

iii. All the project reports submitted by the students should be **plagiarism checked** using **Turnitin software** and the plagiarism report generated by the software should be verified and signed by the Head of the Department or person-in-charge of the Project Coordinator.

3.0 Grading

An alphabetical grading system shall be adopted for the assessment of students' performance in a course. The grade is based on a ten-point scale. The following table gives the range of marks, grade points, and the alphabetical grade.

Range of marks %	Grade points	Alphabetical grade
90–100	9	A+
80–89	8	A
70–79	7	B+
60–69	6	B
50–59	5	C
<50	0	F

A minimum of grade point5 (Grade C) is needed for the successful completion of a course.

The performance of a student at the end of each semester is indicated by the Grade Point Average (GPA) and is calculated by taking the weighted average of grade points of the courses

successfully completed. The following formula is used for the calculation. The average will be rounded off to two decimal places.

$$GPA = \frac{\text{Sum of (grade points in a course multiplied by its credit)}}{\text{Sum of credits of courses}}$$

The overall performance of a student is indicated by the Cumulative Grade Point. Average (CGPA) is calculated using the same formula given above.

The empirical formula for calculating the percentage of marks will be CGPAx10+5. Based on CGPA overall letter grade of the student shall be in the following way.

CGPA	Overall letter grade
9 and above	A+
8 and above but less than 9	A
7 and above but less than 8	B+
6 and above but less than 7	B
5 and above but less than 6	C

Conversion of Grades into classification

Classification	Overall letter grade
First Class with distinction	A+ and A
First Class	B+ and B
Second Class	C

3.1 Grade Card

The Controller of Examination, Kannur University is the authority to issue the semester-wise grade card and consolidated grade statement and certificates on completion of the programbased on the authenticated documents submitted by the Head of the Department after the approval of the department council at the end of each semester.

4.0 Supplementary Examinations for Failed Candidates

1. Candidates who have failed (F grade) in the semester examinations (except project work) can appear for the failed papers for the particular semester along with regular students. However, the Continuous Evaluation (CE) marks shall remain the same.
   Two such supplementary chances will be given for each semester within two years.
2. In the event of a failure in Project Work, the candidate shall re-register for project work, redo the project work and resubmit the project report fresh for evaluation. The Continuous Evaluation marks shall be freshly allotted in this case.

Appearance for continuous Evaluation and End Semester Evaluation is compulsory and no grade shall be awarded to a candidate if he/she is absent for CE/ESE or both.

A student who fails to complete the program/semester can repeat the full program/semester once if the department council permits so.

There shall be no provision for improvement of CE or ESE.

5.0 Department Council

This program is a joint venture of three departments such as Information Technology, Mathematical science, and Statistical science with industrial collaboration. So the conventional structure of the Department council is not sufficient for dealing with the smooth conduct of this course. Hence the department council for the Post Graduate Diploma in Data Science & Analytics may be reconstituted as follows:

Chairman: The Head of the Department of Information Technology.

Members:

1. All faculty members who engaged in classes for this course.

2. The Head of the Department of Mathematical Science/ Senior Faculty nominated by the Head of the department concerned
3. The Head of the Department of Statistical Science/Senior Faculty nominated by the Head of the department concerned.
4. One /two experts from industry/Academician nominated by the Vice-Chancellor as per the recommendation of the Department Council.

6.0 Industrial Collaboration

This program is intended to make 100% industrial collaboration and the experts from the industry will handle different sessions for the course. The course will run in blended mode and is comprised of 10 modules including the industrial related project. Therefore, the expert from the domain handles at least hundred (100 [10 modules ×10 sessions =100 sessions]) sessions. The duration of a session is two (02) hours. The Head of the Department will provide the remuneration/TA/DA to the expert as per the University norms. To the smooth conduct of the program, the Finance Officer of Kannur University has to make a provision to transfer the required fund to the Head of the Department of Information Technology on request within two weeks after the beginning of the first semester of the course. The Head of the Department of Information Technology is entrusted to appoint two Adhoc faculties towards the smooth conduct of the program. Remuneration for the same should be met from the fund transferred by the Finance Officer of Kannur University.

Details of the financial assistance required for the conduct of the session by the industrial/academic experts.

Sl.	Description	Amount	Remarks
1	Remuneration/TA/DA for the experts from industry/academia	Rs. 7,00,000	(Per session Rs.3000/-)
2	Expenses for conducting semester examinations.	Rs. 35,000	
	Total	Rs.7,35,000	

NB: Economic class flight fare is eligible for the experts coming from other state/country with the prior approval from the Vice Chancellor of the Kannur University

7.0 Grievance Redressal Mechanism

Committees will be constituted at the Department and University levels to investigate the written complaints regarding continuous Evaluation (CE). Department Level Committee (DLC) will consist of the Department Council and a student nominee of the Department Students' Union from the concerned faculty.

University Level Committee (ULC) will consist of the Pro-Vice-Chancellor (Chairman and Convener), the Convener of the Curriculum Committee (vice-chairman), the Head of the Department concerned and a nominee of the Students' Union. Department Level Committee will be presided over by the HOD and the University Level Committee by the Pro-vice-chancellor. Department Level Committee will have initial jurisdiction over complaints against CE and University Level Committee will hear appeals against Department level decisions. Complaints will have to be submitted to the Department concerned within two weeks of the publication of results of CE and disposed of within two weeks of receipt of the complaint. Appeals to university Level Committee should be made within one month of the decision taken by the Department level committee and disposed within two months of the receipt of the complaint.

Complaints unsolved by the University Level Grievance committee shall be placed before the Vice Chancellor.

COURSE STRUCTURE

Semester	Theory	Practical
Semester I	5	2
Semester II	2 Electives	1Project

Semester I

Subject Code	Subject	*Instructional Hrs./week*			Marks			Credit
		L	P	T	CE	ESE	Tot	
PGDDSC01	Mathematical and Statistical Methods for	3	0	0	60	40	100	4

	Data Science Using R							
PGDDSC02	Introduction to Data Science and Algorithm Design	3	0	0	60	40	100	4
PGDDSC03	Machine Learning for Data Science and Introduction to Python	4	0	0	60	40	100	4
PGDDSC04	Business Analytics and Prediction	4	0	0	60	40	100	3
PGDDSC05	Advanced Computational Methods for Data Science	4	0	0	60	40	100	3
PGDDSL01	Lab –I	0	6	2	60	40	100	3
PGDDSL02	Lab -II	0	6	3	60	40	100	3
Total		18	12	5	420	280	700	24

Semester II

Subject Code	Subject	*Instructional Hrs./week*			Marks			Credit
		L	P	T	CE	ESE	Tot	
PGDDSE01/ 02/03/04	Elective I	4	0	0	60	40	100	4
PGDDSE05/ 06/07/08	Elective II	4	0	0	60	40	100	4
PGDDSP01	Project	0	12	5	120	80	200	10
Total		8	12	5	240	160	400	18

List of Elective I				
Course code	Course Title	Theory	Practical	Tutorial

PGDDSE01	Advanced Machine Learning	4	0	0
PGDDSE02	Natural Language Processing	4	0	0
PGDDSE03	Big Data Analytics	4	0	0
PGDDSE04	Data Warehousing	4	0	0

List of Elective II				
Course code	**Course Title**	**Theory**	**Practical**	**Tutorial**
PGDDSE05	Deep Learning	4	0	0
PGDDSE06	Time Frequency Analysis	4	0	0
PGDDSE07	Artificial Intelligence	4	0	0
PGDDSE08	Computer Vision	4	0	0

Course Contents:

PGDDSC01: Mathematical and Statistical Methods for Data Science Using R

- Fundamentals of R
- Basic Linear algebra for data science
- Linear programming problem
- Basic statistical concepts and importance sampling methods.
- Data cleaning and visualization using R
- Measures of Central Tendency, dispersion, skewness, and kurtosis

- Pearson correlation coefficient, rank correlation, intra-class correlation
- Basics of probability and random variable
- Probability distributions-Binomial, Poisson, Uniform, Normal, Beta, and Gamma and multinomial and multivariate normal distributions.
- Statistical inference: basics of estimation, testing (parametric and non-parametric), and confidence interval estimation
- Maximum likelihood estimation and Bayesian estimation.
- Basic concepts of Markov chain

PGDDSC02: Introduction to Data Science and Algorithm Design

- Basics of Data and data science
- Data acquisition, cleaning, and aggregation (Python/R)
- Exploratory data analysis (Python/R)
- Feature engineering in data science
- Model creation and validation
- Applications of Data Science in various fields
- Data Security Issues
- Data Science Pipeline: Data Wrangling, Exploratory Analysis, Modeling
- Data structure: Linear and non- linear data structure
- Techniques for design of efficient algorithm: Brute Force approach, Divide-and-Conquer approach
- Branch-and-Bound technique, Greedy method, Dynamic Programming
- Importance of algorithm analysis, time and space complexity

PGDDSC03: Machine Learning for Data science and Introduction to Python

- Introduction to python programming
- Basics of Machine Leaning
- Supervised Machine Learning –Linear regression, Neural networks

- K-NN, SVM
- Decision tree, Naïve Bayes
- Unsupervised Machine Learning – K means, Hierarchical clustering
- Computation with Python – NumPy, SciPy
- Data Manipulation in Python- Pandas, Understanding Data Frame
- Data Visualization in Python - matplotlib
- Introduction to Scikit – Machine learning
- Introduction to Hadoop/Map Reduce

PGDDSC04: Business Analytics and Prediction

- Introduction to analytics
- Simple and multiple linear regressions
- Regression diagnostics
- Logistic regression
- Time series analysis and forecasting
- Autoregressive and moving average models
- Graphics programming: charts, graphs, animations, and techniques for visualization of high dimensional data
- Presentation and visualization of data for effective communication
- TABLEAU: Visual Analytics | Mapping |Calculations | Dashboard and Stories
- POWER BI: Intro to PowerBI | Visualization with BI | Data Analysis Expressions

PGDDSC05: Advanced Computational Methods for Data Science

- Basics of statistical simulation
- Monte Carlo simulation
- Basic concepts of Bayesian computing
- MCMC methods and MH algorithm
- Introduction to Multivariate data analysis
- Dimensionality reduction- SVD
- PCA and FA

- Expectation-Maximization (EM) algorithm
- LDA and multidimensional scaling
- Markov process
- Hidden Markov Models (HMM)

Elective Subjects

PGDDSE01: Advanced Machine Learning

- Neural Networks
- Recurrent Neural Networks
- Convolutional Neural Networks
- Autoencoders
- Back propagation through time
- GPU optimization for Neural Networks
- Momentum for quadratic optimization
- Momentum for convex optimization
- Dimensionality Reduction
- Semantic Segmentation
- Deep learning as non-convex optimization
- Bayesian Statistics

PGDDSE02: Natural Language Processing

- Introduction to Natural Language Processing: lexical categories, Morphology and morphological parsing
- Regular expressions and Automata
- Natural Language Understanding-Levels of language analysis-Syntax, Semantics, and Pragmatics, NLU vs NLG in NLP.
- Understanding NLP Pipeline

- N-grams: simple N-grams, Applications, language modeling
- Grammars and Parsing: CFG, parsing-top down and bottom-up parsing.
- Lexical semantics and word sense disambiguation (WSD)
- Distributed Word Representations: Word2vec, Glove, FastText, BERT, and Flair
- Sequence Modeling: recurrent neural networks (RNN), Bidirectional RNN and LSTM
- Word level and sentence level text classification using deep learning
- Discourse processing: monologue, dialogue, and reference resolution
- Applications of NLP: Machine translation, Information retrieval, text summarization, sentiment analysis, Named Entity Recognition

PGDDSEO3: Big Data Analytics

- Introduction To Big Data and Big Data Analytics
- Big Data Visualization
- Analytical Theory and Methods
- Time Series and Text Analysis
- Data Product & Big Data Operating System
- Distributed Analysis and Patterns
- Understanding Hadoop Ecosystem, Hadoop Streaming, Map Reduce
- In-Memory Computation with Spark
- Learning Data Analytics with R and Hadoop
- Understanding Big Data Analysis with Machine Learning
- Importing and Exporting Data from Various DBs
- Exploring Hive, Pig and Oozie
- Learn NoSQL Data Management

PGDDS E04: Data warehousing

- Introduction to Data warehousing, basic concepts.
- Operational and Informational data stores

- Data warehouse architecture.
- Data Warehousing Components.
- Data warehouse modeling
- Data Matting, ETL, Data cleaning
- Data warehouse Design and usage.
- Data warehouse Administration and Management.
- Building a data Warehouse, Design and Technical Considerations.
- Data warehouse implementation.
- Sourcing, Acquisition, cleanup and transformation tools. Metadata, Access Tools.
- Cloud Data warehousing

PGDDSE05: Deep Learning

- Introduction to Neural Networks: Gradient descent and the backpropagation algorithm.
- Deep networks, model exploration, regularizing DNN, and hyper-parameter tuning.
- Convolution Neural Networks: Introduction to convolution neural networks, stacking, striding, and pooling.
- Applications of CNN: image classification and image segmentation.
- Deep learning for object detection
- Natural language processing (NLP): Distributed Word Representations: Word2vec, FastText and Flair
- Sequence Modeling: recurrent neural networks (RNNs), Bidirectional RNNs
- Word level and sentence level text classification using deep learning
- Auto encoders regularized auto encoders, sparse auto encoders, denoising auto encoders, representational power
- Generative Adversarial Networks (GAN): Deep Convolutional GAN
- Reinforcement learning: Deep reinforcement learning
- Deploying a deep learning model: a case study.

PGDDSE06: Time Frequency Analysis

- Introduction to Time Frequency Analysis

- Local/global averages, Time-frequency distributions
- The Heisenberg uncertainty principle
- Short-time Fourier transform
- Wigner-Ville distribution
- Cohen's class of distributions
- Spaces and Bases, Hilbert spaces, Banach spaces
- Riesz bases, Biorthogonal bases, orthogonal bases, orthonormal bases, Shift-invariant spaces
- Splines, frames, dual frames, Wavelets, scalogram, wavelet frames
- Multi-resolution analysis
- Wavelet orthogonal bases
- Bi-orthogonal wavelet bases, applications of wavelets

PGDDSE07: Artificial Intelligence

- Introduction to AI
- Problem Formulation
- Production System
- Ontology
- Propositional Logic
- First-Order Predicate Logic
- Fuzzy Logic
- Pattern Recognition
- Distance-Based Neural Networks
- Multilayer Neural Network
- Decision Trees
- Population-Based Search

PGDDSE08: Computer Vision

- Introduction to Image Processing: image: representation and properties

- Image preprocessing using python
- Edge detection, line detection and corner detection
- Image segmentation: border detection and region construction
- Image understanding and textures
- Introduction to computer vision
- Shape representation and description
- Object detection and recognition: Knowledge representation, statistical pattern recognition
- 3D vision, geometry and radiometry
- Motion Analysis with practical image understanding

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