MANIPAL ACADEMY of HIGHER EDUCATION
(Institution of Eminence Deemed to be University)

Department of Data Science

Prasanna School of Public Health

Manipal Academy of Higher Education, Manipal

Learning Outcomes-based Curriculum Framework (LOCF)

Two-year Full-time Postgraduate Programme

M.Sc. (Biostatistics)

2024

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1. NATURE AND EXTENT OF THE PROGRAMME

The two-year M.Sc. (Biostatistics) programme offered is a perfect blend of Biostatistics appliedto Health Sciences. Courses include linear algebra, matrix theory, differential calculus, measuretheory, probability distributions, statistical inference, predictive modelling, data management,study designs, stochastic processes, Bayesian methods and research methodology. Hands on training is provided in statistical software namely, R, python and SAS. Regular classesare conducted for the first three semesters and the last semester is exclusively devoted to project work and internship in either a corporate or an academic institution of repute.

Graduates with the following qualifications (with a minimum of 60% of marks or an equivalent grade) from UGC recognized universities/institutions are eligible to apply for the M.Sc. (Biostatistics) programme.

- B.Sc. (Statistics or Mathematics or Computer Science)
- B.E./B.Tech.
- BCA
- Any other graduation with minimum 2 years learning of Mathematics or Statistics.

Selection of eligible candidates will be based on merit of rank obtained in the entrance examination and/or personal interview.

The department prepares students for a career as biostatisticians and researchers enabling themto make a mark in the corporate sector as well as academic institutions. Through industry- academia collaborations, the department provides placement assistance to the students on successful completion of the course.

2. RULES AND REGULATIONS GOVERNING THE PROGRAMME

i. Attendance Requirement

- A student should have a minimum of 75% attendance in a course to appear in the end-semester examination of that course.
- Candidates having attendance shortage in any courses will be detained from attending the end-semester examination of that course and should be re-registered for that course along with next regular batch. In case of syllabus change, if any, the candidate will undergo the equivalent courses as recommended by the BOS.

ii. Progression

- Academic progress is assessed on the basis of a student's performance in the last study period and also takes into account their overall performance to date in the programme they are currently enrolled.
- Students are deemed to be making satisfactory academic progress if they pass at least 50% of their enrolled courses in an academic year.
- Students who fail in more than 50% of the courses in an academic year are not considered to be making satisfactory academic progress and are provided with intervention.

iii. Programme Delivery

The theory courses are delivered through classroom teachings, tutorials, and self-learning, whereas practical courses are with computer exercises using various statistical software. Seminar, journal presentation, internship and project under designated supervisors are other significant activities of the program.

iv. Examination and Assessments

All the end-semester examinations and assessments are governed by MAHE rules, Department of Data Science being the center of examination. In-semester assessments are carried out by the faculty in-charge of the course and by faculty committee in the case of focus seminars, statistical consultancy and internship.

Theory (Core and Elective): In each of theory course student will be evaluated for 100 marks with two components, namely internal assessment and end-semester assessment (having weightage of 50 marks for internal assessment and 50 marks for end semester assessment). End-semester examinations will be organized by the university. Internal assessment will have components such as class tests and/or seminars and/or quiz and/or assignments, one in-semester examination. Theory paper with

practical has internal assessment consisting of one in-semester examination (20 marks), practical examination (20 marks) and continuous assessments such as class tests and/or quiz and/or assignment (10 marks).

Practical: End-semester examination in any practical course is with weight of 40 marks which includes a component of viva-voce having a weight of 10 marks. In-semester assessments have a weight of 60 marks and the students are assessed during the semester and through continuous assessment (30 marks) and one in-semester examination (30 marks)

Focus Seminar and Journal Presentation: There is no end-semester examination in this course. This course is an activity scheduled throughout the first year and evaluated and graded by the supervisor and faculty committee. Each seminar or journal presentation of a student is evaluated out of 50 marks by each faculty member. The average of the marks given by all faculty members is calculated. The total marks for the seminar and journal presentation are given out of 100.

Project: Student enrolled for the program shall carried out an industrial/research project, on the approval of faculty committee, in the second year of the programme. Project will be supervised by a faculty (internal and/or external) who is responsible for student's internal assessment. Project report must be submitted before the end of second year of the programme as per the deadline mentioned by the department, which is necessary for the final evaluation. Internal assessment is with a weight of 50 marks, and supervisor/s is/are responsible for the continuous assessment of candidate's performance regarding protocol presentation and execution of project. Final examination with a weight of 150 marks is based on evaluation of report (100 Marks), presentation of report (20 Marks) and viva-voce (30 Marks). A student with 'F' grade or 'I' grade must re-register for project of the programme.

Internship: Satisfactory completion of supervised internship is an essential requirement for any student to obtain degree in the program. Student may opt any approved institutions/organizations for his/her internship for the duration of minimum 6 months and the activities of internship will be reported along with the project report to the department.

Assessment with a weight of 100 marks is based on the evaluation of performance by the supervisor and the examiners evaluating the report. The successful candidate will be awarded the letter grade 'S'. Unsuccessful candidate will be awarded the letter grade 'NS' and such candidate should repeat the internship in the next available opportunity.

In the internship, a candidate securing lesser than 50% of total marks will be declared as unsuccessful and will be awarded letter grade of 'NS' (Not Satisfactory). Candidate with 50% or more in the internship will be declared successful and will be awarded a letter grade of 'S' (Satisfactory).

Choice- based electives: Students have to take 2 choice-based electives adding to 6 credits. Each choice based elective is assessed for 100 marks, based on two class tests of 50 marks each. The student will be awarded a Satisfactory (S) or Not Satisfactory (NS) grade based on their performance. A candidate securing lesser than 50% of total marks will be declared as unsuccessful and will be awarded letter grade of 'NS' (Not Satisfactory). Candidate with 50% or more will be declared successful and will be awarded a letter grade of 'S' (Satisfactory).

MOOC course: MOOC course is assessed for 100 marks, based on two internal assessment of 50 marks each. The student will be awarded a Satisfactory (S) or Not Satisfactory (NS) grade based on their performance. A candidate securing lesser than 50% of total marks will be declared as unsuccessful and will be awarded letter grade of 'NS' (Not Satisfactory). Candidate with 50% or more will be declared successful and will be awarded a letter grade of 'S' (Satisfactory).

Statistical consultancy Training: Each student must take 10 consultancies from the second semester and submit a report. Based on fulfilling this requirement, the student will be awarded a Satisfactory (S) or Not Satisfactory (NS) grade.

v. Award of Performance Grades

Minimum for pass: A minimum of 40% in end-semester assessment and aggregate (sum of end-semester assessment and internal assessment) of 50% in each course.

Absolute Grading (Fixed Cut Off): In the internship, choice-based electives and MOOC courses a candidate securing lesser than 50% of total marks shall declared as unsuccessful and will be awarded letter grade of 'NS' (Not Satisfactory). Candidate with 50% or more in these will be declared successful and will be awarded a letter grade of 'S' (Satisfactory).

In all other courses 10-point grade system with letter grades is adopted to grade any student in the program. A student detained from a particular examination due to attendance shortage, or non-payment of fees, or due to any disciplinary action will be detained from appearing that examination and will be awarded a letter grade of 'DT'. A student who is absent for an End-semester examination with valid reason will be awarded the letter grade of 'I'. Students absent with valid reason must apply for such exemption, with necessary document at department within a week from the end of the End-semester examinations. A student absent from an End-semester examination without any valid reason will be given 'F' grade with grade point 0. Percentage of marks with a non-zero value in the decimal place shall be approximated to the next integer (example: 60.1 will be 61). Student who obtains below 40% marks in the university examination will be awarded Grade F. Range with fixed cut-off for different letter grades and the corresponding grade points are given in the following table.

Sl. No	Percentage of Marks	Grade	Grade Points
1	90 and above	A+	10
2	80-89	A	9
3	70-79	B	8
4	60-69	C	7
5	55-59	D	6
6	50-54	E	5
7	Less than 50	F (Fail)	0
8		I / DT	0

Credit Earning: A student will be awarded a credit assigned to any course if he/she obtains a letter grade with non-zero grade points (in other words, he/she successfully completes that particular course).

Grade Point Average (GPA): The GPA in a semester will be given to a candidate only on he/she successfully completes all the courses of that semester. The GPA in a semester is weighted average of grade points earned in different courses with respect to weights given by the credits of those courses. For example, if n is the number of courses in i^{th} semester, c_j is the credit of j^{th} subject, and p_j is grade point earned in the j^{th} subject, then the grade point average for the i^{th} semester is given by:

$$G_i = \frac{\sum_{j=1}^{n} c_j \; p_j}{\sum_{j=1}^{n} c_j}.$$

Cumulative Grade Point Average (CGPA): The CGPA at any k^{th} semester will be given to a candidate if he/she successfully completes all the courses till that semester. If T_i is the total credits of the courses available in the i^{th} semester and G_i is the GPA earned in the i^{th} semester, then CGPA in the k^{th} semester is given by:

$$C_k = \frac{\sum_{i=1}^{k} T_i \; G_i}{\sum_{i=1}^{k} T_i}.$$

vi. Supplementary Examinations

Any eligible candidate with the letter grade 'F' or 'I' or 'DT' can register for the supplementary examination as per the university regulations. A student with 'F' grade earlier would be able to improve to the maximum of 'C' grade in the supplementary examination. Others will be securing the actual grade achieved in the supplementary examination. Candidate can appear for supplementary examination in the project if he/she successfully completed the project but failed to appear for final examination. Other failed candidates in the project may re-register for the project at the earliest opportunity available. A student failed in supplementary examination may re-register for the course with the subsequent batch.

vii. Revaluation of answer scripts

A student may apply for revaluation of university examination by submitting an application along with the specific fee. The revaluation will be as per the rules of the regulations of the controller of examinations office.

viii. Improvement of internal assessment

Candidates seeking improvement in the internal assessment must re-register and repeat the course with the subsequent batch to improve the internal assessment.

ix. Promotion to the next semester

Any candidate who has taken all the courses in a particular semester are eligible to be promoted to the next semester, irrespective of their examination results. A candidate must obtain 80% of the credits offered in the first three semesters to be eligible to take up the project defense.

x. Declaration of results

Results of end-semester examinations will be declared within three weeks from the completion of the examinations.

xi. Duration for completion of the programme

Students can take a maximum of FOUR years (including TWO years of regular curriculum) to complete the programme.

xii. Award of degree

A student earning 80 credits of curricular programme and a satisfactory grade in the internship may be considered to be eligible for the award of degree from MAHE. Award of degree is subject to the terms and conditions of MAHE.

xiii. Re-admission after break of study

As per the university regulations.

3. PROGRAMME EDUCATION OBJECTIVEs (PEO)

The M.Sc. (Biostatistics) programme is devoted to the specialized training in analytical skills as applied to pharmaceutical and biological sciences. It aims to nurture the recipients develop as biostatisticians/statistical programmers with productive careers in corporate/academic sectorthrough

- Strong methodological foundations in biostatistics
- Versatile training in handling statistical consultations
- Competency in the use of appropriate techniques, skills and tools necessary for biostatistics

The overall objectives of the Learning Outcomes-based Curriculum Framework (LOCF) for **M.Sc. (Biostatistics)** programme are as follows.

PEO #	Education Objective
PEO 1	Students will be able to effectively visualize and describe data through appropriate statistical methods.
PEO 2	Students will be proficient to identify and apply the most appropriate analytical methods or techniques to solve problems in biological/health sciences.
PEO 3	Students will be able to demonstrate programming skills to provide data driven solutions for decision making.
PEO 4	Students will be able to project their teamwork capabilities through statistical consultations for research projects by best practices of collation and disseminationof data at hand.
PEO 5	Students will be able to exhibit their leadership and pedagogy skills.
PEO 6	Students will be competent to pursue higher studies.

4. GRADUATE ATTRIBUTES

Sl #	Attribute	Description
1	**Disciplinary knowledge**	Adequate competency in the domains of biostatistics such as data management, predictive modelling, visualization techniques, statistics and their application.
2	**Measurable skills and industry-ready professionals**	Competency in the use/development of appropriate techniques, skills and tools to provide data driven solutions to biological/health sciences problems. Capability to use various communication technologies (both online and offline).
3	**Communication and teamwork**	Effective and influencing oral/written communication ability to share thoughts, ideas and findings. Ability to work in a team as well as in isolation.
4	**Leadership readiness/qualities**	Capability to map tasks of a team or an organization, formulate an inspiring vision, build a team to achieve desiredobjectives, motivate and inspire team members. Cultivate key characteristics in learners, to be visionary leaders who can inspire the team to greatness.
5	**Problem solving**	Capacity to extend the knowledge and competencies gained through the programme to solve novel or non-familiar problems in biological/health sciences.
6	**Analytical reasoning / Critical thinking**	Ability to employ critical and reflective thinking to gain expertise required to analyse data and improve decision making.
7	**Self-directed learning**	Ability to work independently, identify appropriate resources required and solve problems in biological/health sciences.
8	**Ethical awareness**	Understand the importance of data integrity, data confidentiality, data security and abide by professional ethics.
9	**Lifelong learning**	Foster independent, coherent and decisive thoughts to ultimately develop competency and motivate lifelong learning.
10	**Research-relatedskills**	Develop originality in thoughts that will enable the student to formulate novel and creative methodologies to tackle real-life multi-disciplinary problems.

5. QUALIFICATION DESCRIPTORS

The qualification descriptors for the master's degree will

- Demonstrate (i) a systematic knowledge of Biostatistics and its applications to emerging real world problems, (ii) skills in the areas related to current developments in applications of Biostatistics, (iii) procedural knowledge that creates Biostatisticians in the government and public services.
- Exhibit skills in retrieval of quantitative and/or qualitative data, analysis and interpretation of data using appropriate methodologies.
- Use knowledge, understanding and skills for critical assessment of a wide range of ideas and complex problems related to Biostatistics.
- Foster the ability to effectively communicate the data-driven solutions in a clear and concise manner to stakeholders across biological/health sciences.
- Address one's learning needs relating to current and emerging areas of study, making use of professional materials as appropriate, including those related to new frontiers of knowledge.
- Showcase subject-specific and transferable skills that will provide a competitive edge in career opportunities.
- Develop skills that are pre requisite for higher studies.

6. PROGRAMME OUTCOMES

On successful completion of M.Sc. (Biostatistics), students will be able to:

PO #	Attribute	Competency
PO 1	**Disciplinary knowledge**	Illustrate in-depth knowledge of data management, analysis and problem solving.
PO 2	**Measurable skills and industry-ready professionals**	Exercise professional skills and values to accept challenges in the industry and academia.
PO 3	**Communication and teamwork**	Demonstrate team work, decision making skills andeffective communication of study design/findings.
PO 4	**Leadership readiness/qualities**	Identify and appraise the leadership skills required to directa team of biostatisticians towards meeting organizational goals.
PO 5	**Problem solving**	Apply statistical skills to biological/health sciences problemsand effectively present the results.
PO 6	**Analytical reasoning / Critical thinking**	Employ analytical and critical thinking to develop methods to provide solutions to biological/health sciences problems based on global needs and trends.
PO 7	**Self-directed learning**	Formulate learning goals, identify resources and implement appropriate learning tools for innovative problem-solving.
PO 8	**Ethical awareness**	Practice the ethics of biostatistics.
PO 9	**Lifelong learning**	Develop and strengthen conceptual knowledge; recognize the need for self-motivation to engage in lifelong learning.
PO 10	**Research-related skills**	Acquire and apply research based knowledge; enhance proficiency through exploration of current research in biostatistics and develop novel methodologies to solve complex problems.

7. COURSE STRUCTURE

FIRST YEAR											
Semester I						**Semester II**					
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
DDS 5101	Computational Mathematics	2	-	2	3	DDS 5201	Linear Regression Models	1	-	2	2
DDS 5102	Probability and Probability Distributions	2	-	2	3	DDS 5202	Categorical Data Analysis and Generalized Linear Models	2	-	2	3
DDS 5103	Statistical Inference	3	-	2	4	DDS 5203	Design and Analysis of Experiments	2	-	2	3
DDS 5104	Design and Analysis of Epidemiological Studies	2	-	2	3	DDS 5204	Survival Analysis	2	-	2	3
DDS 5106*	Data Processing, Data Management and Data Warehousing+	1	-	2	2	DDS 5206	Stochastic Processes	2	-	2	3
DDS 5107*	Programming with R and Python+	-	-	4	2	DDS 5207*	Programming with SAS for Analytics+	-	-	4	2
Total		**10**	**-**	**14**	**17**	**Total**		**9**	**-**	**14**	**16**

SECOND YEAR											
Semester III						**Semester IV**					
Course Code	**Course Title**	**L**	**T**	**P**	**C**	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
DDS 6101	Bayesian Statistical Modelling	2	-	2	3	DDS 6201	Internship	-	-	-	2
DDS 6102	Statistical Methods for Machine Learning	3	-	2	4	DDS 6204	Disease Modelling and Spatial Modelling (MOOC)	-	-	-	2
DDS 6103.1	Non-parametric and Non-linear Regression Models	2	-	2	3						
DDS 6103.2	Time Series Analysis										
DDS 6104	Hierarchical Linear and Generalized Linear Models	2	-	2	3						
DDS 6106*	Statistical Research Methodology+	2	-	4	4						
DDS 6107#	Comprehensive Practical+	-	-	4	2	DDS 6299	Project	-	-	-	15
Total		**11**	**-**	**16**	**19**	**Total**					**19**

DURING THE PROGRAMME				
DDS 6202: Seminar/Journal Presentation (2 presentations)				2
DDS 6203: Statistical Consultancy Training (10 consultations)				1
CHOICE BASED ELECTIVES (2 courses adding to at least 6 credits)**				6

+ Practical papers

* Assessment and moderation of the courses to be done by internal faculty

Assessment to be done by external and internal faculty

**List of choice based electives and credits on next page

8. LIST OF CHOICE-BASED ELECTIVES

Subject Code	Name of the Course	Coursera Components	Offered by	Course Hours	No. of Courses	Credits
DDS 6208.1	Effective Communication	Dynamic Public Speaking	University of Washington	58	4	4
DDS 6208.2	Six Sigma for Quality Improvement	Six Sigma Yellow Belt	University System of Georgia	38	4	2
DDS 6208.3	Microsoft Excel Skills for Statisticians - I	Excel skills for Business: Essentials	Macquarie University	26	1	3
		Excel skills for Business: Intermediate 1	Macquarie University	27	1	
DDS 6208.4	Microsoft Excel Skills for Statisticians - II	Excel skills for Business: Intermediate 2	Macquarie University	28	1	3
		Excel skills for Business: Advanced	Macquarie University	25	1	
DDS.6208.5	Prompt Engineering Specialization	Prompt engineering for ChatGPT	Vanderbilt University	18	1	2
		ChatGPT Advanced Data Analysis	Vanderbilt University	10	1	
		Trustworthy Generative AI	Vanderbilt University	8	1	
DDS 6208.6	Power BI Basics	Harnessing the Power of Data with Power BI	Microsoft	16	2	2
		Extract, Transform and Load Data in Power BI	Microsoft	20	3	
DDS 6208.7	Power BI: Data Modelling and Visualizations	Data Modeling in Power BI	Microsoft	26	4	3
		Data Analysis and Visualization with Power BI	Microsoft	29	5	
DDS 6208.8	Data Visualizations using Tableau	Introduction to Tableau	Tableau learning partner instructor	19	4	4
		Data Visualization with Tableau	Tableau learning partner instructor	26	5	
		Advanced Data Visualization with Tableau	Tableau learning partner instructor	21	6	

9. COURSE ASSESSMENT PLAN

Course code	Course name	Semester	In-semester Weightage		Continuous Assessment Weightage	End-semester Weightage		Credits
			Theory	Practical		Theory	Practical	
DDS 5101	Computational Mathematics	1	20	20	10	50	NA	3
DDS 5102	Probability and Probability Distributions	1	20	20	10	50	NA	3
DDS 5103	Statistical Inference	1	20	20	10	50	NA	4
DDS 5104	Design and Analysis of Epidemiological Studies	1	20	20	10	50	NA	3
DDS 5106	Data Processing, Data Management and Data Warehousing	1	15	30	15	NA	40	2
DDS 5107	Programming with R and Python	1	NA	30	30	NA	40	2
DDS 5201	Linear Regression Models	2	20	20	10	50	NA	2
DDS 5202	Categorical Data Analysis and Generalized Linear Models	2	20	20	10	50	NA	3
DDS 5203	Design and Analysis of Experiments	2	20	20	10	50	NA	3
DDS 5204	Survival Analysis	2	20	20	10	50	NA	3
DDS 5206	Stochastic Processes	2	20	20	10	50	NA	3
DDS 5207	Programming with SAS for Analytics	2	NA	30	30	NA	40	2
DDS 6101	Bayesian Statistical Modelling	3	20	20	10	50	NA	3
DDS 6102	Statistical Methods for Machine Learning	3	20	20	10	50	NA	4
DDS 6103.1	Non-parametric and Non-linear Regression (Elective)	3	20	20	10	50	NA	3
DDS 6103.2	Time Series Analysis (Elective)	3	20	20	10	50	NA	3
DDS 6104	Hierarchical Linear and Generalized Linear Models	3	20	20	10	50	NA	3
DDS 6106	Statistical Research Methodology	3	15	30	15	NA	40	4
DDS 6107	Comprehensive Practical	3	NA	30	30	NA	40	2
DDS 6299	Project	4	NA	NA	25	NA	75	15
DDS 6201	Internship	4	NA	NA	100 (S/NS)	NA	NA	2
DDS 6202	Seminar/Journal Presentation	4	NA	NA	100	NA	NA	2
DDS 6203	Statistical Consultancy Training	4	NA	NA	100 (S/NS)	NA	NA	1
DDS 6204	Disease Modelling And Spatial Modelling (MOOC)	4	NA	NA	100 (S/NS)	NA	NA	2
DDS 6208	Choice Based Electives	4	NA	NA	100 (S/NS)	NA	NA	6

10. PROGRAMME OUTCOMES (POs) AND COURSE OUTCOMES (COs) MAPPING

Sl #	Course Code	Course Name	Credits	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
1	DDS 5101	Computational Mathematics	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7				CO 1 CO 2 CO 3 CO 6 CO 7	CO 1 CO 2 CO 5 CO 6	CO 2 CO 4 CO 7			CO 1 CO 2 CO 4 CO 7
2	DDS 5102	Probability and Probability Distributions	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7				CO 2 CO 5 CO 6	CO 2 CO 5 CO 6				
3	DDS 5103	Statistical Inference	4	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8 CO 9	CO 4 CO 5 CO 6 CO 7 CO 8 CO 9	CO 4 CO 5 CO 6 CO 7 CO 9	CO 4 CO 5 CO 6 CO 7 CO 8 CO 9	CO 9	CO 9	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8 CO 9	CO 9	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8 CO 9	CO 9
4	DDS 5104	Design and Analysis of Epidemiological Studies	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7 CO 8	CO 1 CO 2 CO 6 CO 7 CO 8	CO 2	CO 2	CO 2 CO 4 CO 5 CO 6 CO 7 CO 8	CO 5 CO 6 CO 7 CO 8	CO 1 CO 2 CO 6 CO 7 CO 8	CO 2 CO 6 CO 7 CO 8	CO 1 CO 2 CO 6 CO 7 CO 8	CO 1
5	DDS 5106	Data Processing, Data Management and Data Warehousing	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 5 CO 6			CO 4 CO 6	CO 3 CO 4 CO 5 CO 6			CO 1 CO 6	CO 3 CO 5 CO 6
6	DDS 5107	Programming with R and Python	2	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6			CO 2 CO 3 CO 4 CO 6	CO 2 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 2 CO 6
7	DDS 5201	Linear Regression Models	2	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4			CO 2 CO 4	CO 2 CO 4	CO 1 CO 2 CO3 CO 4	CO 2 CO 4	CO 1 CO 2 CO 3 CO 4	CO 3 CO 4
8	DDS 5202	Categorical Data Analysis and Generalized Linear Models	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7			CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7		CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6 CO 7
9	DDS 5203	Design and Analysis of Experiments	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3		CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 4 CO 5 CO 6	CO 3	CO 4 CO 5 CO 6	CO 4 CO 5 CO 6
10	DDS 5204	Survival Analysis	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6			CO 1 CO 3 CO 4 CO 5 CO 6	CO 1 CO 3 CO 4 CO 5 CO 6	CO 1 CO 4 CO 5 CO 6		CO 1 CO 4 CO 5 CO 6	CO 1 CO 4 CO 5 CO 6

Sl #	Course Code	Course Name	Credits	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
11	DDS 5206	Stochastic Processes	3	CO 1 CO 2 CO 3 CO 4 CO 5				CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5		CO 1 CO 2 CO 3 CO 4 CO 5	CO 5
12	DDS 5207	Programming with SAS for Analytics	2	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 6		CO 2 CO 3 CO 4 CO 5	CO 2 CO 3 CO 4 CO 5	CO 2 CO 3 CO 4 CO 5	CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	
13	DDS 6101	Bayesian Statistical Modelling	3	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4			CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4		CO 1 CO 2 CO 3 CO 4	
14	DDS 6102	Statistical Methods for Machine Learning	4	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 3 CO 4 CO 5 CO 6			CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 3 CO 4 CO 5 CO 6	CO 3 CO 4 CO 6	CO 1 CO 2 CO 6	CO 3 CO 4 CO 5 CO 6	CO 6
15	DDS 6103.1	Non-parametric and Non-linear Regression Models	3	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 5	CO 1 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5				
16	DDS 6103.2	Time Series Analysis	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 2 CO 3 CO 4 CO 5 CO 6	CO 2 CO 3 CO 4 CO 5 CO 6						
17	DDS 6104	Hierarchical Linear and Generalized Linear Models	3	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 5			CO 1 CO 2 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6			CO 6	
18	DDS 6106	Statistical Research Methodology	4	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1	CO 1		CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6
19	DDS 6107	Comprehensive Practical	2	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6			CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 3 CO 4 CO 5 CO 6	CO 3 CO 4 CO 5 CO 6	CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 4 CO 5 CO 6
20	DDS 6201	Internship	2	CO 3	CO 1 CO 2 CO 3	CO 1 CO 2	CO 1 CO 2	CO 3	CO 3	CO 3	CO 1 CO 2 CO 3	CO 1 CO 2 CO 3	CO 3
21	DDS 6202	Seminar/Journal Presentation	3	CO 1 CO 2 CO 3 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 4 CO 5 CO 6	CO 4 CO 5 CO 6	CO 2 CO 3 CO 5 CO 6	CO 2 CO 3 CO 5 CO 6	CO 2 CO 3 CO 5 CO 6	CO 2 CO 3 CO 4 CO 5 CO 6	CO 1 CO 2 CO 3 CO 4 CO 5 CO 6	CO 2 CO 3 CO 5 CO 6
22	DDS 6203	Statistical Consultancy Training	1	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4	CO 1	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4	CO 1 CO 2 CO 3 CO 4
23	DDS 6204	Disease Modelling and Spatial Modelling (MOOC)	2	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3	CO 1 CO 2 CO 3		CO 2 CO 3	CO 4 CO 5	CO 1 CO 2 CO 3 CO 5		CO 5	CO 4 CO 5
24	DDS 6299	Project	15	CO 1 CO 2 CO 3 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 5	CO 1 CO 2 CO 3 CO 5	CO 1 CO 2 CO 3 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 4 CO 5	CO 1 CO 2 CO 3 CO 5