NEP and Learning Outcomes based Curriculum Framework (LOCF)

For Postgraduate Programme

Master of Business Administration- Business Analytics

(Applicable from the Academic Session 2024-25)

(3rd and 4th semester)

Department of Management
Gurugram University, Gurugram (Haryana)
(A State Govt. University Established Under Haryana Act 17 of 2017

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1. About The Department

Established in 2018, the Department of Management aims at developing global citizens of tomorrow through research, innovation, life skills, technical skills, and ethical training. The Department focuses on the education ecosystem through enshrined core values of intellectual excellence, collegiality, diversity, and integrity. As of today, it offers two-year full time MBA (General), MBA (Super Specialization), MBA(Integrated), MBA (Hospitality Management), MBA (Business Analytics) and Ph.D. programme from the University campus. The courses offer a unique and inspirational academic model designed to match the international standards. A wide spectrum of programs is paired with flexibility, experiential learning, and interdisciplinary orientation. The Department has a dynamic academic fraternity drawn from top universities nationally and internationally. The Department is the epitome of excellence and has created dynamic industry leaders and aspires to develop into a destination of choice for future managers. Department attracts a great diversity of students who have the drive, confidence, and a burning desire to advance the progress for business and society. Students here get the platform to train themselves with a view to face the challenges of the corporate world with confidence. Special emphasis is given to their holistic development through a healthy and collaborative learning environment. An integrated approach that combines field work, case studies, presentations and group discussions is followed by the department to inculcate pedagogical and conceptual knowledge along with practical exposure of management concepts and theories in students.

2. Programme Outcomes

Programme Outcomes (PO) of Post Graduate Programmes/Courses in the Faculty of Commerce and Management, Gurugram University, Gurugram are as under:

PO1	Apply knowledge of management theories and practices to solve business problems.
PO2	Foster Analytical and critical thinking abilities for data-based decision making.
PO3	Ability to develop Value based Leadership.
PO4	Ability to understand, analyze and communicate global, economic, legal, and ethical aspects of business.
PO5	Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment.
PO6	Develop deeper understanding, creativity, originality, and critical skills in chosen specialized areas of social science disciplines leading to employability.
PO7	Articulate and apply ethics, values and ideals that demonstrate awareness of current societal challenges leading to better quality of life.
PO8	Communicate conclusions, interpretations, and implications clearly, concisely and effectively, both orally and in writing for different types of audiences.

3. Programme Specific Outcomes (PSOs)

The MBA is a highly prominent management programme of modern times and prepares the participants for taking up middle and top-level challenging executive assignments in private and public sectors. Accordingly, they are imparted adequate conceptual knowledge and practical training in various functional areas of management i.e., Finance, Marketing, Organizational Behaviour and Human Resource Management, Data Analytics, and supply chain management. MBA programme is a two years programme divided into four semesters. The programme is aimed at following outcomes:

PSO1	Developing the ability to think strategically, gaining competency in quantitative and qualitative techniques, gaining an understanding of global business dynamics, inculcating multicultural outlook, learning to navigate and manage organizational change effectively and understanding the role of technology in business transformation to derive business growth and competitiveness.

PSO2	Developing responsiveness to contextual social issues and exploring solutions, understanding business ethics and resolving ethical dilemmas, cultivating a mindset of lifelong learning and professional development to adapt to evolving business trends and challenges throughout their career, fostering an entrepreneurial mindset by encouraging innovation, creativity, and risk-taking abilities to identify and capitalize on business opportunities.

4. Qualification Descriptors

- Students shall be admitted to a two-year programme with the second year devoted entirely to specialization.
- A programme of study leading to the MBA degree is open to those who have met the entrance requirements, including specified levels of attainment, in the programme admission regulations. Admission to a programme of study is based on the evaluation of documentary evidence (including the academic record) of the applicant's ability to undertake MBA study.

5. Scheme of Programme

MBA - a four-semester postgraduate programme is of 106 credits; weightage consisting of **Core Courses (CC), Skill Enhancement Courses (SEC), Ability Enhancement Courses (AEC), Value Addition Courses (VAC), Discipline Specific Elective Courses (DSE), Multidisciplinary Courses (MDC) Specialization Specific Elective Course (SSE) and Internship/ Dissertation/ Research Project/ Seminar.**

Course and Credit Scheme

Semester	Core Courses (CC)		Multidisciplinary Courses (MDC)		Skill Enhancement Courses (SEC)		Ability Enhancement Courses (AEC)		Value Addition Courses (VAC)		Discipline Specific Elective Courses (DSEC)		Specialization Specific Elective Courses (SSEC)		Internship/ dissertation/ Research project / Seminar		Total Credits
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
I	3	12	1	3	-	-	1	2	1	2	1	3	-	-	-	-	22
II	3	12	1	3	1	2	1	2	-	-	1	3	-	-	-	-	22
III	3	12	1	3	1	2	-	-	1	2	1	3	2	6	2	6	34
IV	2	8	1	3	-	-	1	2	-	-	1	3	2	6	1	6	28
Total	**11**	**44**	**4**	**12**	**2**	**4**	**3**	**6**	**2**	**4**	**4**	**12**	**4**	**12**	**3**	**12**	**106**
%age	Core Credits	42	MDC Credits	11	SEC Credits	4	AEC Credits	6	VAC credits	4	DSEC credits	11	Specialization Specific Elective Course	11	Internship/ dissertation/ Research project / Seminar	11	**100**

6. Course Outcomes and Mapping Matrix:

- Each Course of the MBA Programme results in few Course/Learning Outcomes (COs) which are broadly mapped or associated with POs as well as PSOs.
- Mapping is a process of representing the correlation between COs and POs, COs and PSOs in the scale of 1 to 3 as follows.

Scale of Mapping between COs and POs & COs and PSOs

Scale 1	If the contents of course have low correlation (less than 50 %) with the particular Programme Outcomes and particular Programme Specific Outcomes.
Scale 2	If the contents of course have medium correlation (50%-70%) with the particular Programme Outcomes and Programme Specific Outcomes.
Scale 3	If the contents of course have strong correlation (more than 70%) with the particular Programme Outcomes and Programme Specific Outcomes.

7. Scheme of Examination

Summer Training: At the end of second semester, all the students will have to undergo summer training of 4-6 weeks with an industrial, business or service organization. The condition of successfully completing the programme shall not be deemed to have been satisfied unless a student undergoes summer training under the supervision of faculty from the department. Each student will be required to submit a summer training report to the department for the work undertaken for evaluation in the third semester. Internal evaluation of 30 marks will be done by Internal Guide /Mentor and 70 marks will be based on External viva before the committee of three members constituted by the Dean/Chairperson of the Department.

Exit Policy: For MBA-Business Analytics programme, there are two exit points, one, at the end of the first year of the MBA programme after successfully earning 44 credits of First and Second semesters and second, on the completion of the two-year programme, after successfully earning 106 credits of all the four semesters. Students who exit after the first year shall be awarded the Post-Graduate Diploma in Management and students who exit after the completion of the second year will be awarded 'Master of Business Administration- Business Analytics'.

MBA Second Year Third Semester (Total Credits: 34, Marks - 850)

After completing 1st and 2nd Semesters, students are required to study four courses pertaining to Business Analytics Specialization in both the third and the fourth semesters.

Course Code	Course Title	Course Id	Theory Marks		Practical Marks		Total Marks	Credits
			External Marks	Internal Marks	External Marks	Internal Marks		
Core Courses								
243MBCC1	Strategic Management	241/MBABA/CC301	70	30	-	-	100	4
243MBCC2	Business Law	241/MBABA/CC302	70	30	-	-	100	4
243MBCC3	Basic Data Analytics using R and Python	241/MBABA/CC303	70	30	-	-	100	4
Multidisciplinary Course (MDC)								
	To be picked up from the pool						75	3
Skill Enhancement Course								
	To be picked up from the pool OR Equivalent MOOC Course*						50	2
Value Addition Course								
	To be picked up from the pool OR Equivalent MOOC Course*						50	2
Internship/ Dissertation/ Research Project								
243MBIDR1	Summer Training Project Report	241/MBABA/IDR301	-	-	70	30	100	4

243MBIDR2	Seminar/Live Project	241/MBABA/IDR302	-	-	35	15	50	2
Discipline Specific Elective Course#								
243MBDSE1	Predictive Modeling	241/MBABA/DSEC301	50	25	-	-	75	3
243MBDSE2	Statistics with R	241/MBABA/DSEC302	50	25	-	-		
Specialization Specific Elective Courses##								
243MBBA1	Social Media Analytics	241/MBABA/SSEC301	50	25	-	-	75	3
243MBBA2	Relational Database Management and SQL	241/MBABA/SSEC302	50	25	-	-		
243MBBA3	Text Mining using NLP and Machine Learning	241/MBABA/SSEC302	50	25	-	-		
						Total	**850**	**34**

*Each student is required to opt at least one course from MOOC of equivalent course credits. It is mandatory for the student to submit passing certificate of the same to the department, to be able to appear for the viva. For MOOC courses, 35 marks will be for the certificate earned (external practical) and 15 marks will be allotted on the basis of internal (internal practical) viva.

Students have to elect one Discipline Specific Elective Course based on their interest.

Students have to select any two Specialization Specific Elective Courses based on their interest.

MBA Second Year Fourth Semester (Total Credits: 28, Marks - 700)

Course Code	Course Title	Course ID	Theory Marks		Practical Marks		Total Marks	Credits
			External Marks	Internal Marks	External Marks	Internal Marks		
Core Courses								
244MBCC1	Entrepreneurship and Innovation	241/MBABA/CC401	70	30	-	-	100	4
244MBCC2	Big Data Analysis	241/MBABA/CC402	70	30	-	-	100	4
Multidisciplinary Course								
	To be picked up from the pool OR Equivalent MOOC Course*						75	3
Ability Enhancement Course								
	To be picked up from the pool OR Equivalent MOOC Course**						50	2
Internship/ Dissertation/ Research Project								
244MBIDR1	Specialization based Research Project	241/MBABA/IDR401	-	-	100	50	150	6
Discipline Specific Elective Course#								
244MBDSE1	SaS and Tableau	241/MBABA/DSEC401	50	25	-	-	75	3
244MBDSE2	Machine Learning & Artificial Intelligence	241/MBABA/DSEC402	50	25	-	-		

Specialization Specific Elective Course##								
244MBBA1	Natural Language Processing	241/MBABA/SSEC401	50	25	-	-	75	3
244MBBA2	Python Programming	241/MBABA/SSEC402	50	25	-	-		
244MBBA3	Cloud Computing	241/MBABA/SSEC403	50	25	-	-		
						Total	**700**	**28**
	*Each student is required to opt at least one course from MOOC for equivalent course credits. It is mandatory for the student to submit passing certificate of the same to the department, to be able to appear for the viva. For MOOC courses, 50 marks will be for the certificate earned (external practical) and 25 marks will be allotted on the basis of internal (internal practical) viva. **Each student is required to opt at least one course from MOOC for equivalent course credits. It is mandatory for the student to submit passing certificate of the same to the department, to be able to appear for the viva. For MOOC courses, 35 marks will be for the certificate earned (external practical) and 15 marks will be allotted on the basis of internal (internal practical) viva. **# Students have to elect one Discipline Specific Elective Course based on their interest.** **## Students have to select any two Specialization Specific Elective Courses based on their interest.**							

Specialization Based Research Project: During the 4th semester the students will have to work on a research project of their specialized area under the supervision of faculty member of the department. Each student will be required to submit a project report to the department for the work undertaken for evaluation in the 4th semester. Internal evaluation of 50 marks will be done by Internal Guide /Mentor and 100 marks will be based on External viva before the committee of three members constituted by the Dean/Chairperson of the Department.

Notes:

1. PLP Stand for Personal Leadership Programme
2. It is mandatory to teach at least two cases per subject per semester.
3. Spreadsheet is the recommended software for doing basic calculations in subjects applicable, hence shall be used for teaching, practice, problem solving and assignments during all the four semesters.
4. The duration of all the end term theory examinations shall be 3 hours

Instructions for the Examiner:

Instructions for the External Examiner: The question paper shall be divided in two sections as follows:

	Theory Marks	**70**	**50**	**35**

Section A	Seven (7/6) short answer type questions from whole of the syllabus carrying equal marks each, this section will be compulsory	7*2=14 Marks	6*1= 6 Marks	7*1=7 Marks
Section B	8 questions (2 questions from each unit). The students will be required to attempt four questions selecting one question from each unit.	14*4= 56 Marks	11*4= 44 Marks	7*4= 28 Marks
	Total Theory Marks	**70 Marks**	**50 Marks**	**35 Marks**

Instructions for the Internal Examiner: The internal assessment should be spread evenly throughout the semester and must include at least 3 independent components including a mid-term exam. Below are the suggested components for internal marks.

	Marks out of			
Total Marks	**100**	**75**	**50**	**25**
Internal Assessment	**30**	**25**	**15**	**5**
Attendance Below 55= 0 Marks Between 55 to < 65= 1Marks Between 65 to < 70 = 2 Marks Between 70 to < 75 = 3 marks Between 75 to < 80= 4 Marks 80 and more than 80 = 5 Marks	5	5	5	5
Assignment/ Presentations/ Seminars and Class Participation	5	5	-	-
Sessional Examination*	20	15	10	-
Total Marks	**30**	**25**	**15**	**5**

*Sessional will consist of class tests, mid-semester examination(s), homework assignments, class presentations, case analysis, role play etc., as determined by the faculty in charge of the courses of study.

Third Semester

Strategic Management
243MBCC1

Credits: 4

External Marks: 70
Internal Marks: 30
Time Allowed: 3 Hrs.

Type of Course: Core Course

Course Objectives:

The course aims at imparting knowledge of formulation, implementation and evaluation of business strategies, for effective planning and to introduce key strategy concepts to the students for facilitating better decision making.

Course Outcomes: On the completion of this course the student will be able to:

CO1: Develop understanding of the type of decisions taken at different levels of management. .
CO2: Apply various tools and techniques for strategic decision making and problem solving through critical thinking.
CO3: Analyze the significance of strategies and policies for gaining competitive advantage globally.
CO4: Evaluate the strategy which best fits in achieving the organizational goals under various scenarios.

DETAILED SYLLABUS:

UNIT I
Strategy: Concept and Levels, Strategic Decision Making; Schools of thought on Strategy Formulation; Strategic Management: Elements and Models in Strategic Management Process; Strategic Intent, Vision, Mission, Goals and Objectives, Strategic Business Unit.

UNIT II
Strategy Formulation: Environmental Appraisal, Organizational Appraisal, Corporate Level and Business Level Strategies.

UNIT III
Strategic Analysis and Choice: Strategic Analysis, Tools and Techniques for Strategic Analysis - BCG Matrix, Porter's Model, GE Matrix, SWOT Analysis; Strategic Choice - Process of Strategic Choice, Factors in strategic Choice.

UNIT IV
Strategy Implementation: Activating Strategies, Structural, Behavioural, Functional and Operational Implementation; Strategic Evaluation and Control.

SUGGESTED READINGS:

1. Gupta, Gollakota and Srinivasan, Business Policy and Strategic Management –Concepts and Applications, PHI, New Delhi.
2. Jauch and Glueck, Business Policy and Strategic Management, TMH, New Delhi.
3. Kazmi, Azhar, Strategic Management and Business Policy, Tata McGraw Hill Publishing Company Ltd., New Delhi.

4. Pearce and Robinson, Strategic Management–Formulation, Implementation and Control, McGraw Hill Publishing, New Delhi.

Mapping Matrix of Course: 243MBCC1

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBCC1: Strategic Management

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	2	2	3	1	2	2	2
CO2	3	3	1	2	3	3	1	2	3	2
CO3	1	2	2	3	2	2	2	2	3	2
CO4	2	2	2	2	2	2	2	3	2	2
Average	2.25	2.25	1.5	2.25	2.25	2.5	1.5	2.25	2.5	2

Business Law
243MBCC2

Credits: 4

External Marks: 70
Internal Marks: 30
Time Allowed: 3 Hrs.

Type of Course: Core Course

Course Objectives: This course gives an exposure to the students of some of the major commercial laws affecting the businesses and equip them with the deeper understanding of various provisions of the laws pertaining to businesses.

Course Outcomes:
On the completion of this course the student will be able to:

CO1: Remember different laws applicable to a business.
CO2: Apply the knowledge of laws for solving business problems while following ethical code of conduct.
CO3: Analyze cases of law and develop critical thinking to formulate plans as per the regulatory framework.
CO4: Evaluate the existing business laws in India and analyse their relevance in today's globalized environment.

Detailed Syllabus:
UNIT I
The Indian Contract Act, 1872: Meaning of a Contract, Classification of Contracts, Essentials of a Valid Contract; Performance of a Contract; Discharge of a Contract; Breach of Contract; Quasi Contracts.

UNIT II
Contracts of Indemnity: Meaning, Rights of Indemnity holder, Time of commencement of Indemnifier's Liability Are Insurance Contracts the Contracts of Indemnity?

Contracts of Guarantee: Meaning & Features of Contract of Guarantee, Difference between a Contract of Indemnity & Contract of Guarantee, Nature & Extent of Surety's Liability, Meaning & Revocation of Continuing Guarantee, Rights of Surety against Principal Debtor, Creditor & Co-Surety.
Contracts of Bailment: Definition & Essentials of Contract of Bailment, Duties and Rights of Bailor and Bailee, Duties & Rights of Finder of Goods.
Contracts of Agency: Meaning & Essentials of Contract of Agency, Different kinds of Agents-Auctioneers, Brokers & Del Credere Agents, Extent of Agent's Authority – Actual, Apparent, Authority in Emergency, Duties of Agent, Termination of Agency

UNIT III
The Sales of Goods Act, 1930: Meaning and essentials of a valid contract of sale, Distinction between sale and agreement to sell, Meaning of goods and their classification, Conditions and warranties, Doctrine of Caveat Emptor, Rights of an unpaid seller, Rights of buyer.

UNIT IV
Negotiable Instruments Act: Meaning, Characteristics and Types of Negotiable Instruments; Holder and Holder-in-due-course; Negotiation by Endorsements; Crossing of Cheque and Dishonour of Cheque.

SUGGESTED READINGS:

1. Aggarwal, S. K., Singhal, K., Business Laws, Galgotia Publications, New Delhi.
2. Datey, V. S., Business and Corporate Laws, Taxmann Publications, New Delhi.
3. Gulshan, S. S., Business Law, New Age International Publication, New Delhi.
4. Kapoor, N. D., Elements of Mercantile Law, Sultan Chand & Sons, New Delhi.
5. Kuchhal and Prakash, Business Legislation for Management, Vikas Publishing, New Delhi.
6. Tulsian P. C., Business Law, Tata McGraw Hill, New Delhi.

Mapping Matrix of Course: 243MBCC2

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBCC2: Business Law

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	2	2	1	3	2	2	2	2
CO2	3	2	2	3	2	2	3	2	3	2
CO3	2	3	2	3	1	3	2	2	2	2
CO4	1	2	2	2	2	2	2	2	2	2
Average	2	2.25	2	2.5	1.5	2.5	2.25	2	2.25	2

Basic Data Analytics using R and Python

243MBCC3

Credit: 4

External Marks: 70
Internal Marks: 30
Time Allowed: 3 Hrs.

Type of Course: Core Course

Course Objectives:

This course presents a gentle introduction into the concepts of business analysis, the role of a business Analyst, and the tools that are used to perform daily functions. The participants will gain an understanding of the data ecosystem and the fundamentals of data analysis through R and Python, such as data gathering or data mining. The participants will then learn the soft skills that are required to effectively communicate the data to stakeholders, and how mastering these skills can give them the option to become a data driven decision maker.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Memorize the terminology of Big Data Analytics and develop conceptual understanding of R and Python.

CO2: Apply and incorporate the technologies behind big data in business context.

CO3: Analyze the relevance of application of R and Python for data analysis and solving complex business problems.

CO4: Evaluate and design programs for data processing for providing solutions to complex business problems.

Detailed Syllabus:

UNIT I

Understanding data: Importing, plotting, understanding and cleaning the data. Understand Univariate and multivariate, categorical and quantitative data, visual presentations of data, descriptive statistics, data tables, interpretation from graphical charts-bar plots, box plots, scatter diagrams. Hands on case study using software.

UNIT II

Introduction to R: R Data Types (Character, Numeric, Integer, Logical Complex), Different Data Structures in R, Basics of R Syntax, install R / RStudio, RStudio interface, import, export, and view files, save files. Data types in R and its appropriate uses, Program Structure in R, Flow Control: For loop, If condition, While conditions, Concatenation of Data, Combining Vars, cbind, rbind, Sapply, apply, tapply functions, Introduction to Data Structure in R, Vectors, Lists, Scalars, Data Frames, Matrices, Arrays, Factors.

UNIT III

Data Visualization using R: Introduction to ggplot, Univariate Graph, Bivariate Graph, Multivariate Graph, Customizing Graphs, Saving Graphs. Descriptive Analysis in R: Using Summary Command, Using Name Command, Summary command: Single value result, Summary command: Multiple Result cumulative commands, Descriptive Statics for R Data Frames, Descriptive statistics in R for Matrix Objects.

UNIT IV

Introduction to Python: Python Data Types: Functions, String and List, Python Data Types: Tuples and Dictionaries, Files and Exceptions, Types of Operators, Classes and Objects, Reading files with Open, writing files with Open, loading data with Pandas, working with and saving with Pandas, Array oriented Programming with Numpy, Data cleaning and preparation, Plotting and Visualization, data Aggregation and Group Operations.

SUGGESTED READINGS:

1. Levin & Rubin, Statistics for Business, Prentice Hall of India, Delhi.
2. Anderson, Quantitative Methods in Business, Thomson Learning, Bombay.
3. Anderson, Statistics for Business & Economics, Thomson Learning, Bombay.
4. Kothari C.R., Quantitative Techniques, Vikas Publishing House, New Delhi
5. Andy Field, Discovering Statistics Using SPSS, Pearson Press.
6. Damodar Gujrati, Basic Econometrics, McGraw Hill Education, 5th Edition
7. Joseph F. Hair Jr, William C. Black, Barry J. Babin, Rolph E. Anderson, Multivariate Data Analysis, Pearson Press.

Mapping Matrix of Course: 243MBCC3

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBCC3: Basic Data Analytics using R and Python

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	3	2
CO3	2	3	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2.25	2

Predictive Modeling
243MBDSE1

Credit: 3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs.

Type of Course: Discipline Specific Elective Course

Course Objectives:
Predictive modelling is a name given to a collection of mathematical techniques having in common the goal of finding a mathematical relationship between a target, response, or "dependent" variable and various predictor or "independent" variables with the goal in mind of measuring future values of those predictors and inserting them into the mathematical relationship to predict future values of the target variable. Because these relationships are never perfect in practice, it is desirable to give some measure of uncertainty for the predictions, typically a prediction interval that has some assigned level of confidence like 95%. Another task in the process is model building.

Course outcomes:
On the completion of this course the student will be able to:

CO1: Develop conceptual understanding of predictive modelling.

CO2: Apply the techniques of predictive modelling for finding solutions for critical problems through creative thinking.

CO3: Analyze the data using statistical tools and techniques like regression and ANOVA.

CO4: Interpret the findings of statistical tests for predictive performance.

Detailed Syllabus:
UNIT I
Regression: Introduction to regression, simple regression, method of least square, goodness of fit: R^2 , interpretation of regression coefficients, testing the significance of coefficients. Hands on case study using software.

UNIT II
Multiple regression model, sample size in regression, estimating partial regression coefficients, testing of the model fit, interpretation of ANOVA results of regression, testing of regression coefficients, method of regression-hierarchical (block wise entry), forced entry, stepwise regression, forward pass, backward pass, Interpretation of beta values. Interpretation of computer output and report writing

UNIT III
Assumptions of multiple regression-linearity, normality, autocorrelation, multi-co linearity-VIF and tolerance, condition index, homogeneity of variance (heteroscedasticity), regression plots, accuracy of regression modal-checking outliers, leverage and influence (case wise diagnosis). Interpretation of computer output and report writing

UNIT IV

Curvilinear regression-method of fitting the model, checking the assumptions and interpretation of computer output. Concept of Dummy variable in regression, use of dummy variables in seasonal analysis, piecewise linear regression, interaction effect of predictive variables and interpretation of results. Interpretation of computer output and report writing

SUGGESTED READINGS:

1. Levin & Rubin, Statistics for Business, Prentice Hall of India, New Delhi.
2. Anderson, Quantitative Methods in Business, Thomson Learning, Bombay.
3. Anderson, Statistics for Business & Economics, Thomson Learning, Bombay.
4. Kothari C.R., Quantitative Techniques, Vikas Publishing House, New Delhi
5. Andy Field, Discovering Statistics Using SPSS, Pearson Press.
6. Damodar Gujrati, Basic Econometrics, McGraw Hill Education, 5th Edition
7. Joseph F. Hair Jr, William C. Black, Barry J. Babin, Rolph E. Anderson, Multivariate Data Analysis, Pearson Press.

Mapping Matrix of Course: 243MBDSE1

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBDSE1: Predictive Modelling

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	3	2	2	2	2	2	2	3	2
CO3	2	2	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2.25	2

Statistics with R
243MBDSE2

Credit: 3

External Marks: 50
Internal Marks: 25

Time Allowed: 3 Hrs.

Type of Course: Discipline Specific Elective Course

Course Objectives:

This course comprises of R programming basics and application of several Statistical Techniques using it. It aims to provide exposure in terms of Statistical Analysis, Hypothesis Testing, Regression and Correlation using R programming language. The objective of this module to make students exercise the fundamentals of statistical analysis in R environment. They would be able to analysis data for the purpose of exploration using Descriptive and Inferential Statistics. Students will understand Probability and Sampling Distributions and learn the creative application of Linear Regression in multivariate context for predictive purpose.

Course Outcomes:
On the completion of this course the student will be able to:

CO1: Memorize and understand the terminology of R.

CO2: Apply the knowledge of R programming language in R Studio to resolve business problems.

CO3: Analyze the business problems statistically using R programming Language.

CO4: Evaluate the reliability and validity of data and design programmes to resolve complex business problems.

Detailed Syllabus:
Unit -I
R and R Studio, Logical Arguments, Missing Values, Characters, Factors and Numeric, Help in R, Vector to Matrix, Matrix Access, Data Frames, Data Frame Access, Basic Data Manipulation Techniques, Usage of various apply functions – apply, lapply, sapply and tapply, Outliers treatment.

Unit II
Types of Data, Nominal, Ordinal, Scale and Ratio, Measures of Central Tendency, Mean, Mode and Median, Bar Chart, Pie Chart and Box Plot, Measures of Variability, Range, Inter-Quartile- Range, Standard Deviation, Skewness and Kurtosis, Histogram, Stem and Leaf Diagram, Standard Error of Mean and Confidence Intervals. Experiment, Sample Space and Events, Classical Probability, General Rules Of Addition, Conditional Probability, General Rules For Multiplication, Independent Events, Bayes' Theorem, Discrete Probability Distributions: Binomial, Poisson, Continuous Probability Distribution, Normal Distribution & t-distribution, Sampling Distribution and Central Limit Theorem.

Unit III
Population and Sample, Null and Alternate Hypothesis, Level of Significance, Type I and Type II Errors, One Sample t Test, Confidence Intervals, One Sample Proportion Test, Paired Sample t Test, Independent Samples t Test, Two Sample Proportion Tests, One Way Analysis of Variance and Chi Square Test.

Unit IV
Analysis of Relationship, Positive and Negative Correlation, Perfect Correlation, Correlation Matrix,

Scatter Plots, Simple Linear Regression, R Square, Adjusted R Square, Testing of Slope, Standard Error of Estimate, Overall Model Fitness, Assumptions of Linear Regression, Multiple Regression, Coefficients of Partial Determination, Durbin Watson Statistics, Variance Inflation Factor.

Suggested Readings:

1. Ken Black, 2013, Business Statistics, New Delhi, Wiley.
2. Lee, Cheng. et al., 2013, Statistics for Business and Financial Economics, New York: Heidelberg Dordrecht.
3. Anderson, David R., Thomas A. Williams and Dennis J. Sweeney, 2012, Statistics for Business and Economics, New Delhi: South Western.
4. Waller, Derek, 2008, Statistics for Business, London: BH Publications.
5. Levin, Richard I. and David S. Rubin, 1994, Statistics for Management, New Delhi: Prentice Hall.

Mapping Matrix of Course: 243MBDSE2

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBDSE2: Statistics with R

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	2	2
CO3	2	3	1	2	1	2	1	3	2	2

CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2	2

Social Media Analytics

243MBBA1

Credit: 3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs.

Type of Course: Specialization Specific Elective Course

Course Objectives: This course comprises advanced disciplines and units pertaining to Analytics, Data Acquisition via web, Understanding and analyzing unstructured data along with the future implementations and growth in the discipline of Analytics. This course aims at giving exposure on the advanced aspects with regards to Analytics. The course comprises social media, Mobile, Text Analytics along with Web Scraping and the future advancements in the field of Analytics.

Course Outcomes:
On the completion of this course the student will be able to:
CO1: Understand the meaning and scope of Social Media Analytics.
CO2: Apply the tools and techniques of Social Media Analytics for solving complex business problems for the betterment of the businesses.
CO3: Analyze the patterns and techniques in Social Media & Mobile Analytics to solve complex problems.
CO4: Evaluate the effectiveness of various analytics techniques for better output.

Detailed Syllabus:

Unit -I

Social Media, On-Line Social Network, Off-Line Social Network, Metrics and Measurement, Dashboard, Target Audience, Desired Action, Content, Market Research Online Communities, Cluster Analysis, Conjoint Analysis, Multidimensional Scaling, Social Media Listening, Social Media Scoring, Social Media Modelling. Understanding Mobile Analytics Concepts, difference between Mobile Analytics and Site Analytics, Natural language Processing with Mobile Analytics, Text Mining for Mobile Analytics, Mobile Analytics Tools, Churn Analytics.

Unit -II

Text Data, Sources of Text Data, Information Clusters, Patterns, Trends, Tagging, Natural Learning Process, Lexical Analysis, Social Network Nodes, Linkage Structure, Node Labelling, Content- Based Classification, Word Stemming, Stemming Algorithms, Polarity of the Attitude, Psychological Profiling, Sentiment Analysis.

Unit -III

Web Scraping of unstructured data, Gathering data from HTTP and HTTPS format, Web Scraping from XML and JSON file, Regular expressions, Extraction Strategies, Term Document Matrix, Data Cleansing,

Data Manipulation and Data Transformation after Scrapping.

Unit -IV

Introduction to Big Data, Predictive Analysis for Business, Social Information Processing and Distributed Computing, Advances in Machine Learning, Traditional Data Models Evolve, Analytics to Solve Social Problems, Location Based Data Explosion, Data Privacy Backlash, Internet of Things, Artificial Intelligence.

Suggested Readings:

1. Galit Shamuelli, 2017, Data Mining for Business Analytics: Concepts, Techniques and Applications with R, Wiley.
2. Luis Torgo, 2017, Data Mining with R: Learning Case Studies, Chapman.
3. Zaki & Meira, 2014, Data Mining and Analysis Fundamental Concepts and Algorithms, Cambridge.
4. Han, Kamber & Pei, 2013, Data Mining: Concepts and Techniques, Morgan Kaufmann.
5. Han, Jiawei and Kamber, Micheline, 2012, Data Mining: Concepts and Techniques, Morgan Kaufman.

Mapping Matrix of Course: 243MBBA1

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBBA1: Social Media Analytics

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	2	2
CO3	2	3	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2	2

Relational Database Management and SQL
243MBBA2

Credit: 3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs.

Type of Course: Specialization Specific Elective Course

Course Objectives: In this course, the students will learn the basics of the SQL/NoSQL and Relational Databases. They will learn about the Relational Model and Relational Model concepts and constraints. The students will get exposure to key concepts with regards to SQL Language and DBMS such as Normalization, Transaction Processing along-side an exposure to No SQL programming.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Understand the basic concepts, frameworks and applications of Database Management Systems.
CO2: Apply the concepts of SQL architecture for constructing queries using SQL for creative problem solving of complex problems.
CO3: Analyze the techniques pertaining to database design practices for addressing the issues of Transaction Processing and Concurrency Control.
CO4: Evaluate options for creating queries for data processing and retrieval.

Detailed Syllabus:

UNIT I

Introduction to Database Management Systems
Introduction-Database System Applications, Purpose of Database Systems, Views of Data, Data Abstraction, Instances and Schemas, Data Models, Database Languages, DDL, DML, Database Architecture, Database Users and Administrators, Database Design, ER Diagrams, Entities, Attributes and Entity Sets, Relationships and Relationship sets, Integrity Constraints, Views.

UNIT II

SQL Operators and Relational Theorems Relational Algebra and Calculus, Selection and Projection, Set Operations, Renaming, Joins, Division, Relational calculus, Tuple Relational Calculus, Domain Relational Calculus, Forms of Basic SQL Query, Nested Queries, Comparison Operators, Aggregate Operators, NULL values, Logical connectives, AND, OR and NOT, Outer Joins, Triggers.

UNIT III

Normalization: Problems Caused by Redundancy, Decompositions, Functional Dependencies, Normal Forms, First, Second, Third Normal forms, BCNF, Properties of Decompositions, Loss less Join. Decomposition, Dependency Preserving Decomposition, Multi Valued Dependencies, Fourth Normal Form, Join Dependencies, Fifth Normal Form.

UNIT IV

Transactions: Transaction Management, Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent, Executions, Serializability, Recoverability, Implementation of Isolation, testing for Serializability, Concurrency Control, Lock, Timestamp Based Protocols, Validation Based Protocols, Recovery, Failure Classification, Storage Structure, Atomicity, Log Based Recovery, Remote Backup Systems.

SUGGESETD READINGS:

1. Guy Harrison, 2015, Next Generation Databases: No SQL and Big Data, Apress.
2. RamezElmasri, ShamkatB.Navathe, 2013, Database Systems, Pearson.
3. Pramod J. Sadalage, Martin Fowler, 2012, No SQL Distilled, Addison Wesley.
4. A.Silberschatz, H.F. Korth, S.Sudarshan, 2006, Database System Concepts, McGraw Hill.
5. Raghurama Krishnan, Johannes Gehrke, 2003, Database Management Systems, McGraw Hill.

Mapping Matrix of Course: 243MBBA2

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBBA2: Relational Database Management and SQL

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2

Text Mining using NLP and Machine Learning
243MBBA3

Credit: 3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs.

Type of Course: Specialization Specific Elective Course

Course Objectives:
Data mining is the process that focusses upon extracting patterns from data. Data mining is becoming an increasingly important tool to transform the data into information. It is commonly used in a wide range of profiling practices, such as marketing, surveillance, fraud detection and scientific discovery.

Course Outcomes:
On the completion of this course the student will be able to:

CO1: Memorize and understand the fundamentals of data mining, machine learning and statistical pattern recognition.
CO2: Apply data mining and web mining to various quantitative processes of business while following the ethical aspects of mining.
CO3: Analyze the efficacy of various data mining tools and techniques.
CO4: Evaluate the reliability and validity of data mining and machine learning techniques in multiple domains.

Detailed Syllabus:

Unit I
Introduction to Text Mining: Basics of Text Mining, Natural Language Content Analysis, Core Text Mining Operations, Associations, Using Background Knowledge for Text Mining, Domain Ontologies, Domain Lexicons. Text Mining Pre-processing Techniques, Task Oriented Approaches, NLP Tasks, Tokenization, Part-of-Speech Tagging, Syntactical Parsing and Shallow Parsing.

Unit II
Text Categorization and Clustering: Applications of Text Categorization, Document Representation, Knowledge Engineering Approach to Text Categorization, Machine Learning Approach to Text Categorization, Evaluation of Text Classifiers. Clustering Tasks in Text Analysis, Clustering Algorithms and Clustering of Textual Data. Latent Dirichlet Allocation, Word Topic Probabilities, Per-Document Classification, Bywords Assignments, Alternative LDA Implementations. Hidden Markov models, Stochastic Context Free Grammar, Conditional Random fields, Parallel Learning Algorithms.

Unit III
Machine Learning and Cognitive Intelligence: Introduction to Machine Learning- History and Evolution,

Machine Learning categories: Supervised, Unsupervised and Reinforcement learning. Framework for building ML Systems-KDD process model, CRISP-DM & SEMMA, Machine learning Python packages, Machine Learning Core Libraries. Introduction to Cognitive Intelligence, Features of Cognitive Intelligence

Unit IV
Supervised and Unsupervised Learning: Supervised Learning: Introduction to classification, Linear

Regression, Metrics for evaluating linear model, Multivariate regression, Non-Linear Regression, K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Model Evaluation, Applications of supervised learning in multiple domains. Unsupervised Learning: Clustering, Hierarchical clustering, Partitioning Clustering- K-mean clustering, Applications of unsupervised learning in multiple domains.

SUGGESTED READINGS:

1. Richard Duda, Peter Hart and David Stork, "Pattern Classification," John Wiley & Sons.
2. Tom Mitchell, "Machine Learning." McGraw-Hill.
3. Richard Sutton and Andrew Barto, "Reinforcement Learning: An introduction," MIT Press.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The Elements of Statistical Learning," Springer.

Mapping Matrix of Course: 243MBBA3

Table 1: CO-PO & CO-PSO Matrix for the Course 243MBBA3: Text Mining using NLP and Machine Learning

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2

Fourth Semester

Entrepreneurship and Innovation

244MBCC1

Credit: 4

External Marks: 70
Internal Marks: 30
Time Allowed: 3 Hrs.

Type of Course: Core Course

Course Objectives:

The course provides a framework for comprehending the process of forming and leading creative businesses. This will prepare students to deal effectively with changing market and client needs as they become more sophisticated and knowledgeable. Entrepreneurship has a significant impact on the country's economic growth and development. The dynamic of the corporate world is shifting in tandem with the global economy. The goal of this course is to instil and ignite an entrepreneurial spirit in pupils.

Course Outcomes:
On the completion of this course the student will be able to:

CO1: Identify and understand various constituents and environmental factors for innovation and entrepreneurship development.
CO2: Apply SWOT analysis for internal and external environmental assessment for devising a creative strategy for feasible business plans, within ethical boundaries.
CO3: Analyze feasibility of businesses under the constantly changing global environment for sustainable global competitiveness.
CO4: Evaluate the alternatives in order to be able to create successful business plans.

Detailed Syllabus:

UNIT-I
Entrepreneurship: India's startup evolution, Concept, trends, benefits; Rural entrepreneurship, social entrepreneurship, women entrepreneurship; role of entrepreneurship in economic development; Entrepreneur: - characteristics, Entrepreneurial decision process, functions, need for an entrepreneur, types of entrepreneurs.

UNIT-II
Starting the venture: generating business idea – sources of new ideas, methods of generating ideas, creative problem solving, opportunity recognition; environmental scanning, competitor and industry analysis; feasibility study – market feasibility, technical/operational feasibility, financial feasibility: drawing business plan; preparing project report; Business plan- How to develop it, what all should it have, what it shouldn't have presenting business plan to investors

UNIT-III
Need for finance, sources of finance, Venture capital, Nature and Overview, Venture capital process,

locating venture capitalists; Functional Plans: Marketing Plan- Market Segmentation, Market sizing, pricing strategy; Organizational Plan- form of ownership, designing organization structure, job design,

manpower planning and Financial Plan.

UNIT-IV

Project Planning & Project appraisal; legal issues – intellectual property rights patents, trademarks, copyrights, trade secrets, licensing and franchising; Team Formation, Team Work Planning; Role of Government in Promoting Entrepreneurship; Entrepreneurial environment: factors affecting entrepreneurship growth, entrepreneurial motivation; Digital haves and Have-nots, Digital economy as a resource.

Suggested Readings:

1. Holt, David H. Entrepreneurship: New venture creation. prentice hall, 1992.
2. Entrepreneurship in Action, PHI B.K. Mohanty, Sangram Publication, 2005
3. Jayshree Suresh, Entrepreneurial Development, Margham Publications, 2015
4. Poornima M Charantimath, Entrepreneurship Development Small Business Enterprises, Pearson Education, 2006.
5. Mohanty, Sangram Keshari. Fundamentals of entrepreneurship. PHI Learning Pvt. Ltd., 2005.

Mapping Matrix of Course: 244MBCC1

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBCC1: Entrepreneurship and Innovation

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	2	2	2	3	2	2	2	2
CO2	3	3	3	3	3	3	3	2	2	3
CO3	2	2	2	3	3	2	3	2	3	2
CO4	2	2	2	2	2	2	2	3	2	2
Average	2.5	2.25	2.25	2.5	2.5	2.5	2.5	2.25	2.25	2.25

Big Data Analytics
244MBCC2

Credit: 4

External Marks: 70
Internal Marks: 30
Time Allowed: 3 Hrs.

Type of Course: Core Course

Course Objectives: This module forms an introduction as well an in-depth study in the field of Big Data and Hadoop. It comprises the fundamentals as well as advanced topics needed to progress in this technology. The students will learn about the applications, usage and several use case scenarios pertaining to Big Data- Hadoop where they can use the knowledge and progress ahead. This course will help students gain knowledge and understanding about Big Data Technology, Hadoop Ecosystem and various tools related to it. The students will learn about the HDFS File System, Map Reduce Framework, Analyzing data using Hbase and Hive along with the Integration of R with Hadoop.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Memorize and understand the fundamentals of Big Data and its Applications in various Domains.
CO2: Apply and incorporate the technologies behind Big Data in business context.
CO3: Analyze the data using the architectures related to HDFS File Structure and Map Reduce Framework.
CO4: Evaluate and design programs for data processing for solving complex business problems.

Detailed syllabus:

Unit-I
What Is Big Data? History of Data Management, Evolution of Big Data, Structuring of Big Data, Elements of Big Data, Application of Big Data in the Business Context, Careers in Big Data. Business Applications of Big Data: The Significance of Social Network Data, Financial Fraud and Big Data, Fraud Detection in Insurance, Use of Big Data in the Retail Industry. Distributed and Parallel Computing for Big Data, Understanding Hadoop, Cloud Computing, Grid Computing and In-Memory Technology for Big Data. VMWare Installation of Hadoop, Linux and its Shell Commands, Different Hadoop Distributions and their advantages, Hortonworks, Cloudera, MapR.

Unit-II
The Hadoop Ecosystem, Storing Data with HDFS, Design of HDFS, HDFS Concepts, Command Line Interface to HDFS, Hadoop File Systems, Java Interface to Hadoop, Anatomy of a file read, Anatomy of a file write, Replica placement and Coherency Model. Parallel Copying with distcp, keeping an HDFS Cluster Balanced.

Unit-III
Origins of Map Reduce, How Map Reduce Works, Optimization Techniques for Map Reduce Jobs, Applications of Map Reduce, Java Map Reduce classes (new API), Data flow, combiner functions, running a distributed Map Reduce Job. Configuration API, setting up the development environment, Managing Configuration.

Unit-IV

Understanding R-Hadoop, Integration Procedure, Packages needed for R under Hadoop Ecosystem, Text Mining for Deriving Useful Information using R within Hadoop, Introduction to Hive & Hbase, Hive and Hbase Architecture, Understanding Queries, Mining Big Data with Hive & Hbase.

Suggested Readings:

1. Arshdeep Bahga, 2016, Big Data Science & Analytics: A Hands-On Approach.
2. Tom White, 2012, Hadoop: The Definitive Guide, O'Reilly.
3. Adam Shook and Donald Miner, 2012, Map Reduce Design Patterns: Building Effective
4. Algorithms and Analytics for Hadoop and Other Systems, O'Reilly.
5. Dean Wampler, Edward Capriolo & Jason Rutherglen, 2012, Programming Hive, O'Reilly.
6. Lars George, 2011, HBase - The Definitive Guide: Random Access to Your Planet- Size Data, O'Reilly.

Mapping Matrix of Course: 244MBCC2

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBCC2: Big Data Analytics

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	3	2
CO3	2	3	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2.25	2

SaS and Tableau

244MBDSE1

Credit: 3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs

Type of Course: Discipline Specific Elective Course

Course Objective: This course forms an introduction as well as an in-depth study in the discipline of SaS programming with regards to Statistical Analysis along with Data Visualization through Tableau. This course will provide students and exposure towards SaS, Tableau and its usability in the field of analytics. The course comprises an introduction to SaS, its procedures, visualizations along with Tableau application usage and visualization basics.

Course Outcomes:
On the completion of this course the student will be able to:

CO1: Understand SaS in a virtual environment and basics of Tableau Interface.

CO2: Apply the tools of SaS to prepare and manipulate datasets for analysis in SaS.

CO3: Analyze the data for exploratory analysis within SaS environment using various procedures.
CO4: Evaluate the effectiveness of SaS, Tableau Interface, Panes and Visualization Techniques.

Detailed Syllabus:

Unit-I

Overview of SaS university edition, Deploying SaS Studio on virtual platform, File Management, SaS libraries, importing data, Structure of Data and Data Types, Program Syntax, saving data, PROC IMPORT and PROC CONTENTS, Displaying Data and Generating Logs, List Input. Variables and Syntax Rules, Data Set Options, Operators, In-File Statement, Input Styles, Select Statements, Leave and Continue, Decision Making via SaS, Where Statement, Looping Constructs, SaS Functions, Arrays and Array Processing, Modifying and Combining Data Sets.

Unit-II

Proc Data, Proc Sort, Proc Means Sort, Proc Means, Proc Univariate, Proc Freq, Proc Plot, Proc Sgplot, Proc Summary, Proc Contents, Proc Append, Proc Copy, Proc SQL, Proc Delete, Proc Format, Proc Import, Proc Export, Proc Transpose, Proc GChart, Proc GPlot, Proc Report.

Unit-III

Tableau Software Ecosystem, Toolbar Icons, Data Window and Aggregation, Tableau Data Source, Data Extract, Connect to Data, Measure Names, Number of Records & Measures, Heat Maps, Tree maps, Bar

Chart, Line Chart, Area Fill Charts, Pie Chart, Scatter Plot, Circle View, Bullet Graph, Packed Bubble, Histogram, Boxplot and Gantt Chart, Sorting Data, Enhancing Views with Filters, Sets, Groups & Hierarchies.

Unit-IV

Cross-tabulation, Dashboard Designing, Dashboard Actions, Joining Database, Functions in Tableau, Aggregate Functions, Numeric Functions, Date Functions, Stories, Advanced Mapping, Advanced Parameters, Tableau Best Practices, Combining Multiple Dashboards into Stories, Publishing Stories and Dashboards.

Suggested Readings:

1. Ron Cody, 2018, An Introduction to SaS University Edition, SaS Institute.

2. Ron Cody, 2018, Learning SaS by Example, SaS Institute.

3. Deepti Gupta. 2018, Applied Analytics through Case Studies Using SaS, Apress.

4. Joshua N. Milligan, 2015, Learning Tableau, Packt.

5. Ben Jones, 2014, Communication Data with Tableau: Designing, Developing and Delivering Data Visualization, O'Reilly.

Mapping Matrix of Course: 244MBDSE1

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBDSE1: SaS and Tableau

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	3	2
CO3	2	3	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2.25	2

Machine Learning & Artificial Intelligence

244MBDSE2

Credit:3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs

Type of Course: Discipline Specific Elective Course

Course Objective: This module comprises of conceptual, statistical and Machine Learning algorithms. It covers all the necessary models pertaining to Machine Learning such as Regression, Decision Trees, Support Vectors, Clustering, Association Analysis and Dimensionality Reduction. After this course students will gain critical knowledge and understanding about major Data Mining procedures like Decision Tree, Cluster Analysis, Neural Networks, Support Vector Machine, Bayesian Networks and Machine Learning fundamentals. Students will be able to apply and practice this gained knowledge in variety of Business Scenarios.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Understand the fundamentals of machine learning and artificial Intelligence.
CO2: Apply the machine learning algorithms for solving critical problem solving.
CO3: Analyze the efficacy of various machine learning algorithms.
CO4: Evaluate Machine Learning techniques and the Programming Framework to obtain acceptable decisions for the Real-World problems

Detailed syllabus

Unit - I

Classification & Regression, working of a Decision Tree, Attribute Selection Measures, Information Gain, Gain Ratio, Gini Index, Building Decision Trees, CART, C5.0, and CHAID Trees, Prediction by Decision Tree, Advantages and Disadvantages of Decision Trees, Model Overfitting, Building Decision Trees in R.

Unit - II

Cluster Analysis versus Factor Analysis, Overview of Basic Clustering Methods, Agglomerative Hierarchical Clustering, Within-Group Linkage, Nearest Neighbour or Single, Linkage, Furthest Neighbour or Complete Linkage, Centroid Clustering, Ward's Method, K- Means Algorithm, Dendrogram, Profiling of Cluster, Cluster Evaluation. Decision Boundaries for Support Vector Machine, Maximum Margin Hyperplanes, Structural Risk Minimization, Linear SVM-Separable Case, Linear SVM-Non-Separable Case, Kernel Function, Kernel Trick, Kernel Hilbert Space, Model Evaluation.

Unit - III

Market Basket Analysis and Association Analysis, Market Basket Data, Stores, Customers, Orders, Items, Order Characteristics, Product Popularity, Tracking Marketing Interventions, Association Rules, Support, Confidence, Lift, Chi-Square Value, Sequential Pattern Analysis.

Unit - IV

Current Trends in AI, Intelligent Agents, Environments, Problem Solving Agents, Searching Techniques, Knowledge and Reasoning in AI, Forms of Learning, Structure of a Neural Network, Analogy with Biological Neural Network, Activation Functions, Gradient Descent, Model Accuracy. Workshop on AI.

Suggested Readings:

1. Kevin Knight, Elaine Rich, B.Nair, 2017, Artificial Intelligence, McGraw.
2. Han, Jiawei and Kamber, Micheline, 2012, Data Mining: Concepts and Techniques, Morgan Kaufman Publishers.
3. AnandRajaraman, 2011, Mining of Massive Datasets, Cambridge University Press.
4. Mitchell, 2013, Machine Learning, McGraw Hill.
5. Stuart Russell, Peter Norvig, 2004, Artificial Intelligence – A Modern Approach, Pearson.

Mapping Matrix of Course: 244MBDSE2

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBDSE2: Machine Learning & Artificial Intelligence

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2

244MBBA1

Credit:3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs

Type of Course: Specialization Specific Elective Course

Course Objective: This course aims to provide an exposure to students based on Natural Language Processing Techniques, Algorithms and Analytics based on Textual Data. The module comprises of NLP basics, Feature Extraction, Relationship Extraction, Text Categorization, Clustering and Topic Modelling Algorithms and Practices.

Course Outcomes:
On the completion of this course the student will be able to:
CO1: Understand approaches to Syntax and Semantics in NLP.
CO2: Apply the gained theoretical knowledge to extract information from Textual Unstructured Data.
CO3: Analyze the efficacy of various approaches of Natural Language Processing.
CO4: Evaluate topic Modelling and Probabilistic Models for Information Extraction.

Detailed Syllabus:
Unit-I
Basics of Text Mining, Natural Language Content Analysis, Core Text Mining Operations, Associations, Using Background Knowledge for Text Mining, Domain Ontologies, Domain Lexicons. Text Mining Pre-processing Techniques, Task Oriented Approaches, NLP Tasks, Tokenization, Partof-Speech Tagging, Syntactical Parsing and Shallow Parsing. Finding Implicit Features, Finding Opinion Phrases and their Polarity, Context-Specific Word Semantic Orientation, Analysis of Word and Document Frequency, tf-idf, Zipf's Law, bind tf_idf Function, Subsequence Kernels for Relation Extraction, Capturing Relation Patterns with a String Kernel.
Unit-II
Applications of Text Categorization, Document Representation, Knowledge Engineering Approach to Text Categorization, Machine Learning Approach to Text Categorization, Evaluation of Text Classifiers. Clustering Tasks in Text Analysis, Clustering Algorithms and Clustering of Textual Data.
Unit-III
Tokenizing by N-gram, Counting and Filtering N-gram, Analysing Bigrams to provide Context in Sentiment Analysis, visualizing a Network of Bigrams using ggraph, Counting and Correlating Pairs of Words with the widyr Package, Counting and Correlating among Sections, Examining Pairwise Correlation.
Unit-IV
Latent Dirichlet Allocation, Word Topic Probabilities, Per-Document Classification, By-words Assignments, Alternative LDA Implementations. Hidden Markov models, Stochastic Context Free Grammar, Conditional Random fields, Parallel Learning Algorithms.

Suggested Readings:
1. Julia Silge, David Robinson, 2018, Text Mining with R-A Tidy Approach, O'Reilly
2. Matthew L. Jockers, 2014, Text Analysis with R for Students of Literature, Springer.
3. James Pustejovsky, Amber Stubbs, 2012, Natural Language Annotation for Machine Learning, O'Reilly.

4. Steve R. Poteet, 2007, Natural Language Processing with Text Mining, Springer.
5. James Sanger, Ronen Feldman, 2002, The Text Mining Handbook: Advanced Approaches in Analysing Unstructured Data, Cambridge.

Mapping Matrix of Course: 244MBBA1
Table 1: CO-PO & CO-PSO Matrix for the Course 244MBBA1: Natural Language Processing

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2

Credit:3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs

Type of Course: Specialization Specific Elective Course

Course Objectives: Python Programming module is intended for students who wish to learn the Python programming language. The module comprises of Programming basics with regards to Python Language such as Data Types, Operators, Functions, Classes and Exception Handling. This module will help students gain much needed knowledge pertaining to Python Programming, so as to prepare them for the advanced modules such as ML. Python scripting is user-friendly and is the most used language in industry when it comes to designing and scripting applications with respect to Emerging Technologies.

Course Outcomes:

On the completion of this course the student will be able to:

CO1: Memorize and develop conceptual understanding of Python.

CO2: Apply the conceptual knowledge of lists, tuples, and dictionaries to develop python programs.

CO3: Analyze the relevance of application Python for data analysis and solving complex business problems.

CO4: Evaluate and design programs for data processing for providing solutions to complex business problems.

Detailed Syllabus:

Unit-I

History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input- Output, Indentation. Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions.

Unit-II

Lists, Operations, Slicing, Methods, Tuples, Sets, Dictionaries, Sequences, Comprehensions, Conditional blocks using If, Else and El-if, For Loop, For loop using Ranges, String, list and Dictionaries, While Loop, Loop Manipulation using Pass, Continue, Break and Else, Conditional and Loops Block.

Unit-III

Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Function Returning Values, Scope of the Variables in a Function - Global and Local Variables. Creating modules, Name Spacing, Introduction to PIP, Installing Packages via PIP, Using Python Packages. **Unit-IV**

Classes, Self-Variable, Methods, Constructor Method, Inheritance, Overriding Methods, Data Hiding, Difference between an Error and Exception, Handling Exception, Try Except Block, Raising Exceptions, and User Defined Exceptions.

Suggested Readings:

1. R.Nageswara Rao, 2018, Core Python Programming, Dreamtech.
2. John Hearty, 2016, Advanced Machine Learning with Python, Packt.
3. Jake VanderPlas, 2016, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly.
4. Mark Lutz, 2010, Programming Python, O'Reilly.
5. Tim Hall and J-P Stacey, 2009, Python 3 for Absolute Beginners, Apress..

Mapping Matrix of Course: 244MBBA2

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBBA2: Python Programming

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	1	1	3	1	1	2	2
CO2	2	2	2	2	2	2	2	2	3	2
CO3	2	3	1	2	1	2	1	3	2	2
CO4	2	2	2	2	2	2	2	2	2	2
Average	2.25	2.25	1.5	1.75	1.5	2.25	1.5	2	2.25	2

Cloud Computing

244MBBA3

Credit:3

External Marks: 50
Internal Marks: 25
Time Allowed: 3 Hrs

Type of Course: Specialization Specific Elective Course
Course Objectives: The objective of the course is to give students a comprehensive view understanding of the vision and impact of Cloud, cloud and IoT Market perspective and IoT and Cloud architecture.

Course Outcomes:

On the completion of this course the student will be able to:
CO1. Define and understand the concepts related to internet of things and cloud computing.
CO2: Apply cloud computing techniques for various applications for solving critical problems.
CO3: Analyse cloud computing services used at various levels.
CO4: Evaluate the efficacy of cloud computing techniques and designing cloud-based applications

Detailed Syllabus:
Unit - I
Overview of Cloud Computing: Brief history and evolution - history of cloud computing, evolution of cloud computing, traditional vs. cloud computing, cloud service models (IaaS, PaaS & SaaS), cloud deployment models (public, private, hybrid and community cloud), benefits and challenges of cloud computing, introduction to AWS public cloud vendor, cost optimization in AWS, basics of virtualization, virtualization technologies, server virtualization, VM migration techniques, role of virtualization in cloud computing, introduction to EC2 service of AWS.
Unit – II
Working with Private Cloud: Private cloud definition, characteristics of private cloud, private cloud deployment models, private cloud vendors - CloudStack, OpenStack, Eucalyptus Microsoft, private cloud ± benefits and challenges, private cloud implementation in Amazon EC2 service.
Unit – III
Working with Public Clouds: What is public cloud, why public cloud, when to opt for public cloud, public cloud service models, public cloud players, infrastructure as a service offering, IaaS vendors, PaaS offerings, PaaS vendors, software as a service, demonstrating public cloud with AWS ± storage and database services, private vs. public cloud ± when to choose.
Unit - IV
IoT Architecture- Introduction, State of the art: Architecture reference modelintroduction, reference model and architecture, IoT reference model. IoT Reference Architecture: IoT reference architecture- introduction, functional view, information view, deployment and operational view, other relevant architectural views, realworld design constraints- introduction, technical design constraints-hardware is popular again, data representation and visualization, interaction and remote control.

Suggested Readings:
1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Hwang Kai, Fox Geoffrey C, Dongarra Jack G, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2011.
3. Rittinghouse John W. and Ransome James F., "Cloud Computing: Implementation, Management, and Security", CRC Press,2009.
4. Velte Toby, Velte Anthony, Elsenpeter Robert, "Cloud Computing, A Practical Approach", TMH, 2013. 5. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on- approach)", 1st Edition, VPT, 2014.

Mapping Matrix of Course: 244MBBA3

Table 1: CO-PO & CO-PSO Matrix for the Course 244MBBA3: Cloud Computing

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	3	2	1	2	2
CO2	3	2	1	2	2	2	2	2	3	2
CO3	2	3	2	3	2	2	2	2	2	2
CO4	2	3	2	3	2	2	2	3	2	2
Average	2.25	2.5	1.5	2.5	2	2.25	2	2	2.25	2

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