M Sc.-Data Science with Logistic and Supply Chain Management – (2 Years)

CURRICULUM AND SYLLABUS

(From 2024 Admission Onwards)
Program Outcomes

PO1  **Knowledge in Basic Data Science, Logistic and Supply Chain Management:** Understand the basic concepts, fundamental principles and the scientific theories related to Data Science, Logistic and Supply Chain Management.

PO2  **Abstract thinking:** Ability to absorb and understand the abstract concepts that lead to various advanced theories in mathematics and Statistics.

PO3  **Modelling and solving:** Ability in modelling and solving problems by identifying and employing the appropriate existing theories and methods.

PO4  **Advanced theories and methods:** Understand advanced theories and methods to design solutions for complex logistics problems.

PO5  **Applications in Industries:** Understand the role of data analytics and apply the same to solve the real time industrial problems in logistic and supply chain industries.

PO6  **Modern software tool usage:** Acquire the skills in handling scientific tools towards solving problems and solution analysis in Data Science.

PO7  **Environment and sustainability:** Understand the significance of preserving the environment towards sustainable development.

PO8  **Ethics:** Imbibe ethical, moral and social values in personal and social life leading to highly cultured and civilized personality. Continue to enhance the knowledge and skills in applied statistics and data analytics for constructive activities and demonstrate highest standards of professional ethics.

PO9  **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10  **Communication:** Develop various communication skills such as reading, listening, speaking and discussing which will help in expressing ideas and views clearly and effectively.

PO11  **Project management and Research:** Demonstrate knowledge, understand the scientific and management principles and apply these to one’s own work, as a member/ leader in a team to manage projects and multidisciplinary research environments. Also use the research-based knowledge to analyse and solve advanced problems in data sciences.

PO12  **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
M.Sc. Data Science with Logistic and Supply Chain Management  
(Academic Year 2024 onwards)

Curriculum

**Semester - I**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course</th>
<th>L T P</th>
<th>Credit</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>24DLS501</td>
<td>Linear Algebra</td>
<td>3 0 2</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>24DLS502</td>
<td>Probability and Statistics</td>
<td>3 0 2</td>
<td>4</td>
<td>B</td>
</tr>
<tr>
<td>24DLS503</td>
<td>Logistic</td>
<td>3 0 2</td>
<td>4</td>
<td>C</td>
</tr>
<tr>
<td>24DLS504</td>
<td>Optimization Techniques</td>
<td>3 1 0</td>
<td>4</td>
<td>D</td>
</tr>
<tr>
<td>24DLS505</td>
<td>Foundation of Data Science with R Programming</td>
<td>3 0 2</td>
<td>4</td>
<td>E</td>
</tr>
<tr>
<td>24DLS506</td>
<td>Python Programming</td>
<td>3 0 2</td>
<td>4</td>
<td>F</td>
</tr>
<tr>
<td>22ADM501</td>
<td>Glimpses of Indian Culture</td>
<td>2 0 1</td>
<td>P/F</td>
<td>G</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Semester - II**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course</th>
<th>L T P</th>
<th>Credit</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>24DLS511</td>
<td>Supply Chain Management</td>
<td>3 0 2</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>24DLS512</td>
<td>Advanced Data Mining</td>
<td>3 0 2</td>
<td>4</td>
<td>B</td>
</tr>
<tr>
<td>24DLS513</td>
<td>Machine Learning</td>
<td>3 0 2</td>
<td>4</td>
<td>C</td>
</tr>
<tr>
<td>24DLS514</td>
<td>Information System Management</td>
<td>3 1 0</td>
<td>4</td>
<td>D</td>
</tr>
<tr>
<td>24DLS515</td>
<td>Pricing and Revenue Management</td>
<td>3 1 0</td>
<td>4</td>
<td>E</td>
</tr>
<tr>
<td>24DLS516</td>
<td>Warehouse and Production Management</td>
<td>3 1 0</td>
<td>4</td>
<td>F</td>
</tr>
<tr>
<td>22AVP103</td>
<td>Mastery Over Mind</td>
<td>1 0 2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Semester III**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course</th>
<th>L T P</th>
<th>Credit</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>24DLS601</td>
<td>Inventory and Marketing Management</td>
<td>3 1 0</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>24DLS602</td>
<td>Deep Learning</td>
<td>3 0 2</td>
<td>4</td>
<td>B</td>
</tr>
<tr>
<td>Elective I</td>
<td></td>
<td>3 0 0</td>
<td>3</td>
<td>D</td>
</tr>
<tr>
<td>Elective II</td>
<td></td>
<td>3 0 0</td>
<td>3</td>
<td>E</td>
</tr>
<tr>
<td>Elective III</td>
<td></td>
<td>3 0 0</td>
<td>3</td>
<td>F</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Semester IV**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course</th>
<th>L T P</th>
<th>Credit</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>24DLS699</td>
<td>Dissertation</td>
<td></td>
<td>10</td>
<td>P</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Total credits for the programme: 78

ELECTIVES (any three)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Theory</th>
<th>Mid Term</th>
<th>CA</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>24DLS631</td>
<td>Pattern Recognition</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS632</td>
<td>Stochastic Process</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS633</td>
<td>Queueing Theory</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS634</td>
<td>Survival Analysis</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS635</td>
<td>Sampling Techniques</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS636</td>
<td>Demography and Actuarial Statistics</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS637</td>
<td>Official Statistics</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS638</td>
<td>Reinforcement Learning</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS639</td>
<td>Social Network Analytics</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS640</td>
<td>Mining of Massive Datasets</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS641</td>
<td>Parallel and Distributed Systems</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS642</td>
<td>Taguchi Techniques</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
<tr>
<td>24DLS643</td>
<td>Special Distribution Functions</td>
<td>3 0 0</td>
<td>3</td>
<td>D/E</td>
<td></td>
</tr>
</tbody>
</table>

*Amrita Value Programme*

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Theory</th>
<th>Mid Term</th>
<th>CA</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>22ADM502</td>
<td>Vedanta in day-to-day life</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP506</td>
<td>Message of Swami Vivekananda</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP508</td>
<td>Indian Arts and Literature</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP510</td>
<td>Appreciation of Kerala Mural Arts Forms</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP501</td>
<td>Message of Sīrī Mātā Amritanandamayī Devi</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP502</td>
<td>Insights from the Ramayana</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP503</td>
<td>Insights from the Mahabharata</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP504</td>
<td>Insights from the Upanishads</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP505</td>
<td>Insights from Bhagavad Gita</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP512</td>
<td>Ancient Indian Science and Technology</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP507</td>
<td>Great Spiritual Teachers of India</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22AVP509</td>
<td>Yoga and Meditation 1</td>
<td>1-0-0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evaluation Pattern:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Course Type</th>
<th>Theory / Lab</th>
<th>Mid Term marks</th>
<th>CA marks</th>
<th>End Semester marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3- 1- 0- 4 / 4- 0- 0 – 4 / 3- 0 – 3 - 3</td>
<td>Theory</td>
<td>30</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>3- 0- 2- 4 / 2- 0 2 – 3/ 1- 0- 2 -2</td>
<td>Theory &amp; Lab</td>
<td>30</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>0- 0- 2- 1</td>
<td>Lab</td>
<td>-</td>
<td>60</td>
<td>40</td>
</tr>
</tbody>
</table>

Syllabus

24DLS501 Linear Algebra 3 0 2 4
Course Outcomes:
CO-1: To understand the axioms in the definition of a vector space through examples; to understand Subspaces, basis and its relevance.
CO-2: To understand inner products and compute the angle/length of a vector and the orthonormal basis.
CO-3: To understand the concepts of Linear Transformations and Matrices for Linear Transformation
CO-4: To understand the concepts of Eigen Values, Eigen Vectors & Diagonalization form.
CO-5: Decompositions : LU,QR and SVD

Unit-I

Unit-II

Unit-III
Linear Transformations: Positive definite matrices - Matrix norm and condition number - Linear transformation - Relation between matrices and linear transformations - Kernel and range of a linear transformation - Trace and Transpose, Determinants, Symmetric and Skew Symmetric Matrices.

Unit-IV
Eigen values and Eigen vectors: Problems in Eigen Values and Eigen Vectors, Diagonalization, Orthogonal Diagonalization, Quadratic Forms, Diagonalizing Quadratic Forms.

Unit V
Decomposition of matrices: LU, QR and SVD

Text Books

Reference Books:
5. Mike Cohen, Practical Linear Algebra for Data Science, Oreilly Publisher, 2022.

CO-PO Mapping:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Course outcomes

CO1: Understand the basics of probability and random variables.
CO2: Gain knowledge about standard statistical distributions and their properties
CO3: Apply and analyse problems based on hypothesis testing
CO4: Understand the concept of ANOVA and analyse them using real time data set

Unit I:

Unit II:
Standard discrete distributions - Binomial, Poisson, Uniform, Geometric distributions, Negative binomial and Hypergeometric Distributions - Standard continuous distributions - Uniform, Exponential, Gamma, Beta and Normal distributions, Correlation and Regression

Unit III:
Tests of Hypotheses: General Procedure for Hypothesis Tests, Problems based on large sample tests and small sample tests - Z, t, and F test. Analysis of variance- One way classification, Two way classification, Latin square design.

Textbooks:

Reference books:

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
24DLS503  Logistics  3 0 2 4

<table>
<thead>
<tr>
<th>Course Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO01 Understand various concepts and critical elements in the logistics framework</td>
</tr>
<tr>
<td>CO02 Apply the logistics framework to enable enterprises improve business performance, provide customer value and achieve competitive advantage</td>
</tr>
<tr>
<td>CO03 Apply the logistics network to optimize the supply chain and transform them to ICT enabled, green and circular value chains using relevant technology tools and software</td>
</tr>
<tr>
<td>CO04 Analyse the logistics distribution systems to reduce the transportation, warehousing and supply chain costs as also address inefficiencies</td>
</tr>
</tbody>
</table>

**Unit I:**
Logistics: Logistics, SCM & competitive strategy, Competitive advantage, Value chain, Logistics & customer value: Marketing & logistics interface, customer service, out-of-stock, customer retention, customer-service priorities, service standards, market-driven supply chains, Logistics cost: Costing, Cost analysis, Logistics & bottom line, Shareholder value, Profitability analysis, Cost drivers, ABC

**Unit II:**
Matching Supply & Demand: Lead-time gap, Demand forecasting & management, CPFR, Supply Chain fulcrum, Responsive Supply Chain: Push & pull, Agility, Responsiveness, Strategic lead-time management: Lead-time concepts, pipeline management, Risk Management: Developing a risk profile, Managing risk, Achieving supply chain resilience, 3PL to 4PL, Supply Chain Integration: Developing the logistics organization, Logistics as the vehicle of change, Logistics core card

**Unit III:**
Synchronous Supply Chain: Extended enterprise, Virtual supply chain, Bull whip effect, QR logistics, Logistics system dynamics, AI, ML, Data science & block chain for logistics, Globalization: Visibility in the global pipeline, sourcing. Sustainable supply chains: Triple bottom line, Green supply chains and reducing carbon footprint

**Text Book**

**Reference Books**

**CO-PO Mapping**

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
24DLS504  Optimization Techniques  3 1 0 4

CO1 To learn Linear Programming Problems.
CO2 To learn single variable optimization techniques
CO3 To understand the basics of unconstrained optimization problems and direct search, unidirectional search methods for multivariable problems.
CO4 To learn the various unconstrained optimization techniques for multivariable.
CO5 To understand and solve the nonlinear optimization problem with equality and inequality constrained problems and to learn theory of few significant genetic evolutionary algorithms.

Unit I: Introduction to LPP: Lines and hyperplanes, Convex sets, Convex hull, Formulation of a Linear Programming Problem, Linear Programming Problem; Graphical Method; Simplex method; Dual problem, Duality theory, Dual simplex method, Revised simplex method.


Text Book

Reference Books


**CO-PO Mapping**

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**24DLS505 Foundation of Data Science with R Programming 3 0 2 4**

**Course Outcomes**

CO1: Understanding the basic concepts in R programming

CO2: Understanding the concepts of classification, tabulation, diagrammatic and graphical representation of data

CO3: Applying probability distributions and testing of hypothesis to the real time data and analysing the results using R.

CO4: Gaining knowledge and apply the problems related to correlation, regression, times series and forecasting to real time data sets

**Unit I**

Overview of R software, Introduction to R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Basic commands to get started and Special Values functions, Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame – R -Strings - Vectors, Loading and handling Data in R, Writing into a CSV File, Reading the Excel file.

**Unit II**

Classification and Tabulation of Data, Diagrammatic and Graphic presentation of data, Measure of central tendency or averages, Measure of dispersion, Skewness and Kurtosis.

**Unit III**

Correlation and regression, Time series and forecasting: Weighted moving average, Exponential smoothing, Index numbers-Base period, Types of index numbers- price, value, quantity and special purpose index number.

**Unit -IV**

Case studies related logistic and supply chain management.

**Text books / Reference Books**

3. Hadley Wickham and Garrett Gorlemund : R for Data Science, First edition, O’Reilly

CO-PO Mapping:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

24DLS506 Python Programming

Course outcomes

CO-1: Understand the basic data types and string operations.
CO-2: Understand and apply various function calls in Python.
CO-3: Familiarise and implement boolean expressions, logical operators and executive statements.
CO-4: Execute the Python programme for tree traversals and search problems.
CO-5: Understand and apply the concepts of dictionaries and lists in Python programme.


Unit II: Data Structures: Lists – Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences Comprehensions. Case Study: Nondirective Psychotherapy.

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function – Global and Local Variables.

Modules: Creating modules, import statement, from . Import statement, name spacing. Python packages: Introduction to PIP, Installing Packages via PIP, Using Python Packages. Text Files: Text Files and Their Format, Writing Text to a File , Writing Numbers to a File , Reading Text from a File , Reading Numbers from a File, Accessing and Manipulating Files and Directories on Disk. Case Study: Gathering Information from a File System

Unit III:

Data Gathering and Cleaning: Cleaning Data, Checking for Missing Values, Handling the Missing Values, Reading and Cleaning CSV Data, Merging and Integrating Data, Reading Data from the JSON Format, Reading Data from the HTML Format, and Reading Data from the XML Format.

Regular expressions: Character matching in regular expressions, Extracting data using regular expressions, Combining searching and extracting and Escape character. Case Study: Detecting the e-mail addresses in a text file.

Popular Libraries for Data Visualization in Python: Matplotlib, Seaborn, Plotly, Geoplotlib, and Pandas. Data Visualization: Direct Plotting, Line Plot, Bar Plot, Pie Chart, Box Plot, Histogram Plot, Scatter Plot, Seaborn Plotting System , Strip Plot, Box Plot, Swarm Plot, Joint Plot , Matplotlib Plot , Line Plot Bar Chart ,Histogram Plot ,Scatter Plot , Stack Plot and Pie Chart.
Coding Simple GUI-Based Programs: Windows and Labels, Displaying Images, Command Buttons and Responding to Events, Viewing the Images of Playing Cards, Entry Fields for the Input and Output of Text, and Using Pop-up Dialog Boxes. Case Study: A GUI-Based ATM.

**Text Books:**

**Reference Books**
1. https://www.w3schools.com/python
2. Learning Python, Mark Lutz, Orielly

**CO-PO Mapping:**

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**22ADM501**  
**Glimpses of Indian Culture**  
**2 0 1**  
P/F

Introduction: Love is the substratum of life and spirituality. If love is absent life becomes meaningless. In the present world if love is used as the string to connect the beads of values, life becomes precious, rare and beautiful like a fragrant blossom. Values are not to be learned alone. They have to be imbibed into the inner spirit and put into practice. This should happen at the right time when you have vitality and strength, when your hearts are open.

The present course in value education is a humble experience-based effort to lead and metamorphosis the students through the process of transformation of their inner self towards achieving the best. Amma’s nectarous words of wisdom and acts of love are our guiding principles. Amma’s philosophy provides an insight into the vision of our optimistic future.

1. Invocation, Satsang and Question - Answers
2. Values - What are they? Definition, Guiding Principles with examples Sharing own experiences
3. Values - Key to meaningful life. Values in different contexts
4. Personality - Mind, Soul and Consciousness - Q and A. Body-Mind-Intellect and the Inner psycheExperience sharing
5. Psychological Significance of samskara (with e.g. From Epics)
6. Indian Heritage and Contribution and Q and A; Indian Ethos and Culture
7. Self-Discipline (Evolution and Practice) – Q and A
8. Human Development and Spiritual Growth - Q and A
9. Purpose of Life plus Q and A
10. Cultivating self-development
11. Self effort and Divine Grace - their roles – Q and A; - Vedanta and Creation –Understanding a spiritual Master
12. Dimensions of Spiritual Education; Need for change Lecture – 1; Need for PerfectionLecture - 2
13. How to help others who have achieved less - Man and Nature Q and A, Sharing ofexperiences

REFERENCES:

1. Swami Amritaswaroopananda Puri - Awaken Children (Volume VII and VIII)
2. Swami Amritaswaroopananda Puri - Amma’s Heart
3. Swami Ramakrishnanda Puri - Rising Along the Razor’s Edge
4. Deepak Chopra - Book 1: Quantum Healing; Book 2: Alpha and Omega of God; Book 3: Seven Spiritual Rules for Success
5. Dr. A. P. J. Abdul Kalam - 1. Ignited Minds 2. Talks (CD)
6. Swami Ramakrishnanda Puri - Ultimate Success
7. Swami Jnanamritananda Puri - Upadesamritham (Trans: Malayalam)
8. Vedanta Kesari Publication - Values - Key to a meaningful life
9. Swami Ranganathananda - Eternal values for a changing society
10. David Megginson & Vivien Whitaker - Cultivating Self Development
11. Elizabeth B. Hurlock - Personality Development, Tata McGraw Hill
12. Swami Jagatatmananda - Learn to Live (Vol.1 and 2), RK Ashram, Mylapore
Semester - II

24DLS511 Supply Chain Management 3 0 2 4

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO01</td>
<td>Understand various concepts, drivers and key metrics in the supply chain management framework</td>
</tr>
<tr>
<td>CO02</td>
<td>Evaluate single and multiple facility location problems, vehicle routing and scheduling models</td>
</tr>
<tr>
<td>CO03</td>
<td>Develop the appropriate supply chain through distribution requirement planning and strategic alliances</td>
</tr>
<tr>
<td>CO04</td>
<td>Evaluate packing, packaging, and transportation models and modes so as to reduce transportation, warehousing and supply chain costs as also address inefficiencies</td>
</tr>
<tr>
<td>CO05</td>
<td>Identify the issues in global supply chain management, procurement and outsourcing strategies</td>
</tr>
</tbody>
</table>

Unit I:
Introduction: Introduction to Supply Chain Management (SCM), Complexity and key issues in SCM, Location strategy, Facility location decisions, Single facility and multiple location models Supply Chain Integration: Supply chain integration, Distributed strategies, Push versus pull systems. Distribution Requirements Planning (DRP) and demand forecasting, DRP and master production scheduling, DRP techniques – time-phased order point, managing variations in DRP, Strategic alliances, Third party logistics, Distribution integration.

Unit II:

Unit III:
Issues in SCM: Procurement and outsourcing strategies, Framework of e-procurement, International issues in SCM, Regional differences in logistics, coordinated product and supply chain design, Customer value and SCM, Omni-channel supply chains

Text Book

Reference Books

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

24DLS512 Advanced Data Mining 3 0 2 4

CO1: Understand the basic concepts of data mining and apply association rule mining to the real life problems.

CO2: Gain and apply the knowledge to classify the data and apply them to datasets

CO3: Group the data using various clustering techniques and analyse the outliers of the given dataset.

CO4: Gain knowledge about link analysis, spatial mining and temporal mining

Unit-I

Data Mining: Steps in Data mining process, Data Mining Functionalities, Architecture of a Typical Data Mining Systems, Classification of Data Mining Systems, Data Preprocessing, Data Cleaning, Data Transformation, Data Compression and Dimension Reduction, Binning Methods. Association Rule Mining, Classification and Prediction: Efficient and Scalable Frequent Itemset Mining Methods, Mining, Various Kinds of Association Rules, Market Basket Analysis, Apriori Algorithm, Case studies related to logistics and supply chain management

Unit-II


Clustering–Types of Data in Cluster Analysis–Categorization of Major Clustering Methods– Partitioning Methods, Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Modelling based, clustering high dimensional data, Outlier Analysis. Case studies related to logistics and supply chain management

Unit-III

Text/References books

7. Dunham, Sridhar, Data Mining a: Introductory and Advanced topics, Pearson Education, India, 2002

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

24DLS513 \hspace{1cm} Machine Learning \hspace{1cm} 3 0 2 4

Course Outcomes:

CO1: Understand the basic concepts of machine learning
CO2: Apply classification techniques to the real time data sets
CO3: Understand and apply the concepts of advanced supervised learning and ensemble algorithms
CO4: Understand and apply the concepts of genetic algorithms and reinforcement learning

Unit-I:
Introduction: Well-Posed Learning Problems, Over fitting and Under fitting, Bias and Variance, Training and testing sets, Learning a Class from training, Linear, Non-linear, Multi-class and Multi-label classification, Classification techniques: Linear Regression, Multiple Linear Regression, Logistic Regression, Decision Trees: ID3, Classification and Regression Trees (CART), K-Nearest Neighbours, Naïve Bayes classifier. Case studies related to logistic and supply chain management
Unit-II

Unit-IV:
Genetic Algorithms: Fundamentals of genetic algorithms, Genetic algorithms history, Basic concepts, Creation of offsprings, Working principle, Encoding, Fitness function, Reproduction
Genetic Modelling: Inheritance operators, Cross over, Inversion and deletion, Mutation operator, Bit-wise operators, Bit-wise operators used in genetic algorithms, Generational cycle, Convergence of genetic algorithm. Case studies related to logistic and supply chain management
Reinforcement Learning – Introduction, the learning task, Q-learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic Programming.

Text / Reference Books


CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

24DLS514 Information System Management 3 1 0 4

CO1: Understand the basic concepts involved in information systems and enterprise business system.

CO2: Gain knowledge about e-commerce and decision support system.

CO3: Understand about the types of telecommunications networks and it applications

CO4: Gain knowledge about the role of security and ethical issues challenges of information system

Information Management System: Fundamental role of IS in business, Types of Information system, Information system Managing Hardware, Software, and Data resources.
**Enterprise business system**
Customer relationship management (CRM), Three phases of CRM, Trends, challenges and Failure of CRM, Enterprise Resource Planning (ERP), basic features, selection and implantation challenges and Failure of ERP, Supply Chain Management (SCM), challenges and Failure of SCM

**E-Commerce System and Decision support system**
Essential e-commerce processes, Electronic payment process, Business to Consumer, e-commerce, Business to Business e-commerce, Decision support system (DSS) components and trends. Online Analytical Processing, Data mining for decision support. Domain of Artificial Intelligence, Components of expert system, Developing expert systems, Other Intelligence techniques: Neural networks, Fuzzy logic, Genetic algorithm. Virtual Reality and Intelligent agents.

**Telecommunication and Networks**
Basic components in a telecommunication networks, Types of telecommunication networks – Wide area networks, Metropolitan area networks, local area networks, virtual private networks client/server networks, peer to peer networks, digital and analog signals, wired technologies, wireless technologies, cellular and PCS systems, Telecommunication Processors.

**Security and ethical challenges**

**LEARNING RESOURCES**

**CO-PO Mapping**

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**24DLS515 Pricing and Revenue Optimization 3 1 0 4**

CO1 To understand the concepts of price response functions.
CO2 To gain knowledge about price optimization and price differentiation with regard to supply constrain.
CO3 To gain knowledge about Revenue management, capacity allocation and network management.


Text / Reference Books:

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

24DLS516 Warehouse and Production Management 3 1 0 4

CO1 : Understand the role, need and functions of warehouse and procurement management
CO2 : Understand the basic concepts of productions and operation management and
apply the forecasting and scheduling to real life problems

CO3 : Understand the concept of inventory techniques. Also construct and analyse various control charts to real life problems

Unit I:


**Unit II**


Unit III

**Material Management** Scope and Importance of Materials Management. Functions of Materials Management, Need for Inventory, Different Types of Inventory, Inventory Classification, ABC analysis, XYZ analysis, VED analysis.


**Text books / References**


**CO-PO Mapping**

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>


Amrita University's Amrita Values Program (AVP) is a new initiative to give exposure to students to the richness and beauty of the Indian way of life. India is a country where history, culture, art, aesthetics, cuisine, and nature exhibit more diversity than anywhere else in the world. Amrita Values Programs emphasize making students familiar with the rich tapestry of Indian life, culture, arts, science, and heritage which has historically drawn people from all over the world. Post-graduate students shall have to register for any one of the following courses, in the second semester, which may be offered by the respective school.

Courses offered under the framework of the Amrita Values Program:

22AVP501  Message of Śrī Mātā Amritanandamayī Devi
Amma’s messages can be put into action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks, and the guidance received in matters which we consider trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma’s guidance, and She teaches us the art of exemplary life skills where we become witness to all the happenings around us keeping the balance of the mind.

22AVP502  Insights from the Ramayana
The historical significance of Ramayana, the first Epic in the world, influence of Ramayana on Indian values and culture, storyline of Ramayana, study of leading characters in Ramayana, influence of Ramayana outside India, misinterpretation of Ramayana by colonial powers and its impact on Indian life, relevance of Ramayana for modern times.

22AVP503  Insights from the Mahabharata
The historical significance of Mahabharata, the largest Epic in the world, influence of Mahabharata on Indian values and culture, storyline of Mahabharata, study of leading characters in Mahabharata, Kurukshetra War and its significance, importance of Dharma in society, message of the Bhagavad Gita, relevance of Mahabharata for modern times.

22AVP504  Insights from the Upanishads
Introduction: Sruti versus Smrti, overview of the four Vedas and the ten Principal Upanishads, the central problems of the Upanishads, ultimate reality, the nature of Atman, the different modes of consciousness, Sanatana Dharma and its uniqueness, The Upanishads and Indian Culture, relevance of Upanishads for modern times, a few Upanishad Personalities: Nachiketas, Satyakama Jabala, Aruni, Shvetaketu.

22AVP505  Insights from Bhagavad Gita
Introduction to Bhagavad Gita, brief storyline of Mahabharata, context of Kurukshetra War, the anguish of Arjuna, counsel by Sri. Krishna, key teachings of the Bhagavad Gita, Karma Yoga, Jnana Yoga, and Bhakti Yoga, theory of Karma and Reincarnation, concept of Dharma, idea of the self and realization of the self, qualities of a realized person, concept of Avatar, relevance of Mahabharata for modern times.

22AVP506  Message of Swami Vivekananda
Brief sketch of Swami Vivekananda’s life, meeting with Guru, disciplining of Narendra, travel across India, inspiring life incidents, address at the parliament of religions, travel in the United States and Europe, return and reception in India, message to Indians about our duties to the nation.

**22AVP507 Great Spiritual Teachers of India**

Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramanujacharya, Sri Madhvacharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi

**22AVP508 Indian Arts and Literature:**

The aim of this course is to present the rich literature, culture of ancient India, and help students appreciate their deep influence on Indian life, Vedic culture, the primary source of Indian culture, brief introduction, and appreciation of a few of the art forms of India, arts, music, dance, theatre, paintings, sculpture and architecture, the wonder language, Sanskrit, and ancient Indian Literature.

**22AVP509 Yoga and Meditation**

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali’s Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

**22AVP510 Appreciation of Kerala’s Mural Art Forms:**

A mural is any piece of artwork painted or applied directly on a wall, ceiling, or another large permanent surface. In the contemporary scenario, Mural painting is not restricted to permanent structures and is being done even on canvas. A distinguishing characteristic of mural painting is that the architectural elements of the given space are harmoniously incorporated into the picture. Kerala mural paintings are frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches, and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back to the 9th to 12th centuries CE when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

**22AVP512 Ancient Indian Science and Technology**

Science and technology in ancient and medieval India covered all the major branches of humankind knowledge and activities, including mathematics, astronomy, physics, chemistry, medical science and surgery, fine arts, mechanical, civil engineering, architecture, shipbuilding, and navigation. Ancient India was a land of sages, saints, and seers as well as a land of scholars and scientists. The course gives awareness of India’s contribution to science and technology.
Course Outcomes (CO)
CO1: Relate to the causes of stress in one’s life.
CO2: Experiment with a range of relaxation techniques
CO3: Model a meditative approach to work, study, and life.
CO4: Develop appropriate practice of MA-OM technique that is effective in one’s life
CO5: Inculcate a higher level of awareness and focus.
CO6: Evaluate the impact of a meditation technique

Unit 1 (4 hours)

Unit 2 (4 hours)
Improving work and study performance. Meditation in daily life. Cultivating compassion and good mental health with an attitude of openness and acceptance. Research and Science of Meditation: Significance of practising meditation and perspectives from diverse fields like science, medicine, technology. philosophy, culture, arts, management, sports, economics, healthcare, environment etc. The role of meditation for stress and anxiety reduction in one’s life with insights based on recent cutting-edge technology. The effect of practicing meditation for the wholesome wellbeing of an individual.

Unit 3 (4 hours)
Communications: principles of conscious communication. Relationships and empathy: meditative approach in managing and maintaining better relationships in life during the interactions in the world, role of MAOM in developing compassion, empathy and responsibility, instilling interest, and orientation to humanitarian projects as a key to harness intelligence and compassion in youth. Methodologies to evaluate effective awareness and relaxation gained from meditation. Evaluating the global transformation through meditation by instilling human values which leads to service learning and compassion driven research.

Text Books /References Books:
5. Swami Amritaswarupananda Puri “Awaken Children Vol 1, 5 and 7 - Dialogues with Amma on Meditation”, August 2019
6. Swami Amritaswarupananda Puri “From Amma’s Heart - Amma’s answer to questions raised during world tours” March 2018


CO – PO Mapping:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PO13</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

24DLS601 Inventory and Marketing Management 3 1 0 4

Course Outcome

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understanding inventory management, dependent demand, independent demands models and its costs</td>
</tr>
<tr>
<td>CO2</td>
<td>Exploring different types of deterministic and stochastic inventory models.</td>
</tr>
<tr>
<td>CO3</td>
<td>Understanding joint replenishment inventory problem, BoM, MRP and Supply chain management</td>
</tr>
<tr>
<td>CO4</td>
<td>To gain knowledge on sales strategies and management</td>
</tr>
</tbody>
</table>

**Unit I:** The Basic Concepts of inventory management. Independent and dependent demands. Different inventory systems. Inventory costs, Service level and safety stock Inventory policy, order quantity and reorder point.

**Unit II:** Inventory Models: Deterministic demand model, EOQ with price break, Multi-Item Inventory Models, ABC Analysis, Stochastic demand model, Newsvendor model, S-S Policy, Optimal solution and approximations. Joint replenishment inventory problem, Supply chain management: Series, Assembly, Tree and general production network systems, Optimal solution, heuristics and approximation.

**Unit III:** Understanding Marketing Management, Marketing environmental analysis, Strategic marketing planning, Marketing strategy, Product life cycle Strategy, Branding and Packing, Integrated marketing communication, Advertising and sales promotion and sales management. Case studies related to supply chain management.

**Text / Reference Books:**

7. Still, R., Richard, Sales Management, Pearson Prentice Hall, Delhi, 2017

<table>
<thead>
<tr>
<th>CO-PO Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
</tbody>
</table>

24DLS602 Deep Learning 3 0 2 4

Course outcomes
CO1: Understand the basics concepts of machine learning and deep learning architectures
CO2: Gain knowledge convolution neural networks and transfer learning
CO3: Gain knowledge about sequence modelling and auto encoders

Unit-I: Machine learning basic and Deep learning architectures

Unit-II Convolution Neural Networks and Transfer Learning

Unit-III Sequence Modelling (RNN) and Auto encoders
Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short Term Memory Networks, Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoders

Text/Reference books

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Elective Courses**

**24DLS631 Pattern Recognition 3 0 0 3**


**Text Reference Book:**


**24DLS632 Stochastic Process 3 0 0 3**


**Text Books:**


Reference Books:

24DLS633 **Queuing Theory** 3 0 0 3

Queuing Models: Basic characteristics of a Queueing Model – Role of Poisson and Exponential distributions, Stochastic Processes, Markov chains, Poisson Processes, Poisson Queueing Models with single server: Descriptions of the model, Assumptions, Probability distributions for number of Units (steady state), waiting time distribution, simple numerical problems on (M/M/1): (/FIFO) and (M/M/1): (N/FIFO) Models.

Poisson Queueing Models with multiple server: Descriptions of the model, Assumptions, Probability distributions for number of Units (steady state), waiting time distribution, simple numerical problems on (M/M/C): (/FIFO), (M/M/C): (N/FIFO) and (M/M/C): (C/FIFO) Models, M/M/G Models.

**Text Books**

**Reference Books**

24DLS634 **Survival Analysis** 3 0 0 3

Survival Analysis: Functions of survival times, survival distributions and their applications Censoring Schemes: Type I, Type II and progressive or random censoring with biological examples. Estimation of mean survival time and variance of the estimator for Type I and Type II censored data with numerical examples.


Competing Risk Theory: Indices for measurement of probability of death under competing risks and their inter-relations. Estimation of probabilities of death using maximum likelihood principle and modified minimum Chi-square methods.

**References**
2. Collet, D. *Statistical analysis of life time data*, 1984
Sampling Techniques

Preliminary concepts – schedules and questionnaires, pilot survey, non-sampling errors, use of random numbers. Simple random sampling with and without replacements, random number generation – estimates of population mean and population proportion and their standard errors, probability proportional to size sampling, estimates of these standard errors. Stratified random sampling – estimates of sample statistic and estimates of their standard errors. Allocation of sample size in stratified random sampling. Linear and circular systematic sampling. Cluster sampling: Two stage sampling (equal first stage units). Ideas of ratio and regression estimators – only estimates of sample mean.

References


Demography and Actuarial Statistics


Text Books:


Official Statistics

Introduction to Indian Statistical systems- Role, function and activities of Central Statistical organization and State Agencies. Role of National Sample Survey Organization. General and


Text Books:
2. Principles and Accommodation of National Population Census, UNEDCO

24DLS638 Reinforcement Learning 3 0 0 3


Review of Markov process and Dynamic Programming.


Text/ References Book:

24DLS639 Social Network Analytics 3 0 0 3

An Introduction to social network data analytics: research Issues, statistical properties of social networks, random walks in social networks and their applications: survey, applications, community discovery in social networks, node classification in social networks, evolution in social networks - survey, survey of models and algorithms for social influence analysis, survey
of algorithms and systems for expert location in social networks, survey of link prediction in social networks, data mining in social media, text mining in social networks

Text and Reference


24DLS640  Mining of Massive Datasets  3 0 0 3


Text / References Book


24DLS641  Parallel and Distributed Systems  3 0 0 3


System models : physical models, architecture models, operating system support. Distributed file systems – introduction- time and global states – synchronization of physical clocks – coordination and agreements: Mutual exclusion, election, consensus.

Text Books

References


**24DLS642** Tauguchi Techniques

Taguchi loss functions – mean square error loss function, average loss function, higher the better and lower the better loss functions – two-way analysis of variance with interactions – factorial experiments with two and three-level factors – orthogonal array experiments with two and three-level factors – methods of interpretation of experimental results - parameter and tolerance design experiments – signal-to-noise ratios – inner and outer array experiments.

**Text/Reference Books**

1. Taguchi Techniques for Quality Engineering

**24DLS643** Special Distribution Functions


**Text/Reference books**