



# VIGNAN'S INSTITUTE OF MANAGEMENT AND TECHNOLOGY FOR WOMEN

[Sponsored by Lavu Educational Society, Affiliated to JNTUH & Approved by AICTE, New Delhi]  
Kondapur (V), Ghatkesar (M), Medchal - Malkajgiri (D) - 501 301. Phone: 96529 10002/3



## R22 B.Tech. CSE (Data Science) — III Year I Semester

### Course Outcomes & CO-PO/PSO Mapping

#### DS501PC: ALGORITHM DESIGN AND ANALYSIS

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

| CO. No | COURSE OUTCOMES                                                                                                                                  | BT Level |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| CO1    | Analyze the performance of algorithms using asymptotic notations and apply divide-and-conquer technique to solve searching and sorting problems. | 4        |
| CO2    | Apply backtracking technique and disjoint set operations to solve combinatorial problems such as N-Queens and graph colouring.                   | 3        |
| CO3    | Apply dynamic programming technique to solve optimization problems like 0/1 knapsack and shortest path problems.                                 | 3        |
| CO4    | Apply the greedy method and traversal techniques to solve minimum cost spanning tree and shortest path problems.                                 | 3        |
| CO5    | Analyze branch and bound technique and classify problems as NP-Hard or NP-Complete.                                                              | 4        |

#### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 3   | 2   | 3   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO2     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO3     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO4     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO5     | 3   | 3   | 2   | 3   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| Average | 3   | 3   | 2   | 2.4 | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |



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## DS502PC: INTRODUCTION TO DATA SCIENCE

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

| CO. No | COURSE OUTCOMES                                                                                                 | BT Level |
|--------|-----------------------------------------------------------------------------------------------------------------|----------|
| CO1    | Understand fundamental concepts of data science, statistical modeling and the basic R programming environment.  | 2        |
| CO2    | Understand different types of data attributes and compute basic statistical descriptions of data.               | 2        |
| CO3    | Apply R programming constructs such as vectors, matrices, factors, data frames and lists for data manipulation. | 3        |
| CO4    | Apply conditional statements, loops and functions to implement programming logic in R.                          | 3        |
| CO5    | Visualize data using charts and graphs and perform predictive analysis using regression techniques.             | 3        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 2   | 1   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 3    | 2    |
| CO2     | 3   | 2   | 1   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 3    | 2    |
| CO3     | 3   | 2   | 2   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 3    | 2    |
| CO4     | 3   | 2   | 2   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 3    | 2    |
| CO5     | 3   | 2   | 2   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 3    | 2    |
| Average | 3   | 2   | 1.6 | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 3    | 2    |



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## DS503PC: COMPUTER NETWORKS

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

| CO. No | COURSE OUTCOMES                                                                                        | BT Level |
|--------|--------------------------------------------------------------------------------------------------------|----------|
| CO1    | Understand computer network concepts, layered architectures and physical/data link layer fundamentals. | 2        |
| CO2    | Apply data link layer protocols and medium access control techniques for reliable data transmission.   | 3        |
| CO3    | Analyze routing algorithms and congestion control mechanisms in the network layer.                     | 4        |
| CO4    | Analyze transport layer services and TCP/UDP protocols.                                                | 4        |
| CO5    | Analyze application layer protocols and services such as DNS, email and HTTP.                          | 4        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 3   | 1   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO2     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO3     | 3   | 3   | 2   | 3   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO4     | 3   | 3   | 2   | 3   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO5     | 3   | 3   | 2   | 3   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| Average | 3   | 3   | 1.8 | 2.6 | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |



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## PROFESSIONAL ELECTIVE – I

### DS511PE: DATA WAREHOUSING AND BUSINESS INTELLIGENCE

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

| CO. No | COURSE OUTCOMES                                                                                 | BT Level |
|--------|-------------------------------------------------------------------------------------------------|----------|
| CO1    | Understand the architecture of data warehouse and OLAP operations.                              | 2        |
| CO2    | Understand fundamental concepts and components of Business Intelligence.                        | 2        |
| CO3    | Apply key performance indicators and BI implementation frameworks for business decision making. | 3        |
| CO4    | Utilize advanced BI tools and emerging trends such as big data and mobile BI.                   | 3        |
| CO5    | Implement BI integration techniques while addressing legal and ethical issues.                  | 3        |

#### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 2   | 1   | 2   | 2   |     |     |     | 1   | 1    | 2    | 1    | 3    | 3    | 2    |
| CO2     | 3   | 2   | 1   | 2   | 2   |     |     |     | 1   | 1    | 2    | 1    | 3    | 3    | 2    |
| CO3     | 3   | 2   | 2   | 2   | 2   |     |     |     | 1   | 1    | 2    | 1    | 3    | 3    | 2    |
| CO4     | 3   | 2   | 2   | 2   | 2   |     |     |     | 1   | 1    | 2    | 1    | 3    | 3    | 2    |
| CO5     | 3   | 2   | 2   | 2   | 2   |     |     |     | 1   | 1    | 2    | 1    | 3    | 3    | 2    |
| Average | 3   | 2   | 1.6 | 2   | 2   |     |     |     | 1   | 1    | 2    | 1    | 3    | 3    | 2    |



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## DS512PE: ARTIFICIAL INTELLIGENCE

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

| CO. No | COURSE OUTCOMES                                                                                                     | BT Level |
|--------|---------------------------------------------------------------------------------------------------------------------|----------|
| CO1    | Understand intelligent agents and apply uninformed and informed search strategies to solve problems.                | 3        |
| CO2    | Apply adversarial search and constraint satisfaction techniques, and represent knowledge using propositional logic. | 3        |
| CO3    | Represent and reason with knowledge using first-order logic.                                                        | 3        |
| CO4    | Apply knowledge representation techniques and classical planning algorithms.                                        | 3        |
| CO5    | Apply probabilistic reasoning and Bayesian methods to handle uncertainty.                                           | 3        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 3   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO2     | 3   | 3   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO3     | 3   | 3   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO4     | 3   | 3   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO5     | 3   | 3   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| Average | 3   | 3   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |



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## DS513PE: WEB PROGRAMMING

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

| CO. No | COURSE OUTCOMES                                                                 | BT Level |
|--------|---------------------------------------------------------------------------------|----------|
| CO1    | Design web pages using HTML, CSS and JavaScript for client-side scripting.      | 3        |
| CO2    | Apply object-oriented programming concepts of Java for application development. | 3        |
| CO3    | Create database connectivity using JDBC and implement socket-based networking.  | 3        |
| CO4    | Develop applets and servlets to build interactive web-based applications.       | 3        |
| CO5    | Apply XML and web services technologies to build distributed applications.      | 3        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 2   | 3   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO2     | 3   | 2   | 3   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO3     | 3   | 2   | 3   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO4     | 3   | 2   | 3   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO5     | 3   | 2   | 3   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| Average | 3   | 2   | 3   | 2   | 3   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |



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## DS514PE: IMAGE PROCESSING

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

| CO. No | COURSE OUTCOMES                                                                                 | BT Level |
|--------|-------------------------------------------------------------------------------------------------|----------|
| CO1    | Understand digital image fundamentals, sampling, quantization and 2D transformation techniques. | 2        |
| CO2    | Apply image enhancement techniques in spatial and frequency domains.                            | 3        |
| CO3    | Apply image restoration techniques to remove degradation from images.                           | 3        |
| CO4    | Apply image segmentation techniques for edge and boundary detection.                            | 3        |
| CO5    | Analyze image compression models and techniques to reduce redundancy.                           | 4        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 3   | 1   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO2     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO3     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO4     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO5     | 3   | 3   | 2   | 3   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| Average | 3   | 3   | 1.8 | 2.2 | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |



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## DS515PE: COMPUTER GRAPHICS

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

| CO. No | COURSE OUTCOMES                                                                                | BT Level |
|--------|------------------------------------------------------------------------------------------------|----------|
| CO1    | Understand computer graphics systems and apply line, circle and polygon generating algorithms. | 3        |
| CO2    | Apply 2D geometric transformations and clipping algorithms for viewing operations.             | 3        |
| CO3    | Understand 3D object representation techniques including curves, surfaces and colour models.   | 2        |
| CO4    | Apply 3D geometric transformations and viewing techniques.                                     | 3        |
| CO5    | Analyze computer animation techniques and visible surface detection methods.                   | 4        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 2   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO2     | 3   | 2   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO3     | 3   | 2   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO4     | 3   | 2   | 3   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO5     | 3   | 3   | 3   | 3   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| Average | 3   | 2.2 | 2.8 | 2.2 | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |



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## PROFESSIONAL ELECTIVE – II

### DS521PE: SPATIAL AND MULTIMEDIA DATABASES

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

| CO. No | COURSE OUTCOMES                                                                             | BT Level |
|--------|---------------------------------------------------------------------------------------------|----------|
| CO1    | Understand spatial database concepts, data models and query languages.                      | 2        |
| CO2    | Apply spatial storage, indexing techniques and multidimensional data structures.            | 3        |
| CO3    | Represent and retrieve image and text databases using appropriate indexing techniques.      | 3        |
| CO4    | Understand organization and retrieval techniques for video, audio and multimedia databases. | 2        |
| CO5    | Understand distributed multimedia presentation and server architectures.                    | 2        |

#### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 3   | 1   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO2     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO3     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO4     | 3   | 3   | 1   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO5     | 3   | 3   | 1   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| Average | 3   | 3   | 1.4 | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |



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## DS522PE: INFORMATION RETRIEVAL SYSTEMS

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

| CO. No | COURSE OUTCOMES                                                                                     | BT Level |
|--------|-----------------------------------------------------------------------------------------------------|----------|
| CO1    | Understand the objectives, capabilities and functional components of information retrieval systems. | 2        |
| CO2    | Apply indexing techniques and data structures for information extraction.                           | 3        |
| CO3    | Apply automatic indexing and clustering techniques for document organization.                       | 3        |
| CO4    | Apply user search techniques and information visualization methods for effective retrieval.         | 3        |
| CO5    | Apply text search algorithms and multimedia information retrieval techniques.                       | 3        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 3   | 3   | 1   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO2     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO3     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO4     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| CO5     | 3   | 3   | 2   | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |
| Average | 3   | 3   | 1.8 | 2   | 2   |     |     |     |     |      |      | 1    | 3    | 2    | 1    |



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## DS523PE: SOFTWARE PROJECT MANAGEMENT

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

| CO. No | COURSE OUTCOMES                                                                            | BT Level |
|--------|--------------------------------------------------------------------------------------------|----------|
| CO1    | Understand software economics and conventional software management principles.             | 2        |
| CO2    | Examine the life cycle phases, artifacts and workflows of the software management process. | 4        |
| CO3    | Understand model-based software architectures, process workflows and checkpoints.          | 2        |
| CO4    | Apply iterative process planning techniques and organize project responsibilities.         | 3        |
| CO5    | Analyze software project metrics and tailor the process for effective project control.     | 4        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 2   | 2   | 1   | 2   | 1   |     |     | 1   | 2   | 2    | 3    | 1    | 2    | 2    | 1    |
| CO2     | 2   | 3   | 2   | 3   | 1   |     |     | 1   | 2   | 2    | 3    | 1    | 2    | 2    | 1    |
| CO3     | 2   | 2   | 1   | 2   | 1   |     |     | 1   | 2   | 2    | 3    | 1    | 2    | 2    | 1    |
| CO4     | 2   | 2   | 2   | 2   | 1   |     |     | 1   | 2   | 2    | 3    | 1    | 2    | 2    | 1    |
| CO5     | 2   | 3   | 2   | 3   | 1   |     |     | 1   | 2   | 2    | 3    | 1    | 2    | 2    | 1    |
| Average | 2   | 2.4 | 1.6 | 2.4 | 1   |     |     | 1   | 2   | 2    | 3    | 1    | 2    | 2    | 1    |



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## DS524PE: DEVOPS

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

| CO. No | COURSE OUTCOMES                                                                           | BT Level |
|--------|-------------------------------------------------------------------------------------------|----------|
| CO1    | Understand DevOps concepts, the agile development model and continuous delivery pipeline. | 2        |
| CO2    | Understand DevOps influence on software architecture and continuous testing.              | 2        |
| CO3    | Use source code management tools and version control systems for project management.      | 3        |
| CO4    | Use build automation and integration tools for continuous integration.                    | 3        |
| CO5    | Select appropriate testing tools and deployment models for software projects.             | 5        |

### MAPPING:

| CO      | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1     | 2   | 2   | 1   | 1   | 3   |     |     |     | 2   | 1    | 2    | 1    | 2    | 3    | 1    |
| CO2     | 2   | 2   | 1   | 1   | 3   |     |     |     | 2   | 1    | 2    | 1    | 2    | 3    | 1    |
| CO3     | 2   | 2   | 2   | 1   | 3   |     |     |     | 2   | 1    | 2    | 1    | 2    | 3    | 1    |
| CO4     | 2   | 2   | 2   | 1   | 3   |     |     |     | 2   | 1    | 2    | 1    | 2    | 3    | 1    |
| CO5     | 2   | 3   | 2   | 2   | 3   |     |     |     | 2   | 1    | 2    | 1    | 2    | 3    | 1    |
| Average | 2   | 2.2 | 1.6 | 1.2 | 3   |     |     |     | 2   | 1    | 2    | 1    | 2    | 3    | 1    |