B. Tech with

HONORS

in

DATA SCIENCE

Academic Regulations, Course Structure and Syllabus

Effective from 2023-24 admitted batches

Offered by

Department of Computer Science and Engineering

KSRM College of Engineering (A) – Kadapa

(Approved by AICTE, Accredited by NAAC with A+ Grade and NBA and Affiliated to JNTUA, Anantapuramu)

ELIGIBILITY / REGISTRATION / AWARD OF HONORS

The objective of introducing B.Tech. (Hons.) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The program is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i) Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B.Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.

ii) Those students with **at least 7.0 CGPA without any course backlogs up to III Semester in the major degree are only eligible to register for Honor degree**.

iii) A student shall earn **additional 18 credits for award of Honors** from same branch / department / discipline registered for major degree. This is in addition to 163 credits by a regular student and 123 Credits by a Lateral Entry student for the award of Major degree.

iv) A student is permitted to register for Honors in IV Semester after the results of III Semester are declared. Students shall register and pass in all the courses prescribed and being offered from V semester under the respective Honor degree.

v) Students have to attend classwork for courses under Honor degree beyond regular academic hours meant for major degree. Students can also undergo the courses under Honor through any proctored online platforms with the prior approval of the BoS Chairman and the HoD of the respective department offering Honor degree.

vi) The attendance for the registered courses under Honors and regular courses offered for Major degree in a Semester will be considered separately.

vii) A student shall have an aggregate of 75% attendance in all courses registered under Honors in that particular semester to become eligible for attending Semester-End examinations.

viii) The registration for the Honor will be cancelled, if the student is detained due to lack of attendance in Major,

ix) The registration for the Honor will be cancelled, if the student fails in any course of either Honor / Major in any semester from V to VIII Semester.

x) A student registered for Honors shall pass in all subjects that constitute the requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) will be awarded for Honors degree program.

xi) A separate grade sheet will be issued for the Honor degree courses semester-wise.

xii) If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra.

xiii) The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical

Engineering.

xiv) There shall be a minimum enrolment of 20% OR 20 enrollments from the list of eligible students to offer Honors program.

xv) There is no fee for registration of courses for Honors program offered.

xvi) A student can register for either Minor / Honor but not both.

xvii) Student shall submit an application for either Minor / Honor at least one week before the commencement of the V Semester.

HONORS PROGRAMS OFFERED

Offering Department	Title	Who can Register
Civil Engineering	Civil Engineering	B.Tech. CE
	Tunnel Engineering	
	Interior Design	
Mechanical Engineering	Mechanical Engineering	B.Tech. ME
Electrical and Electronics Engineering	Electric Vehicles	B.Tech. EEE
Electronics and Communication Engineering	VLSI	B.Tech. ECE
	Embedded Systems and IoT	
Computer Science and Engineering	Computer Science and Engineering	B.Tech. CSE, B.Tech. AIML, B.Tech. CSE(DS), B.Tech. CSE(AIML)
	Artificial Intelligence and Machine Learning	
	Data Science	
	CSE-Artificial Intelligence and Machine Learning	

COURSE STRUCTURE

for

HONORS

in

DATA SCIENCE

S.No	COURSE CODE	COURSE TITLE	Semester Offered	L	T	P	IM	EM	CR
1	2332571H	Data Science for Business	V	3	0	0	30	70	3
2	2332572H	Agile Project Management and Business Value	V	3	0	0	30	70	3
3	2332671H	Software Defined Data Center	VI	3	0	0	30	70	3
4	2332672H	Medical Image Data Processing	VI	3	0	0	30	70	3
5	2332771H	Data Analytics	VII	3	0	0	30	70	3
6	2332772H	Applied Project Work	VII	0	0	6	60	140	3
Total				**15**	**0**	**6**	**210**	**490**	**18**

2332571H	HONORS IN DATA SCIENCE DATA SCIENCE FOR BUSINESS (CSE-DS)	L	T	P	C
		3	0	0	3

Pre-Requisites: Introduction to Data Science, Data Engineering.

Course Outcomes:

At the end of the course the students will be able to

CO1. Understand the fundamentals of business intelligence.
CO2. Analyze model fitting results and recommend techniques to avoid overfitting.
CO3. Apply similarity and clustering methods to evaluate data-driven decisions
CO4. Understand the data analysis and knowledge delivery stages.
CO5. Apply business intelligence methods to various situations and decide on appropriate technique.

SYLLABUS:

UNIT - I: **(08 Periods)**

Introduction – Business problems and Data Science Solutions, Introduction to Predictive modeling: From Correlation to Supervised Segmentation.

UNIT - II: **(08 Periods)**

Fitting the Data- Fitting a Model to Data, Overfitting and its Avoidance.

UNIT - III: **(09 Periods)**

Similarity, Neighbors, and Clusters, Decision Analytic Thinking: What is a Good model?

UNIT - IV: **(08 Periods)**

Representing and Mining text, Decision Analytic Thinking II: Toward Analytic Engineering.

UNIT - V: **(09 Periods)**

Other Data Science Tasks and Techniques, Data Science and Business Strategy.

Total Periods: 42

TEXTBOOKS:

T1. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly, 2013.

REFERENCE BOOKS:

R1. Decision Support and Business Intelligence Systems, Efraim Turban, Ramesh Sharda, DursunDelen, Pearson, 9 th Edition, 2013.
R2. Business Intelligence Roadmap: The Complete ProjectLifecycle of Decision Making, Larissa T. Moss, S. Atre, Addison Wesley, 2003.
R3. Business Intelligence: Data Mining and Optimization for DecisionMaking, Carlo Vercellis, Wiley Publications, 2009.
R4. Business Intelligence: The Savvy Manager'sGuide, David Loshin Morgan, Kaufman, Second Edition, 2012.

WEB RESOURCES:

1. Edx: IBM Data Warehousing and BI Analytics

2332572H	HONORS IN DATA SCIENCE AGILE PROJECT MANAGEMENT AND BUSINESS VALUE (CSE-DS)	L	T	P	C
		3	0	0	3

Pre-Requisites: Software Engineering

Course Outcomes:

On successful completion of the course, students will be able to

CO1. Explain Agile principles, life cycles, and methods for building Agile business cases using business value models and project balance sheets.
CO2. Analyze Agile quality values and validation techniques, and explain governance mechanisms in hybrid Agile-Waterfall environments.
CO3. Apply Agile methodology for software development.
CO4. Construct cost and schedule estimates considering Agile team dynamics and influencing factors.
CO5. Evaluate governance practices and value measurement techniques such as burn-down charts and value scorecards.

SYLLABUS:

UNIT - 1: INTRODUCTION, THE AGILE BUSINESS CASE (10 Periods)

History, Background, and the Manifesto, Traditional Lifecycle, Agile Lifecycle, Scaling for Enterprise Agile, Four Agile Methodologies. The Agile Business Case: The Business Case, Business Value Models, Project Balance Sheet, Building the Business Case by Levels

UNIT – II: QUALITY IN THE AGILE SPACE (08 Periods)

Quality Values and Principles, Thought Leaders and Agile Quality, Sampling for Quality Validation, Agile in the Waterfall: First Principles and Requisite Conditions, The Black Box, Interfaces, and Connectivity, Governing

UNIT - III: SCOPE AND REQUIREMENTS (09 Periods)

Developing the Scope and Requirements: Agile Scope, Envisioning, Requirements, Planning at a Distance Planning and Scheduling: Planning in the Enterprise Context, Scheduling, Other Plans in the Enterprise Agile Project

UNIT - IV: ESTIMATING COST AND SCHEDULE (10 Periods)

The Nature of Estimates, Drivers on Cost and Schedule, Building Estimates Teams Are Everything: The Social Unit, Principle and Values Guide Teams, Teams Are Building Blocks, Some Teams Work; Others Do Not, Matrix Management in the Agile Space

UNIT - V: GOVERNANCE, MANAGING VALUE (08 Periods)

Governance Is Built on Quality Principles, Governance Verifies Compliance Managing Value: Defining and Accounting for Value, Burn-down Charts and Value Scorecards.

Total Periods: 45

TEXTBOOKS:

T1. Project Management the Agile Way, John C. Goodpasture, PMP, Second Edition, J. Ross Publishing 2016.

REFERENCE BOOKS:

R1. Agile Essentials you always wanted to know, KalpeshAshar, Vibrant publishers, 2020
R2. Agile Software development in the large: Diving into the Deep, Jutta Eckstein, Jutta Eckstein Publisher, 2022

WEB RESOURCES:

1. Coursera: Agile Project Management offered by Google
2. Coursera: Alex Cowan, Agile Development Specialization

2332671H	HONORS IN DATA SCIENCE SOFTWARE DEFINED DATA CENTER (CSE-DS)	L	T	P	C
		3	0	0	3

Pre-Requisites: Operating Systems, Computer Networks, Cloud Computing.

Course Outcomes:

After completion of the course, students will be able to

CO1. demonstrate the evolution of data centers, including the transition from disk to flash storage and the rise of cloud computing.
CO2. Analyze the role of software-defined components and hyper converged infrastructure in meeting evolving IT business requirements.
CO3. Apply virtualization and full-stack management techniques to increase agility and align data center operations with business needs.
CO4. Compare Software Defined Storage (SDS) with traditional storage and evaluate its role in Hyper converged Infrastructure design.
CO5. Predict future trends in data centers and propose how emerging technologies like containers and DevOps will transform operations.

SYLLABUS:

UNIT - I: INTRODUCTION (09 Periods)

Data Center evolution, a history of Modern Data Center, Focus on cost reduction, Focus on Customer service in the business, Flattening of the IT organization, IT as an operational Expense, Monolithic Storage Array rise and fall, Move from Disk to Flash, Emergence of Convergence, The Role of Cloud computing.

UNIT - II: EMERGING DATA CENTER TRENDS (09 Periods)

Emergence of SDCC, Commoditization of Hardware, Software Defined – Compute, Storage, Networking and Security, Software Defined Storage (SDS), Hyperconvergence, Hyper Converged Infrastructure(HCI) and SDS relationship, Flash in Hyperconvergence, Modern IT business Requirements.

UNIT - III: DATA CENTER AGILITY (09 Periods)

Principles and Strategies, Transform Data Center, Align Data Center and Business Needs, Server virtualization, VDI, Eliminate and Implement Monolithic to Hyperconvergence, Full Stack Management.

UNIT - IV: HYPER CONVERGED INFRASTRUCTURE (09 Periods)

Software Defined Storage, SDS comparison to Traditional Storage, SDS requirements, SDS in Hyperconverged, Hyperconvergence Design Model, Virtual Storage appliances, Appliance vs. Software/Reference Architecture,

UNIT - V: FUTURE DATA CENTERS **(09 Periods)**

Data growth, Storage capacity, flash storage deployment, Deployment Experiences SDS and HCI, IT transformations- Automation, Orchestration, DevOps, Open Standards and Interoperability, Performance Benchmarking Standards, Future Trends, Containers Instead of virtual machines, Open Source tools, Beyond Today's Flash, Pooling of Resources.

Total Periods: 45

TEXTBOOKS:

T1. Building a Modern Data Center, Principles and Strategies of Design, Scott D.Lowe, James Green, David Davis. Actual Tech Media, 2016.

REFERENCE BOOKS:

R1. Data Center Handbook: Plan, Design, Build, and Operations of a Smart Data Center, Second Edition, HwaiyuGeng P.E.,2021 John Wiley & Sons.

WEB RESOURCES:

1. https://www.udemy.com/topic/data-center-design/?utm_source=adwords&utm_medium=udemyads&utm_campaign=Search_DSA_Beta_Prof_la.EN_cc.India&campaigntype=Search&portfolio=India&language=EN&product=Course&test=&audience=DSA&topic=&priority=Beta&utm_content=deal4584&utm_term=_.ag_160270535665_.ad_696202838337_.kw__.de_c_.dm__.pl__.ti_dsa-1677053911888_.li_9299135_.pd__.&matchtype=&gad_source=1&gad_campaignid=21178559974&gbraid=0AAAADROdO3okJZYLHI_56FWd4YWy2sli&gclid=Cj0KCQjwm93DBhD_ARIsADR_DjGRZOAFf3ltyqzx5sE9HC3kO5jBulDcOOoAkTxu_5o_JKCYB2cS3KYaApUoEALw_wcB

2332672H	HONORS IN DATA SCIENCE MEDICAL IMAGE DATA PROCESSING (CSE-DS)	L	T	P	C
		3	0	0	3

Pre-Requisites: Machine Learning, Computer Vision.

Course Outcomes:

After completion of the course, students will be able to

- **CO1.** demonstrate the principles of medical imaging techniques such as CT, MRI, and ultrasound, and describe basic image processing operations used in clinical practice.
- **CO2.** Analyze medical image representations in terms of grayscale, color, SNR, and file formats (DICOM, NIFTI), and apply intensity-based transformations.
- **CO3.** Apply frequency domain transformations and segmentation techniques such as thresholding and morphological operations for region analysis in medical images.
- **CO4.** Apply spatial transformations and rendering methods like raycasting and surface rendering to aid in image-guided therapy.
- **CO5.** Evaluate image registration strategies and reconstruction techniques including Radon Transform and Filtered Back Projection.

SYLLABUS:

UNIT - I: BASICS OF MEDICAL IMAGE SOURCES (08 Periods)

Radiology, The Electromagnetic Spectrum, Basic X-Ray Physics, Attenuation and Imaging, Computed Tomography, Magnetic Resonance Tomography, Ultrasound, Nuclear Medicine and Molecular Imaging, Other Imaging Techniques, Radiation Protection and Dosimetry, Image Processing in Clinical Practice: Application Examples, Image Databases, Intensity Operations, Filter Operations, Segmentation, Spatial Transforms, Rendering and Surface Models, Registration, CT Reconstruction

UNIT - II: IMAGE REPRESENTATION (10 Periods)

Pixels and Voxels, Gray Scale and Color Representation, Image File Formats, Dicom, Other Formats – Analyze 7.5, NIFTI And Interfile, Image Quality and The Signal-To-Noise Ratio, Practical Lessons Operations in Intensity Space: The Intensity Transform Function and Dynamic Range, Windowing, Histograms and Histogram Operations, Dithering and Depth, Practical Lessons.

UNIT - III: FILTERING AND TRANSFORMATIONS, SEGMENTATION (08 Periods)

The Filtering Operation, The Fourier Transform, Other Transforms, Practical Lessons

Segmentation: The Segmentation Problem, ROI Definition and Centroids, Thresholding, Region Growing, More Sophisticated Segmentation Methods, Morphological Operations, Evaluation of Segmentation Results

UNIT - IV: SPATIAL TRANSFORMS (09 Periods)

Discretization – Resolution and Artifacts, Interpolation and Volume Regularization, Translation and Rotation, Reformatting, Tracking and Image-Guided Therapy Rendering and Surface Models: Visualization, Orthogonal and Perspective Projection, and The Viewpoint, Raycasting, Surface–Based Rendering

UNIT - V: REGISTRATION, CT RECONSTRUCTION (10 Periods)

Fusing Information, Registration Paradigms, Merit Functions, Optimization Strategies, Some General Comments, Camera Calibration, Registration to Physical Space, Evaluation of Registration Results CT Reconstruction: Introduction, Radon Transform, Algebraic Reconstruction, Some Remarks on Fourier Transform and Filtering, Filtered Back projection

Total Periods: 45

TEXT BOOKS:

T1. Applied Medical Image Processing, Wolfgang Birkfellner, CRC Press, Second Edition.

REFERENCE BOOKS:

R1. Medical Image Processing Concepts and Application, Sinha G.R., PHI, 2014
R2. Digital Image Processing for Medical Applications, Geoff Dougherty, Cambridge university press, 2010

WEB RESOURCES:

1. Coursera: Pranav Rajpurkar, AI for Medical Diagnosis

2332771H	HONORS IN DATA SCIENCE DATA ANALYTICS (CSE-DS)	L	T	P	C
		3	0	0	3

Pre-Requisites: Introduction to Data Science, Machine Learning, Data Visualization.

Course Outcomes:

After completion of this course students will be able to

CO1. Understand the data management principles, data quality issues, and preprocessing techniques for sensor and signal data.
CO2. Apply basic data analytics and modeling techniques using tools to support business analysis.
CO3. Construct and evaluate linear and logistic regression models for various business scenarios.
CO4. Analyze decision trees, segmentation methods, and time series models for feature extraction and prediction tasks.
CO5. Evaluate appropriate visualization techniques for representing and analyzing complex datasets.

SYLLABUS:

UNIT - I: DATA MANAGEMENT (09 Periods)

Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/Signals/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Processing & Processing.

UNIT - II: DATA ANALYTICS (09 Periods)

Introduction to Analytics, Introduction to Tools and Environment, Application of Modeling in Business, Databases & Types of Data and variables, Data Modeling Techniques, Missing Imputations etc. Need for Business Modeling.

UNIT - III: REGRESSION (09 Periods)

Regression – Concepts, Blue property assumptions, Least Square Estimation, Variable Rationalization, and Model Building etc. Logistic Regression: Model Theory, Model fit Statistics, Model Construction, Analytics applications to various Business Domains etc.

UNIT - IV: OBJECT SEGMENTATION (09 Periods)

Regression Vs Segmentation – Supervised and Unsupervised Learning, Tree Building – Regression, Classification, Overfitting, Pruning and Complexity, Multiple Decision Trees etc. Time Series Methods: Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height, Average Energy etc and Analyze for prediction

UNIT - V: DATA VISUALIZATION **(09 Periods)**

Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

Total Periods: 45

TEXT BOOKS:

T1. Student's Handbook for Associate Analytics – II, III.
T2. Data Mining Concepts and Techniques, Han, Kamber, 3rd Edition, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

R1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addision Wisley, 2006.
R2. Data Mining Analysis and Concepts, M. Zaki and W. Meira
R3. Mining of Massive Datasets, Jure Leskovec Stanford Univ. Anand Rajaraman Milliway Labs Jeffrey D Ullman Stanford Univ.

WEB RESOURCES:

1. https://www.coursera.org/courses?query=data%20analytics
2. https://www.udemy.com/topic/data-analysis/?srsltid=AfmBOooNsuKSIpHjWQIdW9EEKJEGYMzVtSr_uz8O-PxXkjFKkCJW-Xm6
3. https://nptel.ac.in/courses/106107220
4. https://nptel.ac.in/courses/110106072
5. https://onlinecourses.swayam2.ac.in/ntr24_ed70/preview

2332772H	HONORS IN DATA SCIENCE APPLIED PROJECT WORK (CSE-DS)	L	T	P	C
		0	0	6	3

Pre-Requisites: Fundamentals of Data Science, Programming (Python/R), Statistical methods for data science and Machine Learning Basics.

Course Outcomes:

On successful completion of the course, student will be able to

CO1. Design and implement data science workflows to address real-world problems using appropriate methodologies and tools.
CO2. Apply data preprocessing, exploratory data analysis, and visualization techniques to extract meaningful insights from diverse datasets.
CO3. Develop and validate predictive models using machine learning algorithms and evaluate their performance with relevant metrics.
CO4. Analyze project outcomes while adhering to ethical considerations, data privacy, and societal and environmental impacts.
CO5. Collaborate effectively in multidisciplinary teams and communicate data-driven results through reports and presentations.
CO6. Manage project tasks independently or as a team member, demonstrating life-long learning and adaptability to emerging technologies in data science.