B. Tech.

Minor

in

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

SCHEME OF INSTRUCTION & SYLLABUS

Effective from 2022-23

Offered by

Department of Artificial Intelligence & Data Science

(for B.Tech. students other than CSE and IT)

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE

(An Autonomous, ISO 9001:2015 Certified Institution)

(Approved by AICTE, Accredited by NAAC with 'A' Grade, Affiliated to JNTUK, Kakinada)

(Sponsored by Siddhartha Academy of General & Technical Education)

Kanuru, Vijayawada

Andhra Pradesh - 520007, INDIA.

www.vrsiddhartha.ac.in

INSTITUTE VISION

To nurture excellence in various fields of engineering by imparting timeless core values to the learners and to mould the institution into a centre of academic excellence and advanced research.

INSTITUTE MISSION

To impart high quality technical education in order to mould the learners into globally competitive technocrats who are professionally deft, intellectually adept and socially responsible. The institution strives to make the learners inculcate and imbibe pragmatic perception and pro-active nature so as to enable them to acquire a vision for exploration and an insight for advanced enquiry.

DEPARTMENT VISION

The department vision is clearly defined and is in line with the college's vision. The vision of the department is:

"To evolve as a centre of academic excellence, advanced research and innovation in the field of Artificial Intelligence and Data Science discipline."

DEPARTMENT MISSION

This mission of the Department is concise and supports the College's mission. The mission of Artificial Intelligence and Data Science Department is:

"To inculcate students with congnitive skills to perform intelligent data analysis, their application in solving data driven problems, with an inclination towards societal issues, research, professional career and higher studies ."

Program Educational Objectives(UG)

We have program educational objectives for our Artificial Intelligence and Data Science Program. Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

Our program educational objectives are:

I. The graduates of the Program will have knowledge and skills for data analysis, including mathematics, science and basic engineering.

II. The graduates of the Program will have in-depth learning skills to function as members of multi-disciplinary teams and to communicate effectively using modern tools.

III. The graduates of the Program will have extensive knowledge in state-ofthe- art frameworks in Artificial Intelligence and be prepared for their careers in the software industry or pursue higher studies and continue to develop their professional knowledge.

IV. The graduates of the program will practice the profession with ethics, integrity, leadership and social responsibility

PROGRAM OUTCOMES

On successful completion of the B.Tech (AI&DS) programme the student will be able to :

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering, data science fundamentals, and artificial intelligence to solve complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems to create solutions using the first principles of mathematics, engineering sciences, and data science.

PO3: Design/development of solutions: Design solutions Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Apply research methods including design of experiments, statistical analysis and business interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate Artificial intelligence principles, techniques, modern engineering and IT tools including prediction and modelling to model complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning using contextual knowledge to assess the needs of societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to data science engineering practice.

PO7: Environment and sustainability: Understand the impact of artificial

intelligence solutions in societal and environmental contexts, and demonstrate the knowledge for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and to execute responsibilities and adhere to norms of the engineering profession.

PO9: Individual and team work: Execute professional functions effectively as an individual, as well as a leader or member in diverse multidisciplinary

teams.

PO10: Communication: Communicate effectively with the engineering community and with society in solving complex problems in terms of being able to comprehend and write effective reports, make effective presentations, as well as execute and receive clear instructions.

PO11: Project management and finance: Demonstrate an ability to use management principles and apply these to one's own work, as a member and lead projects and build cost models in an interdisciplinary professional setting.

PO12: Lifelong learning: Recognize the need for and develop learning mechanisms and inculcate the ability to prepare for lifelong learning in the context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: Develop AI based software applications/solutions as per the needs of Industry and society

PSO2: Adopt new and fast emerging technologies in Artificial Intelligence and Data Science

CURRICULAR FRAMEWORK FOR MINOR PROGRAM

1. a) Students who are desirous of pursuing their special interest areas other than the chosen discipline of Engineering may opt for additional courses in minor specialization groups offered by a department other than their parent department. For example, If Mechanical Engineering student selects subjects from Civil Engineering under this scheme, he/she will get Major degree of Mechanical Engineering with minor degree of Civil Engineering

b) Student can also opt for Industry relevant tracks of any branch to obtain the Minor Degree, for example, a B.Tech Mechanical student can opt for the industry relevant tracks like Data Mining track, IOT track, Machine learning track etc.

2. The BOS concerned shall identify as many tracks as possible in the areas of emerging technologies and industrial relevance / demand. For example, the minor tracks can be the fundamental courses in CSE, ECE, EEE, CE, ME etc or industry tracks such as Artificial Intelligence (AI), Machine Learning (ML), Data Science (DS), Robotics, Electric vehicles, Robotics, VLSI etc.

3. The list of disciplines/branches eligible to opt for a particular industry relevant minor specialization shall be clearly mentioned by the respective BoS.

4. There shall be no limit on the number of programs offered under Minor. The University/Institution can offer minor programs in emerging technologies based on expertise in the respective departments or can explore the possibility of collaborating with the relevant industries/agencies in offering the program.

5. The concerned BoS shall decide on the minimum enrolments for offering Minor program by the department. If a minimum enrolments criterion is not met, then the students may be permitted to register for the equivalent MOOC courses as approved by the concerned Head of the department in consultation with BoS.

6. A student shall be permitted to register for Minors program at the beginning of 4th semester subject to a maximum of two additional courses per semester, provided that the student must have acquired 7.75 CGPA (Cumulative Grade point average) upto the end of 2nd semester without any history of backlogs. It is expected that the 3rd semester results may be announced after the commencement of the 4th semester. If a student fails to acquire 7.75 CGPA upto 3rd semester or failed in any of the courses, his registration for Minors program shall stand cancelled. An CGPA of 7.75 has to be maintained in the subsequent semesters without any backlog in order to keep the Minors registration active.

7. A student shall earn additional 20 credits in the specified area to be eligible for the award of B. Tech degree with Minor. This is in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline (i.e. 160 credits).

8. Out of the 20 Credits, 16 credits shall be earned by undergoing specified courses listed by the concerned BoS along with prerequisites. It is the responsibility of the student to

acquire/complete prerequisite before taking the respective course. If a course comes with a lab component, that component has to be cleared separately. A student shall be permitted to choose only those courses that he/she has not studied in any form during the Program.

9. In addition to the 16 credits, students must pursue at least 2 courses through MOOCs. The courses must be of minimum 8 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to acquire a certificate from the agencies approved by the BOS with grading or marks or pass/fail in order to earn 1 credit for 4 week course If the MOOC course is a pass/fail course without any grades, the grade to be assigned as decided by the university/academic council.

10. Student can opt for the Industry relevant minor specialization as approved by the concerned departmental BoS. Student can opt the courses from Skill Development Corporation (APSSDC) or can opt the courses from an external agency recommended and approved by concerned BOS and should produce course completion certificate. The Board of studies of the concerned discipline of Engineering shall review such courses being offered by eligible external agencies and prepare a fresh list every year incorporating latest skills based on industrial demand.

11. A committee should be formed at the level of department to evaluate the grades/marks given by external agencies to a student which are approved by concerned BoS. Upon completion of courses the departmental committee should convert the obtained grades/marks to the maximum marks assigned to that course. The controller of examinations can take a decision on such conversions and may give appropriate grades.

12. If a student drops (or terminated) from the Minor program, they cannot convert the earned credits into free or core electives; they will remain extra. These additional courses will find mention in the transcript (but not in the degree certificate). In such cases, the student may choose between the actual grade or a "pass (P)" grade and also choose to omit the mention of the course as for the following: All the courses done under the dropped Minors will be shown in the transcript. None of the courses done under the dropped Minor will be shown in the transcript

13. In case a student fails to meet the CGPA requirement for B.Tech degree with Minor at any point after registration, he/she will be dropped from the list of students eligible for degree with Minors and they will receive B. Tech degree only. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

14. Minor must be completed simultaneously with a major degree program without exceeding 8 credits per semester. A student cannot earn the Minor after he/she has already earned bachelor's degree.

MINOR DEGREE IN Artificial Intelligence & Data Science
(For non CSE/IT Students)

S. No	Course Code	Course Name	Offered in Sem	L	T	P	Credits
Applied Artificial Intelligence							
1	20AI&DSM4701	Introduction to Artificial Intelligence & Data science	IV	3	1	0	4
2	20AI&DSM5701	AI in Web Development	V	3	1	0	4
3	20AI&DSM6701	Robotic process management	VI	3	1	0	4
4	20AI&DSM7701	AI in cloud computing	VII	3	1	0	4
02MOOCScourses@2creditseachother than the courses listed above needs to Be taken) (Any CSE/IT related Program Core subject from NPTEL/ SWAYAM course of 8weeks Any other course or platform deemed essential and approved by the Head of the Department							**4**
5	20AI&DSM7702A		IV,V,VI,VII	0	0	0	2
6	20AI&DSM7702B		IV,V,VI,VII	0	0	0	2
						Grand Total	**20**

SEMESTER IV

20AI&DSM4701
Introduction to Artificial Intelligence & Data science

Course Category:	Minors		Credits:	4
Stream/ Course Type:	Theory	Lecture -Tutorial-Practice:		3-1-0
Prerequisites:	20ES1103: Programming for Problem Solving	Continuous Evaluation:		30
		Semester end Evaluation:		70
		Total Marks:		100

COURSE OUTCOMES		BTL	POI
Upon successful completion of the course, the student will be able to:			
CO1	Understand the basic concepts of Artificial Intelligence.	K2	1.2.1,1.7.1, 2.5.2
CO2	Apply different problem-solving strategies involved in problem solving and represent using first order logic	K3	1.7.1, 2.5.1, 2.5.2, 2.5.3, 2.8.2, 3.5.1, 3.6.1, 3.8.2
CO3	Understand the fundamental principles of data science	K2	1.2.1,1.7.1, 2.5.2
CO4	Understand the Platform for Data Science	K2	1.2.1,1.7.1, 2.5.2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3												1	2
CO2	2	2	1	2									2	2
CO3	2	2	1	2									2	2
CO4	1	2	1	2								2	2	2

COURSE CONTENT

UNIT I

Defining Artificial Intelligence, Defining AI techniques, Tic-Tac- Toe, Criteria for Success.

Problems, Problem Spaces And Search: Defining the Problem as a State space Search, Production Systems, Problem Characteristics, Production system characteristics.

UNIT II

Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming

Search Techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, Heuristic search, Greedy best -first search.

UNIT III

Need for Data Science: What is Data Science - Data Science Process – Business Intelligence and Data Science – Prerequisites for a Data Scientist – Tools and Skills required

UNIT IV

Python for Data Science –Python Libraries – Data Frame Manipulation with numpy and pandas – Exploration Data Analysis – Time Series Dataset – Clustering with Python – Dimensionality Reduction. Python integrated Development Environments (IDE) for Data Science

TEXT BOOKS

[1] S. Russel and P. Norvig, "Artificial Intelligence: A modern Approach", Prentice Hall, Third edition, 2015 [Unit I and II]
[2] Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", 1st Edition, Morgan-Kaufmann, 1998. [Unit I and II]

[3] Sanjeev Wagh, Manisha Bhende, Anuradha Thakare, 'Fundamentals of Data Science, CRC Press, 1st Edition, 2022. [Unit III and IV]

REFERENCE BOOKS

[1] Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence",McGraw Hill, 3rd ed.,2017

[2] Deepak Khemani, A first course in Artificial Intelligence, McGraw Hill, 2022

E-RESOURCES AND OTHER DIGITAL MATERIAL

[1] An Introduction to Artificial Intelligence By Prof. Mausam|IIT Delhi https://onlinecourses.nptel.ac.in/noc22_cs56/preview Last accessed on 05-05-2023

Velagapudi Ramakrishna
Siddhartha Engineering College
(Autonomous)

LIST OF COURSES OFFERED UNDER MINORS

DEPARTMENT OF CIVIL ENGINEERING
(Applicable for CSE, ECE, EEE, EIE, IT,ME)

S.No	Course Code	Course Name	L	T	P	Credits
Fourth Semester						
1	20CEM4701	Introduction to Civil Engineering – Concepts and Materials	3	1	0	4
Fifth Semester						
2	20CEM5702	Methodology for Civil Engineering Construction	3	1	0	4
	20CEM5711	SELF LEARNING				2
Sixth Semester						
3	20CEM6703A	System Design for Sustainability	3	1	0	4
4	20CEM6703B	Ecology & Environment	3	1	0	4
Seventh Semester						
5	20CEM7704A	Infrastructure and Transportation System Planning	3	1	0	4
6	20CEM7704B	Construction Planning and Execution	3	1	0	4
7	20CEM7712	SELF LEARNING				2

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
(Applicable for CE, ECE, EEE, EIE, ME)

S. No	Course Code	Course Name	Offered in Sem	L	T	P	Credits
1	20CSM4701	Data Structures and Algorithms	IV	3	1	0	4
2	20CSM5702	Relational Database Systems	V	3	1	0	4
3	20CSM6703	Computer Organization and Architecture	VI	3	1	0	4
	Elective (Opt any one of the course)						
1	20CSM7704A	Computer Communications	VII	3	1	0	4
2	20CSM7704B	Software Engineering	VII	3	1	0	4
3	20CSM7704C	Data Science using Python	VII	3	1	0	4
4	20CSM7704D	Fundamentals of Operating Systems	VII	3	1	0	4
5	20CSM7704E	Fundamentals of IoT	VII	3	1	0	4
02MOOCScourses@2creditseach (Any CSE/IT related Program Core subject from NPTEL/ SWAYAM course of 8weeks (2credits) other than the courses listed above needs to Be taken) Any other course or platform deemed essential and approved by the Head of the Department							4
6			IV,V,VI,VII	0	0	0	2
7			IV,V,VI,VII	0	0	0	2
						Grand Total	20

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
(Applicable for CSE, CE, EEE, EIE, IT, ME)

Course Code	Course Name	L	T	P	Credits
	Minors in ECE				
20ECM4701	**Circuits for Analog Signal Processing**	4	0	0	4
20ECM5702	**Digital Circuits**	3	1	0	4
20ECM6703A	**Communication Systems**	4	0	0	4
20ECM6703B	**Microcontrollers**	3	1	0	4
20ECM6703C	**Image & Video Processing**	4	0	0	4
20ECM7704A	**Digital Signal Processing**	3	1	0	4
20ECM7704B	**VLSI Design**	4	0	0	4
20ECM7704C	**Mobile & Cellular Communications**	4	0	0	4
20ECM5711	**Self Learning Course/MOOCS Course 1**				2
20ECM7712	**Self Learning Course/MOOCS Course2**				2
	Total				20

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING
(Applicable for CSE, CE, ECE, EIE, IT, ME)

S.No	Course Code	Title of the Course	L	T	P	Credits
Fourth Semester						
1.	20EEM4701B	Elements of Electrical Power Systems	4	0	0	4
Fifth Semester						
2.	20EEM5702B	Energy Conservation & Audit	4	0	0	4
Sixth Semester						
3.	20 EEM6703B	Utilization of electrical energy	4	0	0	4
Seventh Semester						
4.	20 EEM7704B	Linear Control Systems	4	0	0	4

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING
(Applicable for CSE, CE, ECE, EEE, IT, ME)

S.No	Course Code	Name of the Course	L	T	P	S	Credits
1	20EIM4701	**Principles of Measurements and Instrumentation**	4	0	0	IV	4
2	20EIM5702	**Process Instrumentation**	4	0	0	V	4
3	20EIM6703	**Programmable Logic Controllers**	4	0	0	VI	4
4	20EIM7704	**Embedded Systems for Automation**	4	0	0	VII	4
	20EIM5711	**SELF LEARNING**					2
	20EIM7712	**SELF LEARNING**					2

Two MOOCS/NPTEL Courses for 04 credits (02 courses @ 2 credits each) are mandatory

DEPARTMENT OF INFORMATION TECHNOLOGY
(Applicable for CE, ECE, EEE, EIE, ME)

S.No	Course code	Course Name	Offered in Semester	L	T	P	Credits
1	20ITM4701	Data Science With R Software	IV	3	0	2	4
2	20ITM5702	Data Warehousing and mining	V	3	0	2	4
3	20ITM6703	Big Data	VI	3	0	2	4
4	20ITM7704	Data Visualization	VII	3	1	0	4
		(MOOCs - Self Learning)					
5	20ITM5711	Data Science for Engineers	V	-	-	-	2
6	20ITM7712	Data Analytics using Python	VII	-	-	-	2

DEPARTMENT OF MECHANICAL ENGINEERING
(Applicable for CSE, CE, ECE, EEE, EIE, IT)

S.No	Course Code	Title of the Course	L	T	P	Credits
		Fourth Semester				
1.	20 MEM4701	Manufacturing Technology	4	0	0	4
		Fifth Semester				
2.	20 MEM5702	Energy Systems Engineering	4	0	0	4
	20 MEM5711	Self Learning Course	0	0	0	2
		Sixth Semester				
4.	20 MEM6703A	Robotics	4	0	0	4
5.	20 MEM6703B	Engineering Materials	4	0	0	4
		Seventh Semester				
7.	20 MEM7704A	Additive Manufacturing	4	0	0	4
8.	20 MEM7704B	Electric and Hybrid Vehicles	4	0	0	4
	20 MEM7712	Self Learning Course	0	0	0	2