ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

ACCREDITED BY NAAC WITH 'A' Grade

PROGRAMME SCHEME & SYLLABI 2021 – 2022

B.Tech - Computer Science & Engineering (Data Science)

- **About the department**

  B.Tech - Computer Science & Engineering (Data Science) is introduced in 2021 to provide exposure & expertise about the paradigm of Data Science which essentially became the integral part of all industries & organizations

  Data Science is a specialized Multidisciplinary confluence of Computer Science, Applied Mathematics, Computational Statistics, Management and Analytics.

  The Data Science Engineers contribute to the organization in a pivotal role of Data Scientists and Data Analysts helping the companies to address complex problems and make objective decisions with strong sense of business Some of the roles of data science engineer in the sector are Data Scientist, Statistician, Data Analysts, Business Analysts, Data Engineer, Machine Learning Engineer, Quantitative Analyst, Data Warehouse Architect, Business Intelligence Analyst, Systems Analyst, Marketing Analyst, Operations Analyst.

  The objective of the program will be to provide focus on core Data Science subjects including Analytics, Visualization, Modelling, Knowledge representation, IoT, Machine Learning & Decision making with strong emphasis on having hand-on experience with the help of practicals, real world case studies and industry exposure in Data Science Area

- **Vision**

  To develop data Science engineers to administer the data centric world for strengthening the modern society with analytical practices and research.

- **Mission**

  To upraise skilled data science professionals by imparting domain specific knowledge to contribute towards analytical data computing area with strong professional ethics and wide industry exposure.

- **Program education objectives**

  - **PEO 1 -** To develop the graduates as professionals by providing exposure to real-life problems using analytical and experiential skills acquired in the field of Data Science
  - **PEO 2 –** To prepare the graduates with a varied range of expertise in different aspects of data science such as data collection, visualization, processing and modeling of large data sets.
  - **PEO 3** – To foster the graduates to cater the growing demand of data scientists and engineers in multidisciplinary industrial, entrepreneurial and research environment

- **Program outcomes**
  - **PO1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
  - **PO2: Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
  - **PO3:** Design/Development of 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:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
  - **PO5: Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
  - **PO6: The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
  - **PO7: Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
  - **PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
  - **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:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
  - **PO11: Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
  - **PO12: Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

- **Program specific outcomes**
  - **PSO 1 -**Gain in-depth knowledge of the key technologies in data science such as Data Handling, Big data, data mining, machine learning, data modelling, and statistics.
  - **PSO 2 -**Model and provide solutions to the real life problems and decision making in the field of data science with expertise in programming, databases, IoT , Business Intelligence and mathematics

ANNEXURE – I

ST VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY

COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Credit Structure for Undergraduate programs

Sr. No	Category	Credits	AICTE Norms
1	Humanities, Social Sciences & Management courses	12	15
2	Basic Science courses	23	25
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	18	24
4	Professional core courses	60	48
5	Professional Elective courses relevant to chosen specialization/branch	18	18
6	Open subjects – Electives from other technical and /or emerging subjects	12/18	18
7	Project work, seminar and internship in industry or elsewhere	18/12	15
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]	0	0
9	Comprehensive Courses [Industry Training and Skill Development, Capstone Course]	4	0
	TOTAL	165	

ANNEXURE – I

Teaching Scheme for First Year (Semester I and II)
Bachelor of Technology

GROUP 1: SEMESTER I / GROUP 2: SEMESTER II

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	AS101T	Engineering Physics & Material Sciences	4	1	-	5	30	70	100
2	AS101P	Engineering Physics & Material Sciences Lab	-	-	2	1	25	25	50
3	AS102T	Applied Mathematics – I	3	-	-	3	30	70	100
4	AS103T	Engineering Practices-I (Electrical & Electronics)	4		-	4	30	70	100
5	AS103P	Engineering Practices-I Lab(Electrical & Electronics)	-	-	2	1	25	25	50
6	AS104T	Logic building with C	3	-		3	15	35	50
7	AS104P	Logic building with C Lab			2	1	25	25	50
8	AS105T	Communication Skills	2	-	-	2	15	35	50
9	AS106P	Communication Skills Lab			2	1	25	25	50
10	AS107P	Sports & Yoga			2	0			
Total			**17**	**1**	**10**	**21**	**220**	**380**	**600**

Induction Program - 3 weeks

Teaching Scheme for First Year (Semester I and II)
Bachelor of Technology
GROUP 1: SEMESTER II / GROUP 2: SEMESTER I

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	AS201T	Engineering Chemistry & Environmental Science	4	1	-	5	30	70	100
2	AS201P	Engineering Chemistry & Environmental Science Lab	-	-	2	1	25	25	50
3	AS202T	Applied Mathematics – II	3	1	-	4	30	70	100
4	AS203T	Engineering Practices-I (Mechanical & Civil)	4		-	4	30	70	100
5	AS203P	Engineering Practices-I Lab(Mechanical & Civil)	-	-	2	1	25	25	50
6	AS204T	Problem Solving with Python	3	-	-	3	30	70	100
7	AS204T	Problem Solving with Python Lab	-	-	2	1	25	25	50
8	AS205T	Essence of Indian Knowledge Tradition	2			0			
9	AS206P	Sports & Yoga			2	0			
10	AS207P	Tinkering & Model Lab			1	0			
Total			**17**	**1**	**11**	**19**	**220**	**380**	**600**

*** Induction Program – 3 weeks**

Scheme of Examination of Bachelor of Technology (CSE(DS))

Semester Pattern

III Semester B. Tech. (Computer Science & Engineering (Data Science))

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	AS301T	Applied Mathematics – III	3	1	-	4	30	70	100
2	DS301T	Data Structure	3	1	-	4	30	70	100
3	DS301P	Data Structure Lab	-	-	4	2	25	25	50
4	DS302T	Digital Circuits and Fundamentals of Microprocessor	3	-	-	3	30	70	100
5	DS302P	Digital Circuits and Fundamentals of Microprocessor Lab	-	-	2	1	25	25	50
6	DS303T	Computer Networks	3	-	-	3	30	70	100
7	DS304T	Introduction to Data Science	3	-	-	3	30	70	100
	DS305P	Computer Lab -I	-	-	2	1	25	25	50
8	H 102	Universal Human Values - 2	3			3	25	25	50
9	DS305P	Sports, Yoga, & Career Development *			2	0			
Total			**18**	**2**	**10**	**24**	**250**	**425**	**700**

***** Career Development (Interpersonal Skills, Aptitude, and Logical Thinking)

Scheme of Examination of Bachelor of Technology (CSE(DS))

Semester Pattern

IV Semester B. Tech. (Computer Science & Engineering (Data Science))

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	DS401T	Mathematics for Data Science	3	1	-	4	30	70	100
2	DS402T	Object Oriented Programming	3	1	-	4	30	70	100
3	DS402P	Object Oriented Programming Lab	-	-	2	1	25	25	50
4	DS403T	Database Management System	3	-	-	3	30	70	100
5	DS403P	Database Management System Lab	-	-	4	2	25	25	50
6	DS404T	Computer Architecture and Organization	3	-	-	3	30	70	100
7	DS405P	Data Handling & Visualization Lab	-	-	2	1	25	25	50
8	DS406P	IoT & Data Acquisition Lab			2	1	25	25	50
9	AS401T	Constitution of India	2			0	25	25	50
10	DS407P	Technical Skill Development			2	1		50	50
11	DS408P	Career Development *	2			0			
Total			**16**	**2**	**12**	**20**	**245**	**455**	**700**

***** Career Development (Interpersonal Skills, Aptitude, and Logical Thinking)

Scheme of Examination of Bachelor of Technology (CSE(DS))

Semester Pattern

V Semester B. Tech. (Computer Science & Engineering (Data Science))

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	DS501T	Theory of Computation	3	-	-	3	30	70	100
2	DS502T	Software Engineering and Project Management	2		-	2	30	70	100
3	DS503T	Data Warehousing and Mining	2	1		3	30	70	100
4	DS504T	Elective-I	3		-	3	30	70	100
5	DS505P	Computer Lab-II	-	-	2	1	25	25	50
6	DS506T	Open Elective - I	3	-		3	30	70	100
7	DS506P	Open Elective - I Lab	-	-	2	1	25	25	50
8	AS501T	Economics and Management	4			4	15	35	50
9	AS502T	English for Engineers	2			2	25	25	50
10	DS507P	Technical Skill Development			2	1		50	50
11	DS508P	Career Development *			4	0			
Total			**19**	**1**	**10**	**23**	**240**	**510**	**750**

***** Career Development (Interpersonal Skills and Aptitude)

DS506T	**Open Elective - I**		DS504T	**Elective - I**
DS506T(i)	Business Intelligence		DS504T(i)	Distributed Database & Object Oriented databases
			DS504T(ii)	Digital Image Processing
DS504P	**Open Elective – I Lab**			
DS506P(i)	Business Intelligence Lab			

Scheme of Examination of Bachelor of Technology (CSE(DS))

Semester Pattern

VI Semester B. Tech. (Computer Science & Engineering (Data Science))

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assesment	End Sem Examination	Total
1	DS601T	Operating System	3	-	-	3	30	70	100
2	DS602T	Design and Analysis of Algorithms	3	-	-	3	30	70	100
3	DS602P	Design and Analysis of Algorithms Lab	-	-	2	1	25	25	50
	DS603T	Data Center Management and Cloud Computing	3	-	-	3	30	70	100
4	DS604T	Elective-II	3	-	-	3	30	70	100
5	DS605P	Computer Lab III	-	-	2	1	25	25	50
6	DS606T	Open Elective-II	3	1		4	30	70	100
7	H 103/4	Foundational Humanities Elective	2			0			
8	DS607P	Project - I			2	2	50	50	100
9	DS608P	Career Development*			4	0			
10	DS609P	Capstone Course – I **			2	1	25	25	50
Total			**17**	**1**	**12**	**21**	**275**	**475**	**750**

* Career Development (Interpersonal Skills and Aptitude)

** Capstone Course – I (Comprehensive knowledge gained in *Computer Science & Engineering (Data Science))*

DS605T	Open Elective - II		Foundational Humanities Elective
DS605T(i)	Cyber Laws and Ethics	H-103	Development of Societies
DS605T(ii)	Computer System Security	H 104	Philosophy

DS603T	Elective - II
DS603T(i)	Soft Computing
DS603T(ii)	Computer Vision

Scheme of Examination of Bachelor of Technology (CSE(DS))

Semester Pattern

VII Semester B. Tech. (Computer Science & Engineering (Data Science))

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	DS701T	Big Data Analytics & Machine Learning	3	1	-	4	30	70	100
2	DS701P	Big Data Analytics & Machine Learning Lab	-	-	2	1	25	25	50
3	DS702T	Data Modeling and Optimization	3	1	-	4	30	70	100
4	DS702P	Data Modeling and Optimization Lab	-	-	2	1	25	25	50
5	DS703T	Elective-III	4		-	4	30	70	100
6	DS704T	Open Elective - III	4			4	30	70	100
7	DS705P	Project - II			4	4	100	100	200
8	DS706P	Summer / Winter Internship *				2		50	50
9	DS707P	Capstone Course – II **			2	1	25	25	50
Total			**14**	**2**	**10**	**25**	**295**	**505**	**800**

* Summer / Winter Internship (Evaluation of Four weeks Internship Completion till 6th Semester)
** Capstone Course – II (Comprehensive knowledge gained in *branch name)*

DS704T	**Open Elective - III**		DS701T	**Elective - III**
DS704T(i)	Android App Development		DS701T(i)	Artificial Intelligence
			DS701T(ii)	Compiler Construction
			DS701T(iii)	Mathematical Modelling for Data Science

Scheme of Examination of Bachelor of Technology (CSE(DS))
Semester Pattern

VIII Semester B. Tech. (Computer Science & Engineering (Data Science))

Option A

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	DS801P	Project based on one semester internship in Industry/Research Institute/ National Laboratories/ Incubation Center				12			
Total			**0**	**0**	**0**	**12**	**200**	**200**	**400**

End Sem Examination consists of evaluation of Seminar and Project report

Option B

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	DS802T	Open Elective -IV	3			3	30	70	100
2	DS803T	Open Elective – V	3			3	30	70	100
3	DS804P	Project based on Research/ Industry/ Entrepreneurship			12	6	100	100	200
Total			**6**	**0**	**12**	**12**	**160**	**240**	**400**

***Open electives can be MOOCs or Courses offered by department in Online/Offline mode**

DS704T	**Open Elective - V**
DS803T(i)	Introduction to Industry4.0 and Industrial IoT

DS704T	**Open Elective - IV**
DS802T(i)	Social Network Data Analytics

Scheme of Examination of Bachelor of Technology (CSE(DS))-Honors

Semester Pattern

SN	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continuous Assessment	End Sem Examination	Total
1	DSH401T	File Processing & Data Handling	4			4	30	70	100
2	DSH501T	Data Science and Visualization	3			3	30	70	100
3	DSH501P	Data Science and Visualization Lab			2	1	25	25	50
4	DSH601T	Statistics and Machine Learning	4			4	30	70	100
5	DSH701T	Machine Learning and Data Science	3			3	30	70	100
6	DSH701P	Machine Learning and Data Science Lab			2	1	25	25	50
7	DSH801T	Artificial Intelligence for Big Data Analytics	4			4	30	70	100
Total			**15**		**04**	**20**	**170**	**380**	**550**

Scheme of Examination of Bachelor of Technology (CSE(DS)) - Minors

Semester Pattern

SN	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continuous Assessment	End Sem Examination	Total
1	DSM401T	Data Structure and algorithms	4			4	30	70	100
2	DSM501T	Database Management System	4			4	30	70	100
3	DSM601T	Data Science Principles and Techniques	4			4	30	70	100
4	DSM701T	Data Mining & Machine Learning	4			4	30	70	100
5	DSM801T	Fundamentals of Big Data analytics & Business Intelligence	4			4	30	70	100
		Total	**20**			**20**	**150**	**350**	**500**

Scheme of Examination of Bachelor of Technology (CSE(DS))

Semester Pattern

List of Open Electives

S.N.	Semester	Course Code	Course Name
1	**5**	DS504T(i)	Business Intelligence
2	**5**	DS504P(i)	Business Intelligence Lab
3	**6**	DS604T(i)	Cyber Laws and Ethics
4	**6**	DS604T(ii)	Computer System Security
5	**7**	DS704T(i)	Android App Development
6	**8**	DS802T(i)	Social Network Data Analytics
7	**8**	DS803T(i)	Introduction to Industry4.0 and Industrial IoT