



Bharatiya Vidya Bhavan's

# Sardar Patel Institute of Technology

(Autonomous Institute Affiliated to University of Mumbai)

[Knowledge is Nectar]

## Liberal, Pi-Model of Engineering Education @ SPIT (Department of Computer Science and Engineering)

### CURRICULUM STRUCTURE FOR UNDERGRADUATE ACADEMIC PROGRAMS IN COMPUTER SCIENCE AND ENGINEERING AT SPIT W.E.F. A.Y. 2023-24 [2023-2027 BATCH]

*A common scheme for “Computer Science and Engineering” and “Computer Engineering” till Semester V.*

**Preamble:** Government of Maharashtra has directed Autonomous Colleges to revise their curriculum and step into the implementation of National Education Policy (NEP) 2020. We commit ourselves to the effective and fruitful implementation of NEP 2020 in its spirit. The holistic development of learners has always been the priority and center of focus for “Bharatiya Vidya Bhavan”. S.P.I.T. started implementing the philosophy of NEP in the year 2019 itself. We have in fact graduated the first batch of our holistic curriculum in 2023. Now based on our learnings from the implementation and recent recommendations of the Government, we are pleased to offer a 2nd iteration of our holistic curriculum for 2023-27, a Liberal Pi Model of Engineering Education.

This curriculum aims at the development of an **all-rounded** personality. It follows a **holistic** approach to education, ensures strong science, and mathematics foundation and program core, develops expertise in domain vertical through the sequel of electives, ensures significant exposure to additional discipline through a “Multidisciplinary Minor” courses, imparts state of the art practical knowledge through a semester-long industry / research internship, collaborates outside world for the imparting relevant skill courses, challenges good learners through “Honors” evaluation, and systematically develops soft skills, and social, physical, mental, spiritual personality through carefully articulated **Liberal Learning** and **Humanities** sequels. Thus, it offers a unique, liberal “**Pi-Model**” of Engineering Education.

**Table 1: Nomenclature of the courses in the curriculum**

Groups	Abbreviation	Course Category
Basic Sciences and Engineering Sciences Courses (BSES)	BSESC	Basic Science & Engineering Science Courses
	BSESEC	Basic Science & Engineering Science Elective Courses
Skill Based Courses (SBC)	SEC	Skill Enhancement Course
	CC	Co-curricular Courses
Humanities, Social Science and Management (HSSM) Courses	HSSMC	Humanities, Social Science and Management Courses
	CP	Community Project
Ability Enhancement Courses (AEC)	IKS	Indian Knowledge System
	UHV	Universal Human Values
Program Related Courses (PRC)	PCC	Program Core Courses
	PEC	Program Elective Courses
	ELC	Experiential Learning Courses
Multi-Cross-Trans disciplinary courses (MCTD)	OEC	Open Elective Courses
	MDM	Multidisciplinary Minor

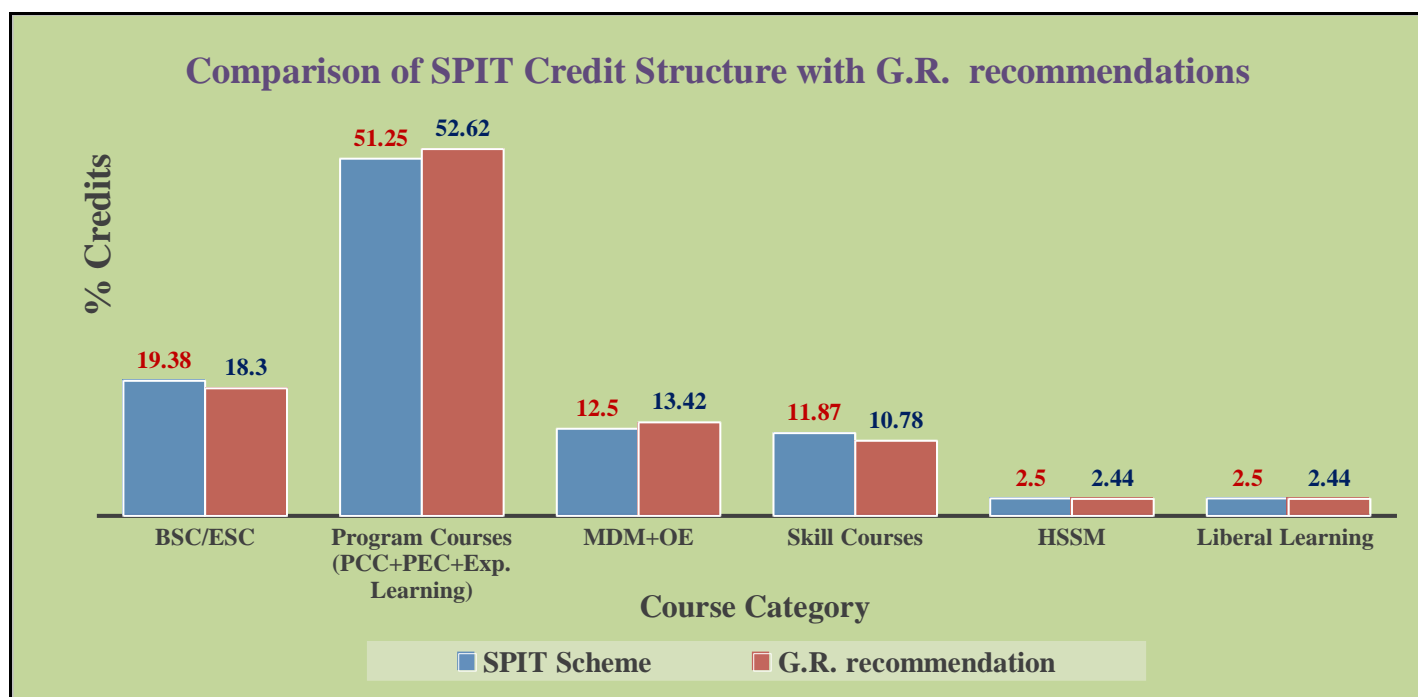
**Indicative List of BSESE Courses:**

- Engineering Physics
- Engineering Chemistry
- Biology for Engineers
- Engineering Mechanics
- Engineering Graphics
- Material Science
- Environmental Science
- Thermal & Fluid Engineering

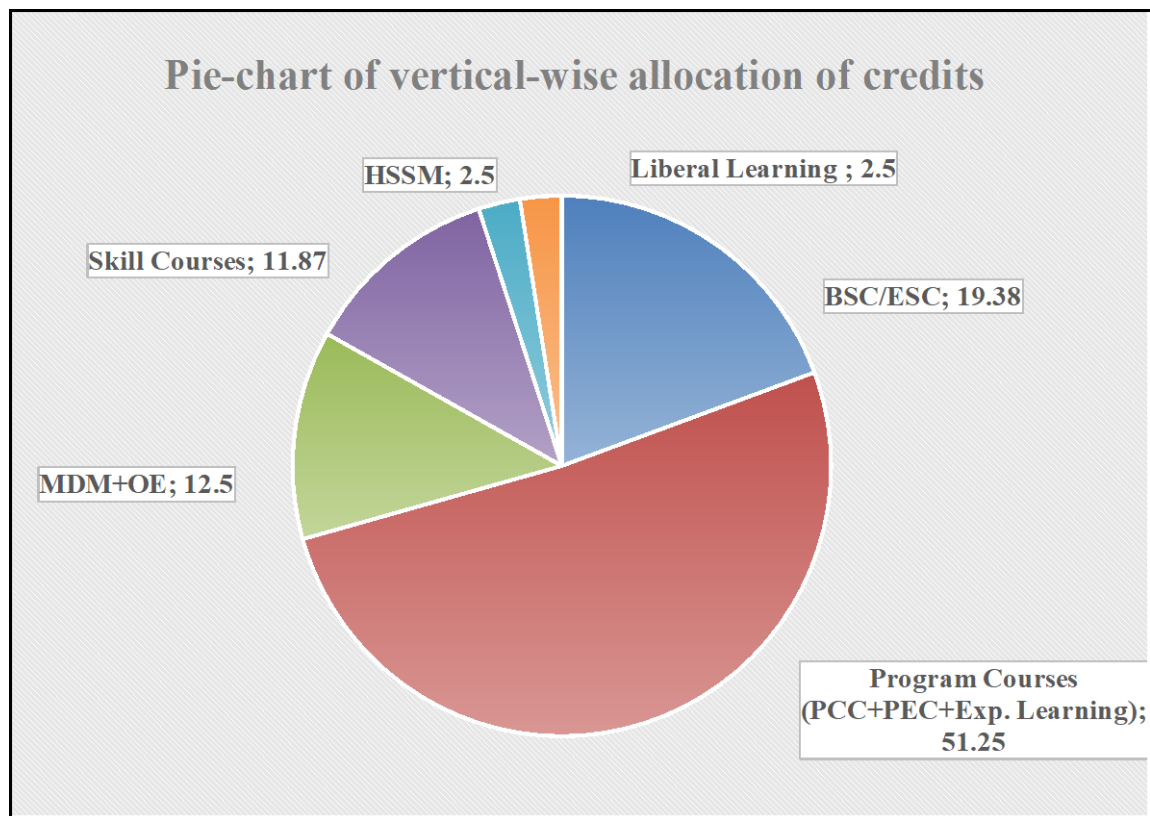
**Table 2: Comparison of S.P.I.T. credit structure with the G.R. recommendations**

SPIT											
Sem	BSES	SE C	AE C	HSSM	CC (LLC )	PCC	PEC	OE	EXP LEARNIN G	MD M	Total
I	11	5	2		1						19
II	11	5	2		1				2		21
III	6	2		2	1	12					23
IV	3	2		2	1	12				3	23
V						17			2	4	23
VI		2				7	6		2	3	20
VII							6	3	4	4	17
VIII								3	11		14
Total	31	16	4	4	4	48	12	6	21	14	160
%	19.38	10	2.5	2.5	2.5	30	7.5	3.75	13.125	8.75	100
G.R. (NEP-2020) Recommended											
Total	30	10	8	4	4	44	20	8	22	14	164
%	18.3	6.1	4.88	2.44	2.44	27	12.2	4.88	13.42	8.54	100

*Figure 1: Comparison of S.P.I.T. credit structure with the G.R. recommendations*



*Figure 2: Pie-chart of vertical-wise allocation of credits*



**Table 3: Semester-wise allocation of credits to different verticals**

<b>SEM I</b>										
<b>Sr. No</b>	<b>Course Category</b>	<b>Abbreviation</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>O</b>	<b>E</b>	<b>C</b>
1	Basic & Engg. Sciences	BSES	MA101	Mathematics I (ECL)	3	1	0	8	12	4
2	Skill Enhancement Course	SEC	CE101	Problem Solving using Imperative Programming Lab	0	1	2+2	4	9	3
3	Basic & Engg. Sciences Elective	BSESE		<b>Course I</b>						3
			AS101	Engineering Physics	2	0	2	4	8	
			AS102	Engineering Chemistry	2	0	2	3	7	
			AS103	Biology for Engineers	3	0	0	3	6	
			AS104	Engineering Mechanics	2	0	2	4	8	
			AS105	Engineering Graphics	1	0	2+2	2	7	
			AS108	Material Science	2	0	2	4	8	
			AS109	Environmental Science	3	0	0	3	6	
			AS110	Energy Science	2	0	2	3	7	
			AS111	Thermal & Fluid Engineering	3	0	0	3	6	
4	Skill Enhancement course	SEC	AS106	Tech Shop	1	0	2	2	5	2
			AS107	Soft Skill I						
5	Basic & Engg. Sciences	BSES	EC102	Basic Electrical Engineering	3	0	2	5	10	4
			EC101	Digital Systems	3	0	2	6	11	
6	Ability Enhancement -*Course	AEC	AS108	IKS	2	0	0	1	3	2
			AS109	UHV						
7	Cocurricular Courses	CC (LLC)	LLCXX	LLC--I	1	0	0	2	3	1
	<b>Total</b>				<b>12</b>	<b>2</b>	<b>10</b>	<b>25</b>	<b>49</b>	<b>19</b>

SEM-II										
Sr. No	Course Category	Abbreviation	Course Code	Course Name	L	T	P	O	E	C
1	Basic & Engg. Sciences	BSES	MA102	Mathematics II (DECA)	3	1	0	8	12	4
2	Skill Enhancement Course	SEC	CE102	Problem Solving using Object Oriented Programming Lab	0	1	2+2	4	9	3
3	Basic & Engg. Sciences Elective	BSESE		<b>Course I</b>						3
			AS101	Engineering Physics	2	0	2	4	8	
			AS102	Engineering Chemistry	2	0	2	3	7	
			AS103	Biology for Engineers	3	0	0	3	7	
			AS104	Engineering Mechanics	2	0	2	4	8	
			AS105	Engineering Graphics	1	0	2+2	2	7	
			AS108	Material Science	2	0	2	4	8	
			AS109	Environmental Science	3	0	0	3	6	
			AS110	Energy Science	2	0	2	3	7	
			AS111	Thermal & Fluid Engineering	3	0	0	3	6	
4	Skill Enhancement course	SEC	AS106	Tech Shop	1	0	2	2	5	2
			AS107	Soft Skill I						
5	Basic & Engg. Sciences	BSES	EC102	Basic Electrical Engineering	3	0	2	6	11	4
			EC101	Digital Systems	3	0	2	5	10	
6	Ability Enhancement -*Course	AEC	AS108	IKS	2	0	0	1	3	2
			AS109	UHV						
7	Cocurricular Courses	CC (LLC)	LLCXX	LLC--I	1	0	0	2	3	1
	<b>Total</b>				<b>12</b>	<b>2</b>	<b>10</b>	<b>25</b>	<b>49</b>	<b>19</b>

Summer Term										
Sr. No	Course Category	Abbreviation	Course Code	Course Name	L	T	P	O	E	C
1	Experiential Learning	CP (in Summer)	PR101	Community Project	0	0	4	4	8	2
2	HSSE	COI	AS112	Constitution of India (2Hrs/Week)	1	0	0	1	2	NC

SEM III										
Sr. No	Course Category	Abbreviation	Course Code	Course Name	L	T	P	O	E	C
1	Basic & Engg. Sciences	BSES	CS201	Discrete Structures and Graph Theory	3	0	0	5	8	3
2	Basic & Engg. Sciences *	FOM-I	MA202	Foundation of Mathematics-I*	2	1	0	0	3	3
3	Skill Enhancement Course	SEC	AS201	Soft Skill II-Professional Communication Skills	0	1	2	4	7	2
4	Basic & Engg. Sciences Elective	BSESE		<b>Course I</b>						3
			AS101	Engineering Physics	2	0	2	4	8	
			AS102	Engineering Chemistry	2	0	2	3	7	
			AS103	Biology for Engineers	3	0	0	3	7	
			AS104	Engineering Mechanics	2	0	2	4	8	
			AS105	Engineering Graphics	1	0	2+2	2	7	
			AS108	Material Science	2	0	2	4	8	
			AS109	Environmental Science	3	0	0	3	6	
			AS110	Energy Science	2	0	2	3	7	
			AS111	Thermal & Fluid Engineering	3	0	0	3	6	
5	Humanities	HSSM-I	HS2XX	<b>Course I</b>	2	0	0	3	5	2
7	Program Core Courses (12 Credits)	PCC	CS202	Data Structures	3	0	2	4	9	4
8		PCC	CS203	Computer Organization and Architecture	3	0	2	4	9	4
9		PCC	CS204	Database Management Systems	3	0	2	4	9	4
10	Cocurricular Courses	CC (LLC)	LLCXX	LLC--III	1	0	0	1	2	1
			<b>Total</b>		<b>17</b>	<b>1</b>	<b>10</b>	<b>28</b>	<b>56</b>	<b>23</b>

SEM IV										
Sr. No	Course Category	Abbreviation	Course Code	Course Name	L	T	P	O	E	C
1	Basic & Engg. Sciences	BSES	CS205	Statistical Methods in Computer Science	3	0	0	6	9	3
2	Basic & Engg. Sciences *	FOM-II	MA204	Foundation of Mathematics-II*	2	1	0	0	3	3
3	Skill enhancement course	SEC	AS202	Python Programming for Data science	0	1	2	4	7	2
4	Humanities	HSSM-II	HS2XX	Course II	2	0	0	3	5	2
5	Program Core Courses (12 credits)	PCC	CS206	Operating Systems	3	0	2	4	9	4
6		PCC	CS207	Design and Analysis of Algorithms	3	0	2	4	9	4
7		PCC	CS208	Computer Communications and Networks	3	0	2	4	9	4
8	Cocurricular Courses	CC (LLC)	LLCXX	LLC--IV	1	0	0	1	2	1
9	Multidisciplinary Minor	MDM	MDEC1X	MDM-I	To be defined by others					3
				<b>Total</b>	<b>15</b>	<b>1</b>	<b>8</b>	<b>26</b>	<b>50</b>	<b>23</b>

\*Only for Lateral Entry Students

Summer term (For Lateral Entry Students)										
Sr. No	Course Category	Abbreviation	Course Code	Course Name	L	T	P	O	E	C
1	Basic & Engg. Sciences	BSES	CS201	Discrete Structures and Graph Theory	3	0	0	5	8	3
2			CS205	Statistical methods in Computer Science	3	0	0	6	9	3

- Students are expected to start working for the Mini Project I during the summer.
- Research internship of minimum 2 months for the “Honors by Research” for 6 credits- HR21 (Not for DSY)
- For Enrollment to Honors by research, Minimum CGPA must be 8.25

SEM V										
Sr. No	Course Category	Abbreviation	Course Code	Course Name	L	T	P	O	E	C
1	Experiential Learning	ELC	PR1	Mini Project I	0	0	4	4	8	2
2	Program Core Courses (19 Credits)	PCC	CS301	Distributed Computing	3	0	2	6	10	4
3		PCC	CS302	Software Engineering	3	0	2	6	10	4
4		PCC	CS303	Artificial Intelligence and Soft Computing	3	0	2	6	11	4
5		PCC	CS304	Theory of Computation	3	0	0	5	8	3
6		PCC	CS305	Cryptography and Network Security	3	0	2	5	10	4
7	Multidisciplinary Minor	MDM	MDEC2X	MDM-II	To be defined by others					4
		Total			13	0	12	32	57	25

- Research internship of a minimum 1 month for the “Honors by Research” for 3 credits HR31 (Not for DSY)
- For Enrollment to Honors by research, Minimum CGPA must be 8.25

SEM VI										
Sr. No	Course Category	Abbreviation	Course Code	Course Name	L	T	P	O	E	C
1	Program Core Courses (7 credits)	PCC	CS306	Human Machine Interaction	3	0	2	4	9	4
2		PCC	CS307	Machine Learning	2	0	2	5	9	3
3	Multidisciplinary Minor	MDM	MDEC3X	MDM-III	To be defined by others					3
4	Experiential Learning	ELC	PR3-I	Main Project Stage I	0	0	2	4	6	1
5	Program Elective Courses	PEC	CS3X1	PE-I	2	0	1	4	7	3
6	Program Elective Courses	PEC	CS3X2	PE-II	2	0	1	4	7	3
7	Skill Enhancement Course	SEC	CS308	DevOps Lab	0	1	2	2	5	2
		Total			9	1	10	23	43	19

- Research internship of minimum 2 month for the “Honors by Research” for 6 credits HR32 (Not for DSY)
- For Enrollment to Honors by research, Minimum CGPA must be 8.25



SEM VII									
Course Category	Abbreviation	Course Code	Course Name	L	T	P	O	E	C
Multidisciplinary Minor	MDM	MDEC4X	MDM-IV	To be defined others					4
Program Elective Courses	PEC	CS4X3	PE-III	2	0	1	4	7	3
Program Elective Courses	PEC	CS4X4	PE-IV	2	0	1	4	7	3
Open Elective	OE	OE1	OE-I	2	0	1	4	7	3
Experiential Learning	ELC	PR3-II	Main Project Stage II	0	0	6	4	10	3
Total				6	0	9	16	31	16

- Research internship of minimum 1 month for the “Honors by Research” for 3 credits HR41 (Not for DSY)
- For Enrollment to Honors by research, Minimum CGPA must be 8.25

SEM VIII										
Sr. No	Course Category	Abbr eviati on	Cours e Code	Course Name	L	T	P	O	E	C
1	Open Elective	OE	OE2	OE-II**	2	0	1	4	7	3
2	Experiential Learning	ELC	INTR	Research/ Industry Internship/Major Project Stage III***	0	0	24	12	36	11
			INTI							
			PR4							
		Total			2	0	25	16	43	14

\*\* To be completed from MOOCs

\*\*\*Students neither taking research or industry internship nor willing to extend their project work can earn additional 11 credits from Swayam Platform or NPTEL or registering courses from any peer institution of higher learning., besides open elective program elective courses offered by the institute.

**Indicative List of Humanities courses (HSSM-I):**

<b>Course Code</b>	<b>Course Title</b>	<b>Course Code</b>	<b>Course Title</b>
HS211	Law for Engineers-I	HS212	Law for Engineers-II
HS221	Psychology -I	HS222	Psychology -II
HS231	Finance for Engineers-I	HS232	Finance for Engineers-II
HS241	Economics-I	HS242	Economics-II
HS251	French-I	HS252	French-II
HS261	German-I	HS262	German-II
HS271	Japanese-I	HS272	Japanese-II
HSNP	NPTEL (HSS/Management)	HSNP	NPTEL (HSS/Management)

**Indicative List of Cocurricular courses (LLC)**

<b>Course Code</b>	<b>Course Title</b>
LLC01	Dance (Kathak)
LLC02	Dance (Bharatnatyam)
LLC02	Fundamentals of Photography
LLC03	Art of Short Film Making / Cinematography
LLC04	Film Appreciation
LLC05	Basics of Music Composition
LLC06	Basics of Keyboard playing
LLC07	Physical Fitness
LLC08	Self Defense for Women
LLC09	Pran-Vidya (Combo of Yoga and Pranayam)
LLC10	Jeevan Vidya (Work Life Balance)
LLC11	Integrated Personality Development-I
LLC12	Indian Knowledge System-I
LLC13	Design Thinking
LLC14	Innovation and Creativity
LLC15	Principle Centered Leadership
LLC16	Social Psychology
LLC17	Mentoring of School Children at SPIT (Abhudaya)
LLC18	Basics of Fire Safety
LLC19	Study of one of the Identified Books
LLC20	Teaching Assistantship
LLC21	Trekking
LLC22	Kannada Language
LLC23	Telugu Language
LLC24	Tamil Language
LLCXX	Any other Course approved by Dean Academics and Research

## PROGRAM ELECTIVE COURSES.

Track	PE-I CS3X1	PE-II CS3X2	PE-III CS4X3	PE-IV CS4X4
<b>Emerging Networking Technologies</b>	CS311: Digital Forensic	CS312: Cloud Computing	CS413: Block chain Technology	CS414: IT Infrastructure Monitoring and Management
<b>Emerging AI</b>	CS321: Natural Language Processing	CS322: Deep Learning	CS423: Generative AI	CS424: Explainable AI
<b>Data Analytics</b>	CS331: Business analytics with Python	CS332: Big data Analytics	CS433: Data Warehouse and Mining	CS434: AI for Healthcare Analytics
<b>Digital Visualization</b>	CS341: Fundamentals of Signal & Image Processing	CS332: Augmented Reality & Virtual Reality [AR-VR]	CS433: Computer Vision	CS434: Visual Intelligence

## LIST OF MULTIDISCIPLINARY MINORS [MDM]

### MDM SEQUELS FOR ELECTRONICS & TELECOMMUNICATIONS ENGG. [EXTC]

- Computer Engineering
- AIML
- Data Science
- Interface and Experience Design

Course Category of Multidisciplinary Minor	MDM-I (Semester IV)	MDM-II (Semester V)	MDM-III (Semester VI)	MDM-IV (Semester VII)
<b>Computer Engineering</b>	<b>MDCE11:</b> Database Management Systems	<b>MDCE12:</b> Data Structures and Algorithms	<b>MDCE13:</b> Cloud Computing	<b>MDCE14:</b> Internet and Web Technology
<b>Artificial Intelligence and Machine Learning</b>	<b>MDCS21:</b> Fundamentals of NNFL	<b>MDCS22:</b> Machine Learning	<b>MDCS23:</b> Deep Learning	<b>MDCS24:</b> Capstone Project on Image Processing and Deep Learning
<b>Data Science</b>	<b>MDCS31:</b> Fundamentals of Data Science	<b>MDCS32:</b> Data Analytics and Visualization	<b>MDCS33:</b> Decision Making and Business Intelligence	<b>MDCS34:</b> Social Media Analytics
<b>Interface and Experience Design</b>	<b>MDCS41:</b> Fundamentals of Interface and Visual Design	<b>MDCS42:</b> Fundamentals of Experience Design	<b>MDCS43:</b> Human Machine Interaction	<b>MDCS44:</b> Prototyping and Interaction Design[Capstone Project]

## MDM SEQUELS FOR CE/CSE

- Industrial IoT
- Digital Signal Processing
- Electronics Communication
- VLSI

Course Category of Multidisciplinary Minor	MDM-I (Semester IV)	MDM-II (Semester V)	MDM-III (Semester VI)	MDM-IV (Semester VII)
<b>Industrial IoT</b>	<b>MDEC11:</b> Fundamental of Internet of Things	<b>MDEC12:</b> Embedded “C” and Micro Python for IoT	<b>MDEC13:</b> IOT Communication and Network Layer Protocols	<b>MDEC14:</b> IoT Applications and Security
<b>Digital Signal Processing</b>	<b>MDEC21:</b> Digital Signal Processing	<b>MDEC22:</b> Digital Image Processing	<b>MDEC23:</b> Multimedia Signal Processing	<b>MDEC24:</b> Digital Signal Processor System Design
<b>Electronics Communication</b>	<b>MDEC31:</b> Linear Electronics Circuit	<b>MDEC32:</b> Principles of Communication & Systems	<b>MDEC33:</b> Data Compression and Encryption	<b>MDEC34:</b> Wireless Communication and Networks
<b>VLSI</b>	<b>MDEC41:</b> Hardware Description Language programming	<b>MDEC42:</b> Digital CMOS VLSI Design	<b>MDEC43:</b> VLSI Physical Design	<b>MDEC44:</b> ASIC Verification

## MDM COURSE OFFERED BY INDUSTRY

Course Category of Multidisciplinary Minor	MDM-I (Semester IV)	MDM-II (Semester V)	MDM-III (Semester VI)	MDM-IV (Semester VII)
<b>Barclays Minor in Banking Technology</b>	<b>MD—</b> BFSI , Data Management & Analytics	<b>MD—:</b> Enterprise Risk Management & Applied cyber security	<b>MD—:</b> Agile Methodology	<b>MD—:</b> Academic-Industry collab Project
<b>SPJIMR Management</b>	<b>MD—</b> Finance & Cost Management	<b>MD—</b> Supply Chain Management	<b>MD—</b> IT for Business	<b>MD—</b> Marketing Management
<b>Six Ladders- Entrepreneurship &amp; Innovation</b>	<b>MD—</b> Entrepreneurship And Innovation	<b>MD—</b> Entrepreneurship and Socio Cultural Environment of Businesses in India	<b>MD—</b> Entrepreneurial Finance & Management	<b>MD—</b> Innovation: Learning By Doing
<b>Six Ladders- Financial &amp; Strategic Management</b>	<b>MD—</b> Economics and Strategic Management	<b>MD—</b> Introduction to Financial Analysis	<b>MD—</b> Introduction to Finance	<b>MD—</b> Industry Project (FNSM)
<b>Six Ladders- AI in Digital Marketing</b>	<b>MD—</b> Digital Marketing	<b>MD—</b> Advanced Digital Marketing Techniques	<b>MD—</b> Introduction to AI for Digital Marketing	<b>MD—</b> Industry Project (AIDM)

**Notes:**

1. Learners who earn a minimum of total 160 credits will be awarded **“B. Tech in Engg. /Tech. with Multidisciplinary Minor”** degree.
2. Learners will have the following options to earn **B. Tech. in Engg. /Tech. degree with MDM and Honors Certification**. If learners earn top grades in any 8 Program core courses. They will be awarded a Honors Certification.
3. Learners who earn 18 additional credits through 6-month (2+1+2+1) Research Internships during summer and winter breaks, as mentioned in the scheme, are eligible for the degree: **“B. Tech. in Engg. /Tech. with Multidisciplinary Minor and Honors by Research”**, subject to earning CGPA of 8.25 throughout all semesters.
4. Learner can earn the certificates based on his/her exit from the program as follows:
  - a. After a one-year (40 credits to be earned) and 8-week summer workshop:  
**Certificate in Engineering.**
  - b. After two-years (80 credits to be earned) and 8-week summer workshop:  
**Diploma in Engineering.**
  - c. After three-years (120 credits to be earned) and 8-week summer workshop:  
**B. Sc. Engineering.**

**Dr. D. R. Kalbande**  
**HoD Computer Science and Engg.**

**Dr. Y. S. Rao**  
**Dean Academics & Research**

**Dr. B. N. Chaudhari**  
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