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 Engineering

Effective from Academic Year 2024-25 [2024-2028 BATCH]

Revised -Board of Studies Approval: 18th July 2025,
Revised - Academic Council Approval: 30th August 2025

Dr. P. B. Bhavathankar	**Dr. Y. S. Rao**	**Dr. B. N. Chaudhari**
H.O.D. CE	**Dean (Academics & Research)**	**Principal**

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

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CURRICULUM STRUCTURE FOR UNDERGRADUATE ACADEMIC PROGRAMS IN COMPUTER ENGINEERING AT SPIT
W.E.F. A.Y. 2024-25 [2024-2028 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 Leaning 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**	**SEC**	**AEC**	**HSSM**	**CC (LLC)**	**PCC**	**PEC**	**OE**	**EXP LEARNING**	**MDM**	**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						19			2	4	**25**
VI		2				7	6		1	3	**19**
VII							6	3	3	4	**16**
VIII								3	11		**14**
Total	31	16	4	4	4	50	12	6	19	14	**160**
%	**19.38**	**10**	**2.5**	**2.5**	**2.5**	**31.25**	**7.5**	**3.75**	**11.87**	**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

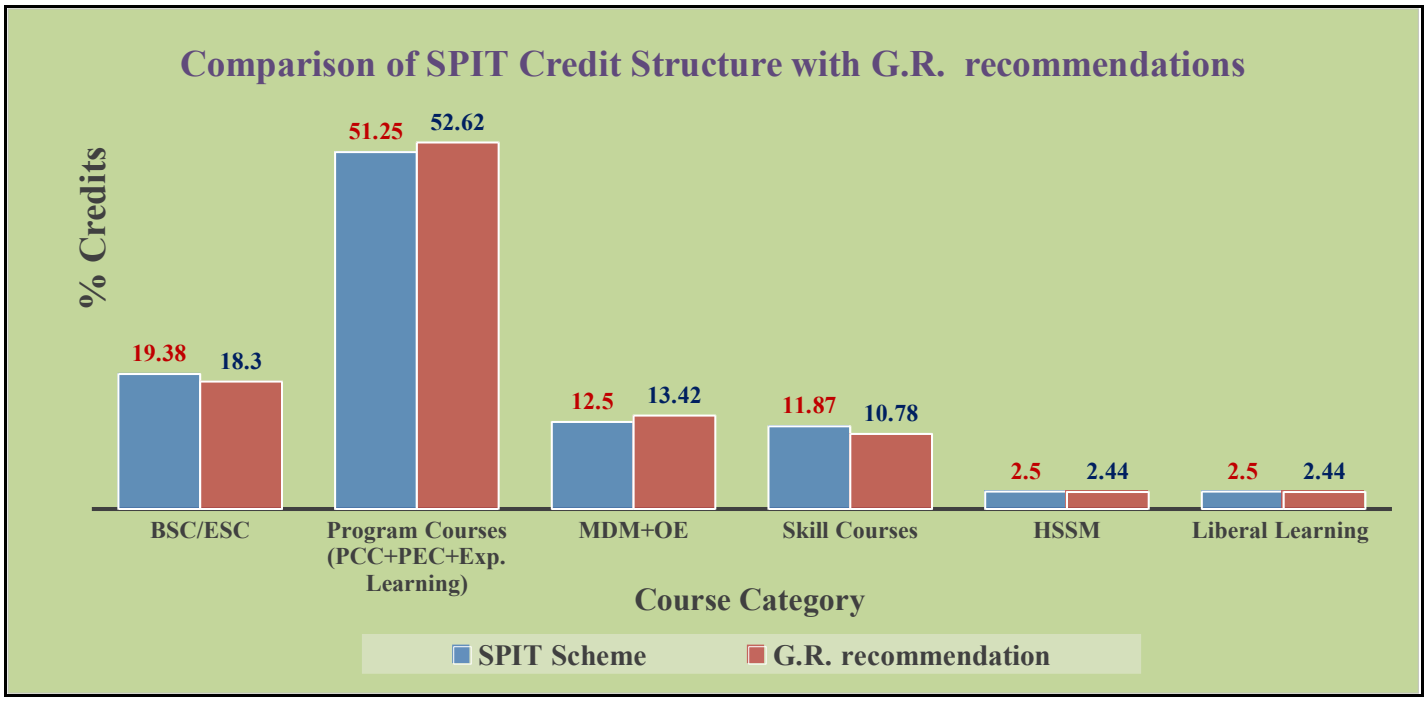

Figure 2: Pie-chart of vertical-wise allocation of credits

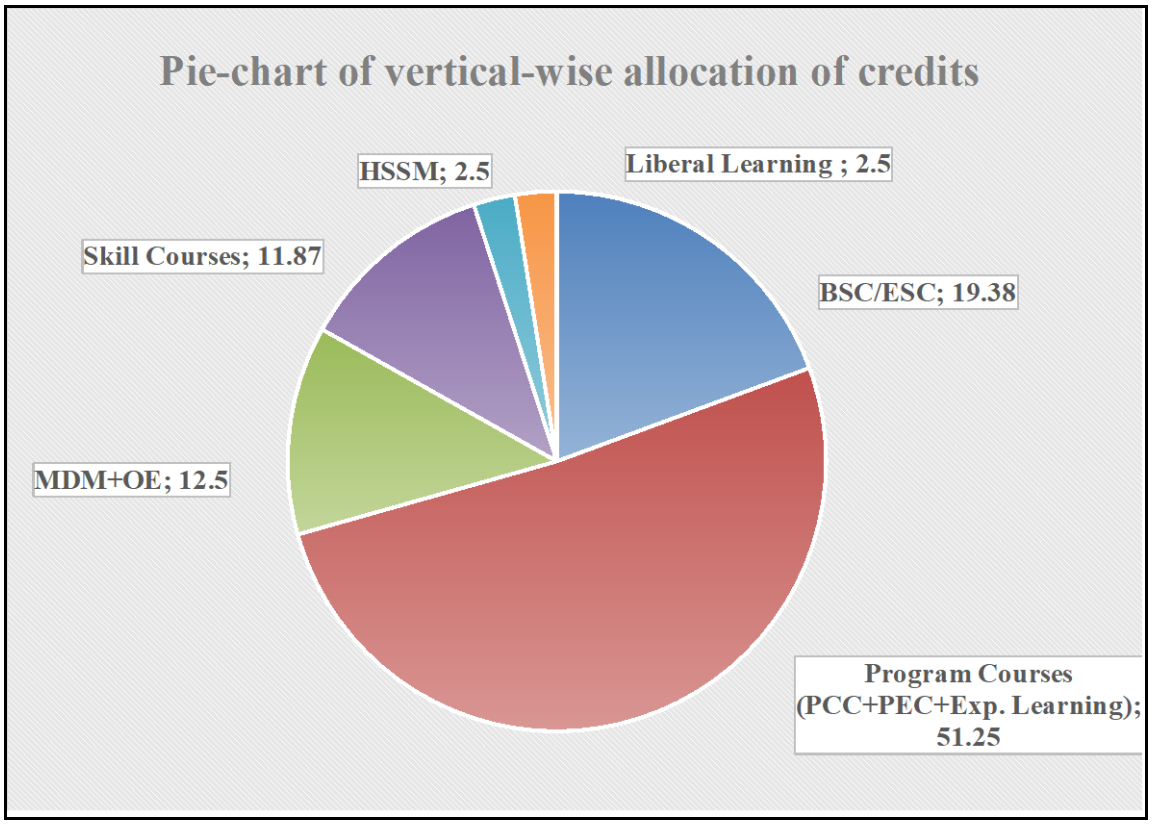

Table 3: Semester-wise allocation of credits to different verticals

SEM I										
Sr. No	**Course Category**	**Abbreviation**	**Course Code**	**Course Name**	**L**	**T**	**P**	**O**	**E**	**C**
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	1	0	2+2	4	9	3
3	Basic & Engg. Sciences Elective	BSESE		**Course I**						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	ET101	Digital Systems	3	0	2	5	10	4
			ET102	Basic Electrical Engineering	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
				Total	**13**	**1**	**10**	**25**	**49**	**19**

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	1	0	2+2	4	9	3
3	Basic & Engg. Sciences Elective	BSESE		**Course I**						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	ET101	Digital Systems	3	0	2	5	10	4
			ET102	Basic Electrical Engineering	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
				Total	**13**	**1**	**10**	**25**	**49**	**19**

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	CE201	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	AS202	Python Programming for Data science	0	1	2	4	7	2
4	Basic & Engg. Sciences Elective	BSESE		**Course I**						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	**Course I**	2	0	0	3	5	2
7	Program Core Courses (12 Credits)	PCC	CE202	Data Structures	3	0	2	4	9	4
8		PCC	CE203	Computer Organization and Architecture	3	0	2	4	9	4
9		PCC	CE204	Database Management Systems	3	0	2	4	9	4
10	Cocurricular Courses	CC (LLC)	LLCXX	LLC--III	1	0	0	1	2	1
				Total	**17**	**1**	**10**	**28**	**56**	**23**

SEM IV										
Sr. No	**Course Category**	**Abbreviation**	**Course Code**	**Course Name**	**L**	**T**	**P**	**O**	**E**	**C**
1	Basic & Engg. Sciences	BSES	CE205	Statical 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	AS201	Soft Skill II-Professional Communication Skills	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	CE206	Operating Systems	3	0	2	4	9	4
6		PCC	CE207	Design and Analysis of Algorithms	3	0	2	4	9	4
7		PCC	CE208	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
				Total	**15**	**1**	**8**	**26**	**50**	**23**

**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	CE201	Discrete Structures and Graph Theory	3	0	0	5	8	3
2			CE205	Statical methods in Computer Science	3	0	0	6	9	3

- Students are expected to start working for the Mini Project I during the summer.
- Summer Research Phase I of minimum 2 months and Course on Research Methodology for the "Honors by Research" for 7(4+3) credits- HR21
- 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	CE301	Distributed Computing	3	0	2	6	10	4
3		PCC	CE302	Software Engineering	3	0	2	6	10	4
4		PCC	CE303	Artificial Intelligence and Soft Computing	3	0	2	6	11	4
5		PCC	CE304	Theory of Computation	3	0	0	5	8	3
6		PCC	CE305	Cryptography and Network Security	3	0	2	5	10	4
7	Multidisciplinary Minor	MDM	MDEC2X	MDM-II	To be defined by others					4
		Total			**15**	**0**	**12**	**32**	**57**	**25**

SEM VI										
Sr. No	**Course Category**	**Abbreviation**	**Course Code**	**Course Name**	**L**	**T**	**P**	**O**	**E**	**C**
1	Program Core Courses (7credits)	PCC	CE306	System Programming and Compiler Construction	3	0	2	4	9	4
2		PCC	CE307	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	CE3X1	PE-I	2	0	2	4	8	3
6	Program Elective Courses	PEC	CE3X2	PE-II	2	0	2	4	8	3
7	Skill Enhancement Course	SEC	CE308	DevOps Lab	0	1	2	2	5	2
				Total	**9**	**1**	**12**	**23**	**45**	**19**

- Summer Research Phase II of minimum 2 month and A course on Optimization for the “Honors by Research” for 7(4+3) credits HR31
- 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	CE4X3	PE-III	2	0	2	4	8	3
Program Elective Courses	PEC	CE4X4	PE-IV	2	0	2	4	8	3
Open Elective	OE	OE1	OE-I	2	0	2	4	8	3
Experiential Learning	ELC	PR3-II	Main Project Stage II	0	0	6	4	10	3
			Total	**6**	**0**	**12**	**16**	**34**	**16**

SEM VIII										
Sr. No	**Course Category**	**Abbreviation**	**Course Code**	**Course Name**	**L**	**T**	**P**	**O**	**E**	**C**
1	Open Elective	OE	OE2	OE-II**	2	0	2	4	8	3
2	Experientia l Learning	ELC	INTR INTI	Research/ Industry Internship/Main Project Stage III***	0	0	24	12	36	11
				Total	**2**	**0**	**26**	**16**	**44**	**14**

- Extended Research Internship of minimum 2 month for the "Honors by Research" for 4 credits HR41
- For Enrollment to Honors by research, Minimum CGPA must be 8.25

*** To be completed from MOOCs*

****Students neither taking research or industry internships 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):

Course Code	Course Title	Course Code	Course Title
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)

Course Code	Course Title
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

4 Electives are sufficient to specialize in a particular domain.

Track	PE-I CE3X1	PE-II CE3X2	PE-III CE4X3	PE-IV CE4X4
Artificial Intelligence	CE311: Natural Language Processing	CE312: Deep Learning	CE413: Generative AI	CE414: Explainable AI
Network and Security	CE321: Ethical Hacking	CE322: Information and System Security	CE423: Blockchain Technology	CE424: Digital Forensics and Cyber Security
Data Science	CE331: Big Data Analytics	CE332: Information Visualization	CE433: Time-series Data Analysis	CE434: Decision Making and Business Intelligence
General	CE341: Digital Image Processing	CE342: High Performance Computing	CE443: Quantum Computing	CE444: Edge Computing
Generative AI Mastery (by Vizuara)	CE351: Generative AI Fundamentals	CE352: Foundations of Large Language Models	CE453: Large Language Models: Production and Deployment	CE454: Capstone Project in Artificial Intelligence

LIST OF MULTIDISCIPLINARY MINORS OFFERED BY S.P.I.T.[MDM]

MDM SEQUELS FOR ELECTRONICS AND TELECOMMUNICATIONS ENGG. [EXTC]

Course Category of Multidisciplinary Minor	MDM-I (Semester IV)	MDM-II (Semester V)	MDM-III (Semester VI)	MDM-IV (Semester VII)
Computer Engineering	**M051:** Database Management Systems	**M052:** Data Structures and Algorithms	**M053:** Cloud Computing	**M054:** Internet and Web Technology
Artificial Intelligence and Machine Learning	**M061:** Fundamentals of NNFL (NN, Fuzzy)	**M062:** Machine Learning	**M063:** Deep Learning	**M064:** Generative AI and application
Data Science	**M071:** Fundamentals of Data Science	**M072:** Data Analytics and Visualization	**M073:** Decision Making and Business Intelligence	**M074:** Social Media Analytics
Interface and Experience Design	**M081:** UI/UX Fundamentals	**M082:** Fundamentals of Experience Design	**M083:** Human Machine Interaction	**M084:** Prototyping and Interaction Design [Capstone project]

MDM SEQUELS FOR CE/CSE

Course Category of Multidisciplinary Minor	MDM-I (Semester IV)	MDM-II (Semester V)	MDM-III (Semester VI)	MDM-IV (Semester VII)
Industrial IoT (MDM-01)	**M01:** Fundamental of Internet of Things	**M02:** Embedded “C” and Micro Python for IoT	**M03:** IOT Communication and Network Layer Protocols	**M04:** IoT Applications and Security
Signal Processing and Communication (MDM-02)	**M021:** Digital Signal Processing	**M022**: Principles of Communication & Systems	**M023:** Digital Image Processing	**M024:** Wireless Communication and Networks
VLSI (MDM-04)	**M041:** Hardware Description Language Programming	**M042:** Digital CMOS VLSI Design	**M043:** VLSI Physical Design	**M044:** ASIC Verification

MDM COURSE OFFERED BY INDUSTRY/IIT Patna

Course Category of Multidisciplinary Minor	MDM-I (Semester IV)	MDM-II (Semester V)	MDM-III (Semester VI)	MDM-IV (Semester VII)
AI (For Non CS Students) (MDM 09) (Vizuara Technologies Pvt Ltd)	**M091:** Foundations in AI and ML	**M092:** Machine Learning and Deep Learning Mastery	**M093:** NLP and CV Mastery	**M094:** Large Language Models Theory and Deployment, Capstone Project
Financial & Strategic Management (MDM-11) (Six Ladders)	**M111:** Economics and Strategic Management	**M112:** Introduction to Financial Analysis	**M113:** Introduction to Finance	**M114:** Industry Project (FNSM)
UI/UX Design Programme (MDM-13) (Pearl Academy Pvt. Ltd.)	**M131:** Foundations of UI/UX Design	**M132:** Intermediate UI/UX Design	**M133:** Advanced UI/UX Design and Specializations	**M134:** Advanced Research and Emerging Practices in
Management (MDM-15) (SPJIMR Management)	**M151:** Fundamentals of Accounting & Finance	**M152:** Supply Chain Management	**M153:** IT for Business	**M154:** Marketing Management
Barclays Minor in Banking Technology (MDM-16) (Barclays)	**M161:** BFSI , Data Management & Analytics	**M162:** Enterprise Risk Management & Applied cyber security	**M163:** Agile Methodology	**M164:** Academic-Industry collab Project
Corporate Finance & Investment Banking (MDM -17) (IIT Patna)	**M171_P:** Data Preparation using MS Excel	**M172_P:** Corporate Finance & Investment Banking Fundamentals	**M173_P:** Detailed Investment Banking Operations Activities	**M174_P:** Performing Diversification in Portfolios and Investments
Business Analytics (MDM-18) (IIT Patna)	**M181_P:** Python for Data Science	**M182_P:** SQL for Business Analytics	**M183_P:** Stats & Machine Learning	**M184_P:** Data Visualization Tools: Power BI, Excel, Intro to Excel

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 they earn top grades in any 8 Program core courses and earn 80 percentile in GATE examination.
3. Learners who earn 18 additional credits through 6-month (2+2+2) Research Internships during summer breaks and a semester-long Research Internship in Semester 8, as mentioned in the scheme, are eligible for the degree: ***"B.Tech. in Engg./Tech. with Multidisciplinary Minor and Honors by Research"***, subject to the conditions specified under the Honors through Research Program.
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. P. B. Bhavathankar	**Dr. Y. S. Rao**	**Dr. B. N. Chaudhari**
HoD Computer Engineering	**Dean Academics and Research**	**Principal**