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 Electronics and Telecommunication Engineering)

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

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
HSSM	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						16			2	4	**22**
VI		2				8	6		2	3	**21**
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

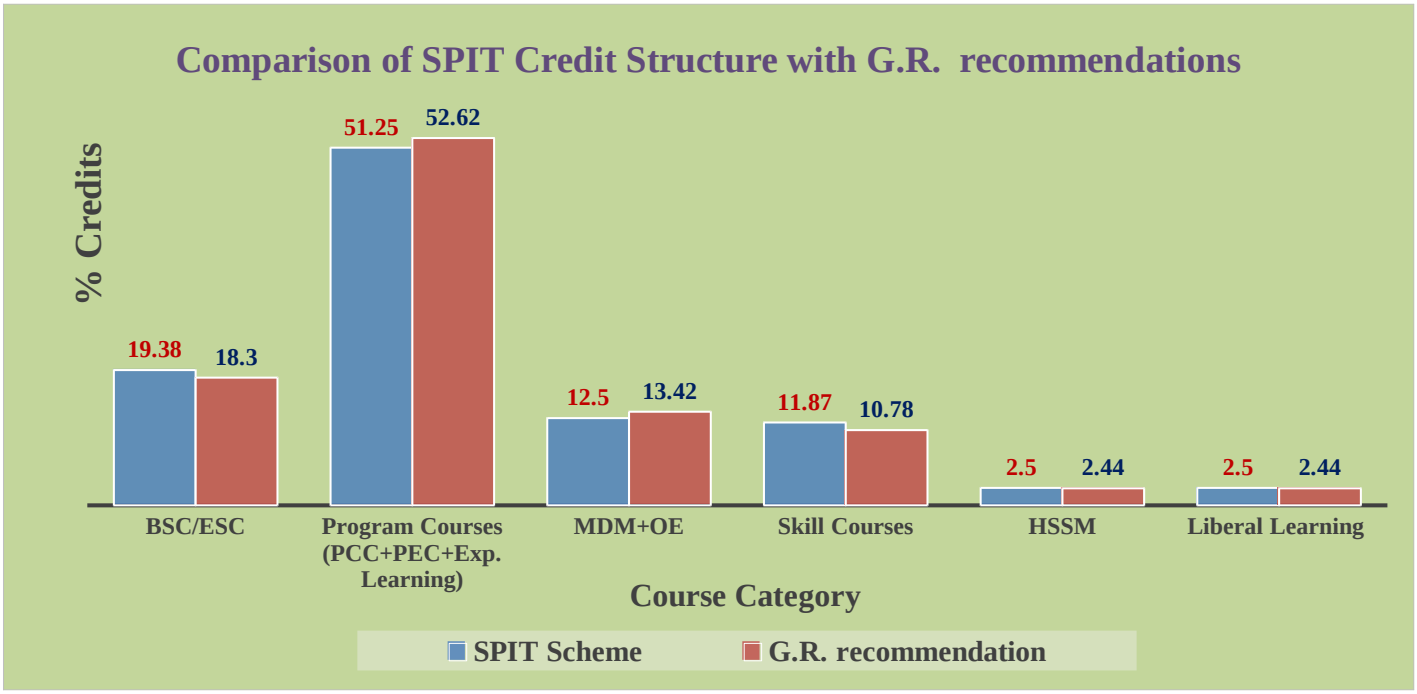

Figure 2: Pie-chart of vertical-wise allocation of credits

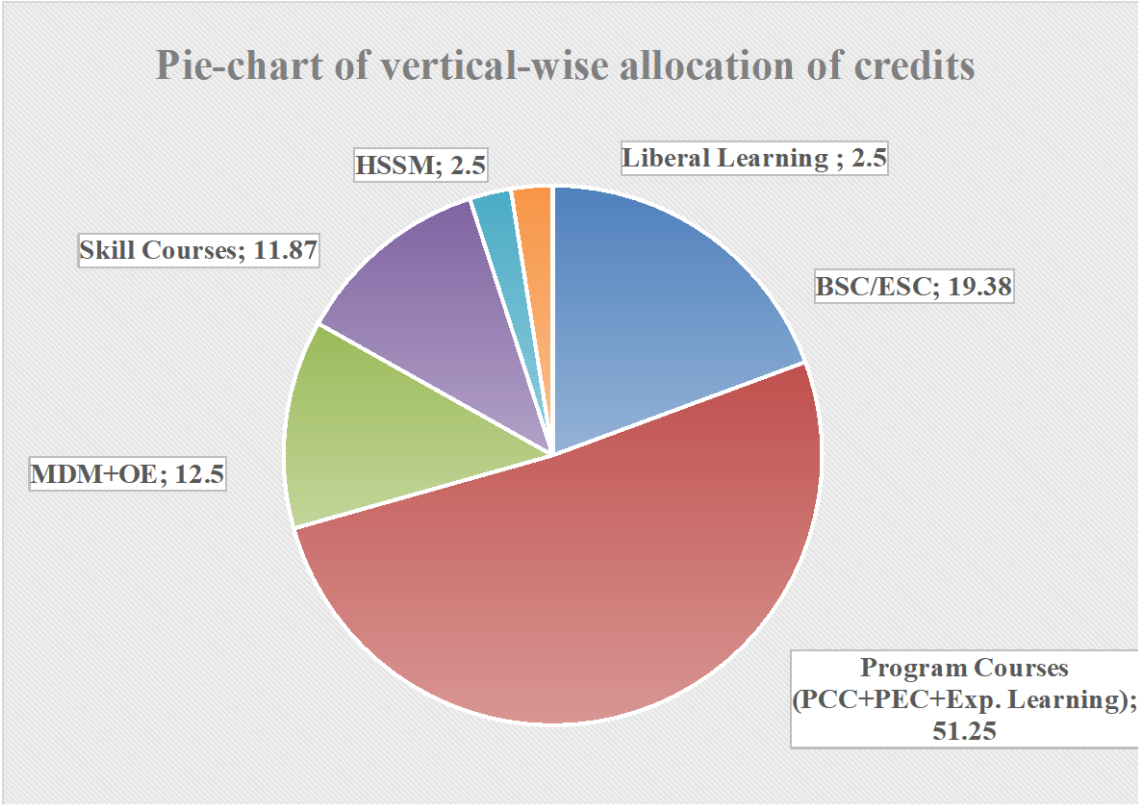

Table 3: Semester-wise allocation of credits to different verticals

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	Basic & Engg. Sciences	BSES	EC101	Digital Systems /	3	0	2	6	11	4
			EC102	Basic Electrical Engineering	3	0	2	5	10	
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/	0	1	2+2	2	7	
			AS108	Material Science/	3	0	0	4	8	
			AS109	Environmental Science/	3	0	0	3	6	
			AS110	Energy Science/	3	0	0	3	7	
			AS111	Thermal & Fluid Engineering/	3	0	0	3	6	
4	Skill Enhancement Course	SEC	AS106	Tech Shop/	0	1	2	2	5	2
			AS107	Soft Skill I	0	1	2	2	5	
5	Skill Enhancement Course	SEC	CE101	Programming Lab I	0	1	2+2	4	9	3
6	Ability Enhancement Course	AEC	AEC01	IKS /	1	1	0	1	3	2
			AEC02	UHV	1	1	0	1	3	
7	Cocurricular Courses	CC (LLC)	LLC01	LLCXX	0	1/0	0/2	2	3	1
				Total	**12**	**5**	**10**	**26**	**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	Basic & Engg. Sciences	BSES	EC102	Basic Electrical Engineering	3	0	2	5	10	4
			EC101	Digital Systems /	3	0	2	6	11	
3	Basic & Engg. Sciences Elective	BSESE		**Course II**						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/	0	1	2+2	2	7	
			AS108	Material Science/	3	0	0	4	8	
			AS109	Environmental Science/	3	0	0	3	6	
			AS110	Energy Science/	3	0	0	3	7	
			AS111	Thermal & Fluid Engineering/	3	0	0	3	6	
4	Skill Enhancement Course	SEC	AS106	Tech Shop/	0	1	2	2	5	2
			AS107	Soft Skill I	0	1	2	2	5	
5	Skill Enhancement Course	SEC	CE102	Programming Lab II	1	0	2+2	4	9	3
6	Ability Enhancement Course	AEC	AEC01	IKS /	1	1	0	1	3	2
			AEC02	UHV	1	1	0	1	3	
7	Cocurricular Courses	CC (LLC)	LLC02	LLCXX	0	1/0	0/2	2	3	1
				Total	**12**	**5**	**10**	**26**	**49+**	**19**

1	Experiential Learning	CP (in Summer)	PRJ01	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	MA201	Program Specific Maths-I – Linear Algebra	2	0	2	5	9	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	2	5	2
4	Basic & Engg. Sciences Elective	BSESE		**Course III**						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/	0	1	2+2	2	7	
			AS108	Material Science/	3	0	0	4	8	
			AS109	Environmental Science/	3	0	0	3	6	
			AS110	Energy Science/	3	0	0	3	7	
			AS111	Thermal & Fluid Engineering/	3	0	0	3	6	
5	Humanities	HSSM-I	HS2XX	**Course I**	2	0	0	3	5	2
6	Program Core Courses (12)	PCC	EC201	Electromagnetic Wave Engineering	2	0	2	5	9	3
7		PCC	EC202	Electronic Devices and Circuits	3	0	2	4	9	4
8		PCC	EC203	Signal, Network and System	3	0	2	4	9	4
9		PCC	EC204	Hardware Description Language programming	0	0	2	2	4	1
10	Co-curricular Courses	CC (LLC)	LLC03	LLCXX	0	1/0	0/2	2	3	1
				Total	**14**	**1**	**14**	**27**	**57+**	**23**

**Only for Lateral Entry Students*

SEM IV										
Sr. No	**Course Category**	**Abbreviation**	**Course Code**	**Course Name**	**L**	**T**	**P**	**O**	**E**	**C**
1	Basic & Engg. Sciences	BSES	MA203	Program Specific Maths-II ---Probability and Stochastic Process	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	Programming lab III---Computational numerical methods	0	1	2	4	8	2
4	Humanities	HSSM-II	HS2XX	**Course II**	2	0	0	3	5	2
5	Program Core Courses (11)	PCC	EC205	Analog and Digital Communication	3	0	2	4	7	4
6		PCC	EC206	Computer Organization & Architecture	3	0	0	4	9	3
7		PCC	EC207	Mixed Signal Integrated Circuit	3	0	2	4	9	4
8	Cocurricular Courses	CC (LLC)	LLC04	LLCXX	0	1/0	0/2	2	3	1
9	Multidisciplinary Minor	MDM	MDEC1X	MDM-I	To be defined by others					3
				Total	**15**	**1**	**4**	**26**	**49+**	**22**

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	MA201	Program Specific Maths-I – Linear Algebra	2	0	2	5	9	3
2	Basic & Engg. Sciences	BSES	MA203	Program Specific Maths-II --- Probability and Stochastic Process	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 (18 credits)	PCC	EC301	Control Systems	3	0	1	5	8	4
3		PCC	EC302	Computer Communication Networks	3	0	0	5	8	3
4		PCC	EC303	Digital Signal Processing	3	0	1	6	9	4
5		PCC	EC304/	Digital CMOS VLSI Design /	2	0	1	5	8	3
			EC305	Fundamental of Power Electronics	2	0	1	5	8	
6		PCC	EC306	Embedded Systems	3	0	1	5	9	4
7	Multidisciplinary Minor	MDM	MDEC2X	MDM-II	To be defined by others					4
				Total	**14**	**0**	**8**	**30**	**50+**	**24**

- **Research internship of 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 (7credits)	PCC	EC307	Fundamentals of Antenna	3	0	1	5	8	4
2		PCC	EC308	Mobile Wireless Communication	2	0	1	4	7	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	4	4	8	2
5	Program Elective Courses	PEC	EC3X1	PE-I	2	0	1	4	7	3
6	Program Elective Courses	PEC	EC3X2	PE-II	2	0	1	4	7	3
7	Skill Enhancement Course	SEC	AS301	(Special Lab) Internet of Things Laboratory	0	1	2	2	5	2
				Total	**9**	**1**	**10**	**19**	**42+**	**20**

- **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										
Sr. No	**Course Category**	**Abbreviation**	**Course Code**	**Course Name**	**L**	**T**	**P**	**O**	**E**	**C**
1	Multidisciplinary Minor	MDM	MDEC4X	MDM-IV	To be defined others					4
2	Program Elective Courses	PEC	EC3X3	PE-III	2	0	1	4	7	3
3	Program Elective Courses	PEC	EC3X4	PE-IV	2	0	1	4	7	3
4	Open Elective	OE	OE1	OE-I	2	0	1	4	7	3
5	Experiential Learning	ELC	PR3-II	Main Project Stage II	0	0	8	4	12	4
				Total	**6**	**0**	**11**	**16**	**33+**	**17**

- **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**	**Abbreviation**	**Course 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/ INTI/PR3-III	Research/ Industry Internship/Main Project Stage III/ ***	0	0	24	12	36	11
				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):

Course Code	Course Title	Course Code	Course Title
HSM11	Finance for Engineers-I	HSM12	Finance for Engineers-II
HSM21	Economics-I	HSM22	Economics-II
HSM31	Psychology -I	HSM32	Psychology -II
HSM41	Law for Engineers-I	HSM42	Law for Engineers-II
HSM51	Sanskrit-I	HSM52	Sanskrit-II
HSM61	French-I	HSM62	French-II
HSM71	German-I	HSM72	German-II
HSM81	Japanese-I	HSM82	Japanese-II
HSM91	(NPTEL) HSS/Management-I	HSM92	(NPTEL) HSS/Management-II

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.

PE-I	PE-II	PE-III	PE-IV
EC311 Optical Fiber Communication	**EC312:** Error Correction & Coding	**EC413:** Microwave Communication	**EC414:** Space Communication on Technologies
EC321: Cyber Security and Digital Forensic	**EC322**: Software Defined networks	**EC423:** Network Virtualization	**EC424:** Telecomm Network Operation and Management
EC331: Embedded System Design and Development	**EC332:** Real Time Operating System	**EC433:** Advanced Wireless Networks	**EC434:** Wireless Sensor Networks
EC341: Speech and Audio Processing	**EC342:** Image and Video Processing	**EC443:** Communication Protocol for IoT	**EC444:** IoT Applications and Analytics
EC351: Natural Language Processing	**EC352:** Biomedical Signal Processing	**EC453:** DSP System Design	**EC454:** Multimedia System Design
EC361: Semiconductor Technologies	**EC362:** Analog CMOS VLSI Design	**EC463:** Mixed CMOS VLSI Design	**EC464:** ASIC Verification
EC371: Control of Power Electronics Converters	**EC372:** Electric Motor Drive Systems	**EC473:** Embedded & Digital Control of PE Systems	**EC474:** Selected topic in Power Electronics & Drives

Indicative list of Multidisciplinary Minors

MDM Sequels for EXTC

- Computer Engineering
- AIML
- Data Science
- Interface and Experience Design
- IT Infrastructure
- Mathematics and Statistics
- Finance
- Economics

Course Category of Multidisciplinary Minor	MDM-I (Semester IV)	MDM-II (Semester V)	MDM-III (Semester VI)	MDM-IV (Semester VII)
Computer Engineering	**MDCE11:** Database Management Systems	**MDCE12:** Data Structures and Algorithms	**MDCE13:** Cloud Computing	**MDCE14:** Internet and Web Technology + DevOps (Project)
Artificial Intelligence and Machine Learning	**MDCE21:** Fundamentals of NNFL (NN, Fuzzy)	**MDCE22:** Artificial Intelligence Machine Learning (AI, ML, Deep Learning)	**MDCE23:** Natural Language Processing	**MDCE24:** Image Processing and Pattern Recognition + Project
Data Science	**MDCS31:** Fundamentals of Data Science	**MDCS32:** Data Analytics and Visualization	**MDCS33:** Decision Making and Business Intelligence	**MDCS34:** Social Media Analytics
Interface and Experience Design	**MDCS41:** UI/UX Fundamentals	**MDCS42:** Design Thinking and Innovations	**MDCS43:** Human Computer Interaction	**MDCS44:** Total Experience Design
IT Infrastructure	**MDCE51:** Data Centre Technology (HPC)	**MDCE52:** Cloud and DevOps	**MDCE53:** SDN and Network Flow Virtualization	**MDCE54:** Network Management + Project

MDM Sequels for CE/CSE

- Industrial IoT
- Digital Signal Processing
- Electronics Communication
- VLSI
- Mathematics and Statistics
- Finance
- Economics

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

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 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.
3. Learners will be allowed to earn **B. Tech. in Engg. /Tech. degree with MDM and Honors Certification, if they earn top grade in any 8 Program core courses and earn 80 percentiles in Gate exam.**
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. Reena Sonkusare	**Dr. Y. S. Rao**	**Dr. B. N. Chaudhari**
HoD EXTC	**Dean Academics & Research**	**Principal**