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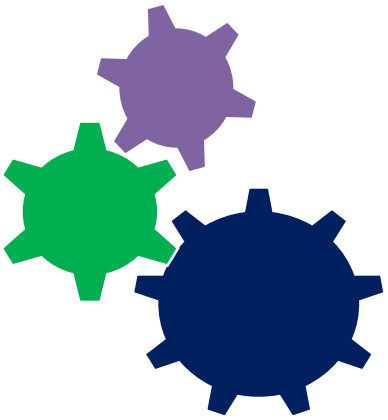
Approved by AICTE, New Delhi

School of Engineering



Master of Technology Degree

Program Regulations and Curriculum 2021-2023

M. Tech. (Embedded System and VLSI)

2021-2023

Regulation No.: PU/AC-18.4/ECE15/ESV/2021-23

Resolution No. 4 of the 18th Meeting of the Academic Council held on 3rd August, 2022, and ratified by the Board of Management in its 19th Meeting held on 4th August, 2022.

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August 2022

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1.0 PROGRAM CURRICULUM

MASTER OF TECHNOLOGY DEGREE PROGRAM IN EMBEDDED SYSTEM AND VLSI
M. TECH. (EMBEDDED SYSTEM AND VLSI)
2021-2023

The M. Tech. Program in Embedded System and VLSI provides a unique understanding to develop high-tech, ecological and socially responsible products from concept, to design, to production. Combining the strengths of the School of Engineering this innovative Embedded System and VLSI Program's courses bring together hands-on learning in product and industrial design and product development with product lifecycle management. Through interdisciplinary, collaborative group projects, student develop creative design problem-solving abilities and innovative strategies by applying all stages of the visual design process. Students acquire a wide range of skills in this Program, including idea generation, creative problem solving, drawing, model-making, the creative design process, 3D CAD advanced computer modelling, rapid prototyping, product development through CAE analysis, reverse engineering technology, materials selection, quality testing, product costing and optimization. Students also develop a strong sense of the functional and aesthetic principles of design, as well as a solid understanding of the technical and business aspects of product development. The M. Tech. Program in Embedded System and VLSI in Presidency University meets the growing need for graduates with a strategic vision of interdisciplinary product design and an understanding of all stages of the product lifecycle, who are ready to work in a variety of exciting careers related to consumer product development, electronics, furniture, transportation and more to cater local, regional, national and global needs.

The Program Education Objectives, Program Outcomes, Program Specific Outcomes and Learning Objectives of the M. Tech. Program in Embedded System and VLSI are as follows.

Program Educational Objectives

1. To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms.
2. To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.
3. To prepare graduates who will achieve peer recognition as individuals or in a team through demonstration of good analytical, research, design and implementation skills.
4. To prepare graduates who will thrive to pursue life-long reflective learning to fulfil their goals.

Program Outcomes

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1. An ability to analyze, manage and supervise engineering systems and processes with the aid of appropriate advanced tools.
2. An ability to design a system and process within constraints of health, safety, security, economics, manufacturability to meet desired needs.
3. An ability to carry out research in the respective discipline and publish the findings.
4. An ability to effectively communicate and transfer the knowledge/ skill to stakeholders.
5. An ability to realize the impact of engineering solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.

Program Specific Outcomes

After the successful completion of the program, the graduate shall have:

1. An ability to be a successful engineer by applying the knowledge of Embedded System Design, Software for Embedded Systems, CMOS VLSI Design and Advanced Digital System Design.

2. An ability to be a successful entrepreneur by understanding the impact of Embedded Systems and provide solutions to real world problems related to global, environmental and socio-economic context specially related to IOT.

3. An ability to be a successful researcher by identifying, formulating and solving the security, Defence and VLSI Design related problems.

4. An ability to identify, formulate and solve the communication engineering problems from knowledge gained during the course to work in a team as well as to lead a team.

Learning Objectives

1. Identify and analyze the Embedded System and VLSI processes in the manufacturing industry.
2. Define the components and their functions of Embedded System and VLSI processes and their relationships from concept to customer over whole product lifecycle.
3. Analyze, evaluate and apply the methodologies for product design, development and management.
4. Undertake a methodical approach to the management of product development to satisfy customer needs.
5. Carry out cost and benefit analysis through various cost models.
6. Be familiar with the design protection and Intellectual Property.

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3.1 MANDATORY COURSES AND CREDITS

The M. Tech. Degree Program in Embedded System and VLSI 2021-2023 comprises of 68 mandatory credits. Table 3.1.1 summarizes the Courses and their associated credits that are mandatorily required for the completion of the M. Tech. Degree.

TABLE 3.1.1: Summary of Courses and Credits

S. No	BASKET	CREDITS
1	SCHOOL CORE	32
2	PROGRAM CORE	15
3	DISCIPLINE ELECTIVE*	15
4	OPEN ELECTIVE	6
TOTAL		**68**

The Table 3.1.1 is indicative of various components such as Foundation Courses, Core (Professional) Courses, Discipline (Professional) Elective, Interdisciplinary Elective Courses, Seminars and Project Work.

3.2 SUGGESTED PROGRAM STRUCTURE

A suggested structure of the M. Tech. Program in Embedded System and VLSI is as shown in the Tables 3.2.1-3.2.4 that follow. These tables list the courses students may cover in the four semesters of their M. Tech. Program. Table 3.2.5 lists the Discipline Elective Courses that may be offered by the Department of Electronics and Communication Engineering.

M. Tech. EMBEDDED SYSTEM & VLSI

TABLE 3.2.1: I SEMESTER						
Sl. No.	**Course Code**	**Course Name**	**L**	**P**	**C**	**Basket**
1	MAT6001	Advanced Engineering Mathematics	3	0	3	School Core
2	ENG5001	English for Employability	2	2	3	School Core
3	ECE6001	Embedded System Design	2	2	3	Program Core
4	ECE6002	CMOS VLSI Design	2	2	3	Program Core
5	ECE5005	Advanced Digital System Design	3	0	3	Program Core
6	ECEXXXX	Discipline Elective - I	3	0	3	Discipline Elective
7	XXX XXXX	Open Elective - I	3	0	3	Open Elective
8	SEM5001	Seminar – I	-	-	1	School Core
		TOTAL			**22**	

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TABLE 3.2.2: II SEMESTER						
Sl. No.	**Course Code**	**Course Name**	**L**	**P**	**C**	**Basket**
1	ECE5006	Hardware Software Co-Design	3	0	3	Program Core
2	ECE5007	Embedded Real Time Operating System	3	0	3	Program Core
3	ECE XXXX	Discipline Elective - II	3	0	3	Discipline Elective
4	ECE XXXX	Discipline Elective - III	3	0	3	Discipline Elective
5	ECE XXXX	Discipline Elective - IV	3	0	3	Discipline Elective
6	ECE XXXX	Discipline Elective - V	3	0	3	Discipline Elective
7	XXX XXXX	Open Elective - II	3	0	3	Open Elective
8	SEM5002	Seminar – II	-	-	1	School Core
		TOTAL			**22**	

TABLE 3.2.3: III SEMESTER						
Sl. No.	**Course Code**	**Course Name**	**L**	**P**	**C**	**Basket**
1	PIP6001	Dissertation/ Internship - I	-	-	10	School Core
		TOTAL			**10**	

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TABLE 3.2.4: IV SEMESTER						
Sl. No.	**Course Code**	**Course Name**	**L**	**P**	**C**	**Basket**
1	PIP6002	Dissertation/ Internship - II	-	-	14	School Core
		TOTAL			**14**	

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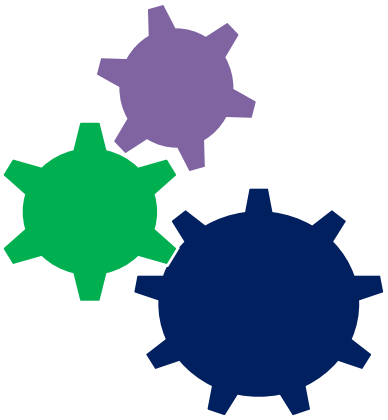

Master of Technology Degree

Program Regulations and Curriculum 2019-2021

M. Tech. (Embedded System and VLSI)

2019-2021

Regulation No.: PU/AC-11/8/06_2019

Resolution No. 11.8 of the 11th Meeting of the Academic Council held on 11th June, 2019, and ratified by the Board of Management in its 12th Meeting held on 12th June, 2019.

June 2019

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Master of Technology Degree
Program Regulations and Curriculum 2019-2021

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations, 2019, of the University, the Academic Council hereby makes the following Regulations, namely;

Preliminary:

Short Title and Commencement

(a) These Regulations shall be called the **Master of Technology Degree Program Regulations and Curriculum 2019-2021**.

(b) These Regulations are subject to, and, pursuant to the Academic Regulations, 2019.

(c) These Regulations shall be applicable to the ongoing Master of Technology Degree Programs of the 2019-2021 batch and to all other two-year Master of Technology Degree Programs which may be introduced in future.

(d) These Regulations shall come into force from the academic year 2019-2020.

Definitions :

In these Regulations, unless the context otherwise requires:

a) "Academic Council" means the Academic Council of the University;

b) "Academic Regulations" means the Academic Regulations, 2019, of the University;

c) "Academic Term" means a Semester or Summer Term;

d) "Act" means the Presidency University Act, 2013;

e) "Board of Examinations (BOE)" means the Board of Examinations of the University;

f) "Board of Management (BOM)" means the Board of Management of the University;

g) "CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations, 2019;

h) "Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;

i) "Course" means, a specific subject usually identified by its Course Code and Course Name, with specified Credit Structure and Credits, Course Description/Content/Syllabus, a set of textbooks/references, taught by assigned Course Instructor(s) to a specific class (group of students) during a specific Academic Term;

j) "Course Instructor" means the faculty member who is the Teacher/Course Instructor for the concerned Course;

k) "DAC" means the Departmental Academic Committee;

l) "Dean" means the Dean of the concerned School;

m) "HOD" means the Head of the concerned Department;

n) "Parent Department" means the Department that offers the Degree Program that a student undergoes;

o) "Program" means the Master of Technology (M. Tech.) Degree Program;

p) "Program Regulations" means the Master of Technology Degree Program Regulations and Curriculum 2019-2021;

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q) *"Registrar" means the Registrar of the University;*

r) *"SGPA" means the Semester Grade Point Average as defined in the Academic Regulations, 2019;*

s) *"School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;*

t) *"Section" means the duly numbered Section, with Clauses included in that Section, of these Program Regulations;*

u) *"Statutes" mean the Statutes of Presidency University;*

v) *"Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;*

w) *"Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days, and,*

x) *"University" means Presidency University, Bengaluru;*

1. INTRODUCTION:

1.1. The **Master of Technology Degree Program Regulations and Curriculum 2019-2021** are subject to, and, pursuant to the Academic Regulations, 2019.

1.2. These Program Regulations shall be applicable to the following two-year, Semester based, full time **Master of Technology (M. Tech.) Degree Programs of 2019-2021:**

1.2.1. Master of Technology in Building Construction Technology, abbreviated as M. Tech. (Building Construction Technology);

1.2.2. Master of Technology in Artificial Intelligence, abbreviated as M. Tech. (Artificial Intelligence);

1.2.3. Master of Technology in Data Sciences, abbreviated as M. Tech (Data Sciences);

1.2.4. Master of Technology in Embedded System and VLSI, abbreviated as M. Tech. (Embedded System and VLSI);

1.2.5. Master of Technology in Product Design and Development, abbreviated as M. Tech. (Product Design and Development).

1.3. These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

1.4. These Program Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

1.5. The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations.

1.6. These Program Regulations are structured as follows:

1.6.1. **Part A:** Specific regulations relevant to the two-year, Semester based, full time Master of Technology (M. Tech.) Degree Programs in pursuant of the provisions in Section 6.0 of the Academic Regulations, 2019, of the University.

1.6.2. **Part B:** Program Curriculum for the specific ongoing Master of Technology (M. Tech.) Degree Program of study as enumerated and named in Clause 1.2.

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2. PART A: M. TECH. DEGREE PROGRAM REGULATIONS

2.1. Program Description and Duration

M. Tech. Degree Programs are offered in the following branches/disciplines by the respective Parent Departments as indicated in Table 2.1 below:

Table 2.1

M. Tech. Degree Programs and Respective Parent Departments

S. No.	*M. Tech. Program (Branch/Discipline)*	*Parent Department*
1	M. Tech. (Building Construction Technology)	Department of Civil Engineering
2	M. Tech. (Artificial Intelligence)	Department of Computer Science and Engineering
3	M. Tech. (Data Sciences)	
4	M. Tech. (Embedded System and VLSI)	Department of Electronics and Communication Engineering
5	M. Tech. (Product Design and Development)	Department of Mechanical Engineering

The Master of Technology Degree Program is a two-year, Semester based, full time Program. The minimum duration of the M. Tech. Program is two (02) years and each year comprises of two academic Semesters (Odd and Even Semesters) and, hence, the duration of the M. Tech. Program is four (04) Semesters.

2.2. Admission Criteria to the Two-Year, Master of Technology (M. Tech.) Degree Programs

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time.

The admission criteria to the M. Tech Programs are listed in the following Sub-Clauses:

2.2.1. An applicant who has successfully completed a Bachelor's Degree Program, for example, the B. E. or B. Tech. or equivalent degrees in appropriate disciplines or branches, from an Indian or foreign university, recognised by the UGC having a minimum of 50% marks in aggregate (45% in the case of reserved category candidates), may apply for and be admitted into the course.

2.2.2. A valid score in GATE or Karnataka PGCET is preferred.

2.2.3. Reservation for the SC/ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.

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2.2.4. Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admissions, issued from time to time by the Government of India.

2.2.5. Candidates must fulfil the medical standards required for admission as prescribed by the University.

2.2.6. If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.

2.2.7. The decision of the BOM regarding the admissions is final and binding.

2.3. Seminar

Every student of the M. Tech. Program has to mandatorily register for two Seminar Courses, one in the first semester and the other in the second semester. The Seminar Courses are to be conducted with the following options and guidelines:

2.3.1. Each Seminar Course is to be carried out individually by each student with the assigned Seminar Guide.

2.3.2. Students may be assigned different Seminar Guides for the two Seminar Courses.

2.3.3. The topics of the Seminar Courses are to be approved by the Seminar Guides/Department within two weeks of the start of the Semester.

2.3.4. Each student is expected to put in thirty hours of effort for each Seminar Course over the duration of a Semester.

2.3.5. The assessment of the Seminar Courses will be based on a report and a presentation as shown in Table 2.3. The report, typically ten pages long, must be submitted in a format prescribed by the Department one week before the date for the presentations announced by the Department. Students will be given thirty minutes to deliver their presentations. The report and the presentation will be assessed by a Seminar Committee as decided by the Dean, SOE.

Table 2.3 Components of Assessment for the Seminar Courses

S. No.	Component of Assessment	Weightage (% of Total Marks)
1	Evaluation of Seminar Report	60%
2	Presentation	40%
	Total	**100%**

A minimum of 40% of the allotted marks is required for the "PASS" grade (Grade D) in the Seminar. In case a student fails to achieve the pass grade he/she will be required to repeat the Seminar Course and submit a revised report within two weeks from the date of result declaration.

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2.4. Project Work

The Project Work is a 5-Credit Non Teaching Credit Course (NTCC) based Course conducted in the 3rd Semester of the M. Tech. Program in accordance with the following options and guidelines:

2.4.1. The Project Work is to be carried out individually by each student with the assigned Project Guide

2.4.2. The student and the Guide must submit a Project Plan with a schedule of activities and the deliverables to the concerned HOD who will approve the Plan before Pre-Registration for the third semester.

2.4.3. Students need to be in continuous contact with their respective Guides and update them on the progress of their Project Work. Project Guides will monitor the progress of the students under them. The students are expected to adhere to the schedule of activities mentioned in the Project Plan.

2.4.4. The students must submit a report of the work carried out to the Parent Department by the last day specified by the Department. The work carried out can continue into the M. Tech. Dissertation Course done in the fourth semester but this is not a requirement.

2.4.5. The components of assessment for the Project Work shall be as detailed in Table 2.4 below:

Table 2.4 Components of Assessment for the Project Work

S. No.	Component of Assessment	Weightage (% of Total Marks)
1	Continuous Assessment Based on Monthly Reviews	20%
2	Evaluation of Project Report	60%
3	Viva-Voce Examination	20%
	Total	**100%**

A minimum of 40% of the allotted marks is required for the "PASS" grade (Grade D) in the Project Work. In case a student fails to achieve the pass grade he/she will be required to repeat the Project Work and submit a revised report within four weeks from the date of result declaration.

2.5. M. Tech. Dissertation

The M. Tech. Program requires each student to submit an M. Tech. Dissertation by the end of the 4th semester for 15 Credits. The work for the Dissertation is to be carried out individually by each student in accordance with the following options and guidelines:

2.5.1. Industry Project with Dissertation

Industry Project with Dissertation involves the use of design thinking to solve real time problems faced by an Industry/Organisation. A student who has got a final placement or placement with internship or internship may undergo the Industry Project for the duration of the fourth semester in the Industry/Organisation, subject to the following conditions:

2.5.1.1. The Industry Project with a Project Plan that includes a schedule of

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activities and the deliverables shall be approved by the concerned HOD before Pre-Registration for the fourth Semester. It will be carried out under the guidance of a Faculty Guide from the University and an Industry Expert from the Organisation.

2.5.1.2. The student will identify the pressing problems, challenges and opportunities in the Industry/Organisation. The student is expected to provide solutions to address the problems and challenges faced.

2.5.1.3. The entire Industry Project will have to be done in a single Organisation. The student will not be allowed to do short-duration internships in different companies to achieve the cut-off duration of one semester. Students must do their entire Industry Project in the Organisation where they were initially placed.

2.5.1.4. Students need to be in continuous contact with their Faculty Guides and Industry Experts and update them on the progress of their work. Faculty Guides will monitor the progress of the students under them. The students are expected to adhere to the schedule of activities mentioned in the Project Plan.

2.5.2. Research Project with Dissertation

A student may opt to do an academic Research Project with Dissertation in a Research Centre/University Department(s), subject to the following conditions:

2.5.2.1. The Research Project with a Project Plan that includes a schedule of activities and the deliverables shall be approved by the concerned HOD before Pre-Registration for the fourth semester. It will be carried out under the guidance of a Faculty Guide. The Faculty Guides for the Research Project with Dissertation will be allotted by the Dean, School of Engineering, four weeks before the date for Pre-Registration.

2.5.2.2. The student may carry out the Research Project in a Research Centre/University Department(s) of her/his choice provided the choice is approved by the Departmental Academic Committee. Provided further, that the Research Centre offering such a project confirms to the University that the work will be conducted in accordance with the Program Regulations and requirements of the University and allots a Research Expert to guide the student.

2.5.2.3. Students need to be in continuous contact with their Faculty Guides and Research Experts and update them on the progress of their work. Faculty Guides will monitor the progress of the students under them. The students are expected to adhere to the schedule of activities mentioned in the Project Plan. Each student will have to appear for a viva-voce examination. The student will be assessed by a committee comprising of the Faculty Guide, HOD or a nominee of the HOD, an Internal Examiner appointed by the Dean, School of Engineering, from the faculty members in the Department, and an External Examiner approved by the Board of Studies.

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The components of assessment for the M. Tech. Dissertation for both the options of

Industry Project with Dissertation and Research Project with Dissertation shall be as detailed in Table 2.5 below:

Table 2.5 Components of Assessment for the M. Tech. Dissertation		
S. No.	**Component of Assessment**	**Weightage (% of Total Marks)**
1	Continuous Assessment Based on Monthly Reviews	20%
2	Evaluation of Project Report	60%
3	Viva-Voce Examination	20%
	Total	**100%**

A minimum of 40% of the allotted marks is required for "PASS" grade (Grade D) in the M. Tech. Dissertation. In case a student fails to achieve the pass grade he/she will be required to repeat the M. Tech. Dissertation and submit a revised Dissertation within two months from the date of result declaration.

2.6. Interdisciplinary Electives

The primary objective of asking students to register for Interdisciplinary Electives is to provide them interdisciplinary/transdisciplinary learning experiences. The outcome is a graduate with a fair exposure to disciplines beyond the chosen Branch in the M. Tech. Program.

Students have to complete six Credits of Interdisciplinary Courses during their M. Tech. Program. They must accrue these six Credits from online platforms like SWAYAM-NPTEL in case such options are not offered by the University. The concerned Parent Department will announce a list of Courses, with attached Credits, which can by taken by students to satisfy the Credit requirements for Interdisciplinary Courses. On successful completion of such Courses students can request for transfer of credits. The rules and guidelines for such transfers are discussed in Clause 2.9.

2.7. Specific Regulations regarding Assessment and Evaluation

The components of continuous assessments, weightage for each component and the method of evaluation shall be assigned considering the nature of the Courses in terms of the pedagogy and outcomes.

2.7.1. Normally, for the Courses that have only the Lecture and Tutorial or Lecture Credit Structure (L–T–0 or L–0–0), with no Practical component, the components of Continuous Assessment and the distribution of weightage among the components of Continuous Assessment and duration of the examination/assessment shall be as detailed in Table 2.7.1 below:

Table 2.7.1 Method of Assessment for Courses with Credit Structures L–T–0 and L–0–0

S. No.	Components of Continuous Assessment	Weightage (% of Total Marks)	Duration of Assessment
1	Continuous Assessment 1: Mid Term Examination	20%	90 Minutes
2	Continuous Assessment 2: This component of Continuous Assessment shall consist of at least two (02) of the following: assignment(s), quiz, technical seminar/report, attendance/class participation, assessment on the self-learning topic(s), or, any other type of assessment as prescribed in the concerned Course Handout.	30%	NA
3	End Term Final Examination	50%	3 hours
	Total	**100%**	

2.7.2. Normally, for Laboratory/Practice Based Courses with a Credit Structure of (0–0–P) or (L–0–P) the components of Continuous Assessment and the distribution of weightage among the components of Continuous Assessment and duration of the examination/assessment shall be as detailed in Table 2.7.2 that follows.

Table 2.7.2 Method of Assessment for Practical Courses with Credit Structures 0–0–P and L–0–P

S. No.	Components of Continuous Assessments	Weightage (% of Total Marks)	Duration of Assessment
1	Continuous Assessment 1: Laboratory Work/Practical exercises, conducted in every Laboratory/Practice session/activity, including Laboratory records, practice/project reports, attendance/class participation as applicable, and as prescribed by the Course Handout.	30%	NA
2	Continuous Assessment 2: Practical Test/Viva-Voce/Quiz/Practice Assignments/Presentations and other assessments as prescribed in the Course Handout.	20%	NA

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3	End Term Practical Examination: Practical Experiment/Practice Test(s) with Viva-Voce, Jury or any other type of assessment as prescribed in the Course Handout.	50%	2 or 3 hours
	Total	**100%**	

2.7.3. Normally, for Non Teaching Credit Courses, like Seminars, without a defined Credit Structure (L–T–P) but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations, 2019), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be prescribed in the concerned Course Handout. There shall be no component of End Term Final Examinations for such Courses.

2.7.4. Similarly, for Non Teaching Credit Courses, like the Minor and Major Project Works, without a defined credit structure (L–T–P) but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations, 2019), the method of evaluation shall be based as per the Tables 2.4.1 and 2.5.1, respectively.

2.7.5. In case any exception is required for a particular Course, where the methods of assessment prescribed in the specific regulations mentioned above in Sub-Clauses 2.7.1, 2.7.2, 2.7.3 and 2.7.4 are not suitable/relevant for assessing the performance in the concerned Course, the DAC shall recommend the appropriate method of assessment for approval by the BOS.

2.8. Course Handout

The Course Handout (Refer Clause 6.2 of the Academic Regulations, 2019) is a comprehensive document describing the Objectives/Outcomes of the Course, the detailed syllabus (with the prescribed Text Book(s) and Reference Material), the Lesson/Session-wise Plan, and all the relevant and necessary details regarding the pedagogy, expectation from the students regarding preparation, participation and self-learning, components of continuous assessment and respective weightage (in percentage (%) of the total marks of all components of assessment) given to the components, and the method of evaluation. The guidelines for preparation of the Course Handout, its approval and delivery are listed in the following Sub-Clauses:

2.8.1. The Course Handout will be prepared as per Outcome Based Education guidelines.

2.8.2. Normally, the Course Handout is prepared by the Course Instructor(s) assigned to teach the Course. In cases of multiple sections of students registered for the same Course, an Instructor In-Charge, assigned by the DAC, shall prepare the Course Handout in consultation with the other Course Instructors assigned to the concerned Course.

2.8.3. The DAC shall examine each Course Handout and arrange for necessary deliberations as required. On acceptance of the completeness and quality of the Course Handout, the DAC shall approve the Course Handout.

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2.8.4. A consolidated printed/soft copy of the Booklet of all Course Handouts corresponding to the concerned Semester of a particular Program of Study shall be provided to every student concerned on the first day/Registration day of the concerned Semester.

2.8.5. The Course Handout Booklet is a very important guide for the students registered in the concerned course. The students are expected to use the Course Handout Booklet to prepare regularly and benefit from each session (Lecture/Tutorial/Practical) of the Course(s) and perform well in the Continuous Assessments and End Term Final Examinations, as applicable. Every student shall read and adhere to all the guidelines prescribed in the Course Handout Booklet.

2.9. Rules and Guidelines for Transfer of Credits from Massive Open Online Courses

(Refer Section 18.0 of the Academic Regulations, 2019.)

The provisions and rules pertaining to the transfer of credits through Massive Open Online Courses are outlined in Section 18.0 of the Academic Regulations.

With reference to Clause 18.2 of the Academic Regulations, the rules and guidelines for transfer of credits specifically from Study Webs of Active-Learning for Young Aspiring Minds-National Program on Technology Enhanced Learning (SWAYAM-NPTEL) (Refer Sub-Clause 18.2 of the Academic Regulations) are as stated in the following Sub-Clauses:

2.9.1. A student may complete SWAYAM-NPTEL courses and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned M. Tech. Program Regulations and Curriculum. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Program Regulations and Curriculum of the concerned M. Tech. Program.

2.9.2. Approved SWAYAM-NPTEL Courses shall be included as annexes to the Program Regulations and Curriculum for the concerned M. Tech. Program and shall be announced through University Notifications to the students from time to time. A student shall only request for transfer of credits from such approved/notified SWAYAM-NPTEL Courses as published by the concerned Departments.

2.9.3. SWAYAM-NPTEL Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM-NPTEL Course(s) and obtained the SWAYAM-NPTEL Certificate to this effect.

2.9.4. A student cannot transfer credits from SWAYAM-NPTEL Courses to earn the mandatory credits assigned for any other type of Courses (other than Discipline and Open Elective Courses) as prescribed in the concerned Program Regulations and Curriculum. However, a student may complete SWAYAM-NPTEL Courses and transfer equivalent credits in excess of the required mandatory Credits (and Courses). In the case of such transfers beyond the mandatory Credits the transferred Credits will be in included in the calculations of SGPA and CGPA.

2.9.5. Before the commencement of each Semester or during Pre-Registration schedule as per the Academic Calendar, Parent Departments may release a list of SWAYAM-NPTEL courses approved as Discipline Elective courses for each M. Tech. Program offered by them. In addition, Departments may also release a list of Open Elective courses for all M. Tech. Programs.

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2.9.6. Students may Pre-Register for the approved SWAYAM-NPTEL Courses in the respective Departments and register for the SWAYAM-NPTEL Courses as per the schedule announced by SWAYAM-NPTEL.

2.9.7. The credit equivalence of the SWAYAM-NPTEL Courses are based on course durations and/or as recommended by SWAYAM-NPTEL. The Credit Equivalence mapped to SWAYAM-NPTEL course durations for transfer of credits is summarised in Table 2.9.1 below.

Table 2.9.1 SWAYAM-NPTEL Course Durations and Credit Equivalence

S. No.	Course Duration	Credit Equivalence for Transfer of Credits
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

2.9.8. A student who has successfully completed the approved SWAYAM-NPTEL Course(s) and wants to avail the provision of transfer of equivalent credits to fulfil (partially or fully) the mandatory credit requirements of the Discipline Electives and/or Open Electives as prescribed in the concerned Program Regulations and Curriculum, must submit the original SWAYAM-NPTEL Course Certificates to the Head of the Parent Department concerned, with a written request for the transfer of the equivalent credits. On verification of the SWAYAM-NPTEL Course Certificates and approval by the Head of the Department concerned, the SWAYAM-NPTEL Course(s) and equivalent Credits will be included in Course (with associated Credits) Registration of the concerned student in the Semester immediately following the completion of the SWAYAM-NPTEL Course(s).

2.9.9. The grading system for such SWAYAM-NPTEL Courses with transfer of credits is specified in Table 2.9.2 below.

Table 2.9.2 Grading System for SWAYAM-NPTEL Courses

S. No.	Final Score on the SWAYAM-NPTEL Certificate	Grade Awarded
1	90% and above	O
2	From 80% to 89%	A+

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Table 2.9.2 Grading System for SWAYAM-NPTEL Courses		
S. No.	**Final Score on the SWAYAM-NPTEL Certificate**	**Grade Awarded**
3	From 70% to 79%	A
4	From 60% to 69%	B+
5	From 50% to 59%	B
6	From 40% to 49%	C

2.9.10. A student may submit a request for credit transfer from SWAYAM-NPTEL Courses before the last instruction day of the third (3rd) Semester of the M. Tech. program as specified in the Academic Calendar. Requests for credit transfers shall not be permissible in the fourth (4th) semester.

2.9.11. The maximum permissible number of credits that a student may request for transfer in a Semester is ten (10) credits.

2.9.12. The University shall not reimburse any fees/expense, a student may incur for the SWAYAM-NPTEL Courses.

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3 PART B: PROGRAM CURRICULUM

MASTER OF TECHNOLOGY DEGREE PROGRAM IN EMBEDDED SYSTEM AND VLSI
M. TECH. (EMBEDDED SYSTEM AND VLSI)
2019-2021

The M. Tech. Program in Embedded System and VLSI provides a unique understanding to develop high-tech, ecological and socially responsible products from concept, to design, to production. Combining the strengths of the School of Engineering this innovative Embedded System and VLSI Program's courses bring together hands-on learning in product and industrial design and product development with product lifecycle management. Through interdisciplinary, collaborative group projects, student develop creative design problem-solving abilities and innovative strategies by applying all stages of the visual design process. Students acquire a wide range of skills in this Program, including idea generation, creative problem solving, drawing, model-making, the creative design process, 3D CAD advanced computer modelling, rapid prototyping, product development through CAE analysis, reverse engineering technology, materials selection, quality testing, product costing and optimisation. Students also develop a strong sense of the functional and aesthetic principles of design, as well as a solid understanding of the technical and business aspects of product development. The M. Tech. Program in Embedded System and VLSI in Presidency University meets the growing need for graduates with a strategic vision of interdisciplinary product design and an understanding of all stages of the product lifecycle, who are ready to work in a variety of exciting careers related to consumer product development, electronics, furniture, transportation and more to cater local, regional, national and global needs.

The Program Education Objectives, Program Outcomes, Program Specific Outcomes and Learning Objectives of the M. Tech. Program in Embedded System and VLSI are as follows.

Program Educational Objectives

5. To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms.
6. To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.
7. To prepare graduates who will achieve peer recognition as individuals or in a team through demonstration of good analytical, research, design and implementation skills.
8. To prepare graduates who will thrive to pursue life-long reflective learning to fulfil their goals.

Program Outcomes

6. An ability to apply knowledge of mathematics, science and engineering in practice

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7. An ability to identify, critically analyse, formulate and solve engineering problems with comprehensive knowledge in the area of specialisation.
8. An ability to select modern engineering tools and techniques and use them with dexterity.
9. An ability to design a system and process to meet desired needs within realistic constraints such as health, safety, security and manufacturability.
10. An ability to contribute by research and innovation to solve engineering problems.
11. An ability to devise and conduct experiments, interpret data and provide well informed conclusions.
12. An ability to understand the impact of engineering solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.
13. An ability to function professionally with ethical responsibility as an individual as well as in multidisciplinary teams with positive attitude.
14. An ability to communicate effectively.
15. An ability to appreciate the importance of goal setting and to recognise the need for life-long reflective learning.

Program Specific Outcomes

After the successful completion of the program, the graduate shall have:

1. An ability to be a successful engineer by applying the knowledge of Embedded System Design, Software for Embedded Systems, CMOS VLSI Design and Advanced Digital System Design.

2. An ability to be a successful entrepreneur by understanding the impact of Embedded Systems and provide solutions to real world problems related to global, environmental and socio-economic context specially related to IOT.

3. An ability to be a successful researcher by identifying, formulating and solving the security, Defence and VLSI Design related problems.

4. An ability to identify, formulate and solve the communication engineering problems from knowledge gained during the course to work in a team as well as to lead a team.

Learning Objectives

7. Identify and analyse the Embedded System and VLSI processes in the manufacturing industry.
8. Define the components and their functions of Embedded System and VLSI processes and their relationships from concept to customer over whole product lifecycle.
9. Analyse, evaluate and apply the methodologies for product design, development and management.
10. Undertake a methodical approach to the management of product development to satisfy customer needs.
11. Carry out cost and benefit analysis through various cost models.
12. Be familiar with the design protection and Intellectual Property.

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3.1 MANDATORY COURSES AND CREDITS

The M. Tech. Degree Program in Embedded System and VLSI 2019-2021 comprises of 78 mandatory credits. Table 3.1.1 summarises the types of Courses, number of Courses under each type and the associated credits that are mandatorily required for the completion of the M. Tech. Degree.

TABLE 3.1.1
M. Tech. (Embedded System and VLSI) 2019-2021: Mandatory Credits

S. No	TYPE OF COURSES	NO. OF COURSES	CREDITS
1	Foundational Courses (FC)	2	7
2	Core (Professional) Course (CC)	9	34
3	Discipline (Professional) Elective (DE)	—	9
4	Inter Disciplinary Elective (IE)	—	6
5	Seminar (SM)	2	2
6	Project Work (PW)	2	20
TOTAL		—	**78**
The mandatory minimum credits required for the award of the M. Tech. (Embedded System and VLSI) Degree is 78 Credits.			

The Table 3.1.1 is indicative of various components such as Foundation Courses, Core (Professional) Courses, Discipline (Professional) Elective, Interdisciplinary Elective Courses, Seminars and Project Work.

3.2 SUGGESTED PROGRAM STRUCTURE

A suggested structure of the M. Tech. Program in Embedded System and VLSI is as shown in the Tables 3.2.1-3.2.4 that follow. These tables list the courses students may cover in the four semesters of their M

Tech. Program. Table 3.2.5 lists the Discipline Elective Courses that may be offered by the Department of Electronics and Communication Engineering.

M.Tech. EMBEDDED SYSTEM & VLSI

TABLE 3.2.1: I SEMESTER

SL. No.	COURSE CODE	COURSE TITLE	CREDIT STRUCTURE				Contact Hours	Types of Skills	Course Addresses to
			L	T	P	C			
1.	MAT 301	Advanced Engineering Mathematics	3	1	0	4	4	F^1	-
2.	ECE 361	Embedded System Design	3	0	2	4	5	E^2	S^6
3.	ECE 362	Software for Embedded Systems	4	0	0	4	4	E^2	S^6
4.	ECE 363	CMOS VLSI Design	3	0	2	4	5	E^2	S^6
5.	ECE 364	Advanced Digital System Design	3	0	0	3	3	E^2	S^6
6.	RES 301	Research Methodology	3	0	0	3	3	R^3	S^6
7.	ECE 511	Seminar	0	0	0	1	-	P^4	
		Total	**19**	**1**	**4**	**23**	**24**		

F^1 =Fundamentals
E^2 =Employability
R^3=Research Skills
P^4=Professional Skills
K^5=Knowledge Enhancement Skills
S^6=Sustainability Issues

TABLE 3.2.2: II SEMESTER

SL. No.	COURSE CODE	COURSE TITLE					Contact Hours	Types of Skills	Course Addresses to
			L	T	P	C			
1.	ECE 365	ASIC Design and Modeling	3	0	0	3	3	F^1	S^6
2.	ECE 366	Hardware Software Codesign	3	0	2	4	5	E^2	S^6
3.	ECE 367	Embedded Real Time Operating Systems	3	0	2	4	5	E^2	S^6
4.	ECE 368	Low Power VLSI Design	4	0	0	4	4	E^2	S^6
5.	ECE XXX	Discipline Elective – 1	3	0	0	3	3	K^5	-
6.	XXX XXX	Interdisciplinary Elective-I	3	0	0	3	3	K^5	-
7.	ECE 512	Seminar	0	0	0	1	-	P^4	-
		Total	**19**	**0**	**4**	**22**	**23**		

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TABLE 3.2.3: III SEMESTER									
SL. No.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**	**Contact Hours**	**Types of Skills**	**Course Addresses to**
1.	ECE 369	Design for Testability	4	0	0	4	4	E^2	S^6
2.	ECE XXX	Discipline Elective - 2	3	0	0	3	3	K^5	-
3.	ECE XXX	Discipline Elective - 3	3	0	0	3	3	K^5	-
4.	XXX XXX	Interdisciplinary Elective-2	3	0	0	3	3	K^5	-
5.	ECE 513	Project Work	0	0	0	5	-	E^2	-
		Total	**13**	**0**	**0**	**18**	**13**		

SEMESTER IV

TABLE 3.2.4: IV SEMESTER									
SL. No.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**	**Contact Hours**	**Types of Skills**	**Course Addresses to**
1.	ECE 514	M. Tech. Dissertation	0	0	0	15	-	E^2	-
		Total				**15**			

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GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi

School of Engineering

Master of Technology Degree

Program Regulations and Curriculum 2021-2023

M. Tech. (Embedded System and VLSI)

2021-2023

Regulation No.: PU/AC-18.4/ECE15/ESV/2021-23

Resolution No. 4 of the 18th Meeting of the Academic Council held on 3rd August, 2022, and ratified by the Board of Management in its 19th Meeting held on 4th August, 2022.

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August 2022

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1.0 PROGRAM CURRICULUM

MASTER OF TECHNOLOGY DEGREE PROGRAM IN EMBEDDED SYSTEM AND VLSI
M. TECH. (EMBEDDED SYSTEM AND VLSI)
2021-2023

The M. Tech. Program in Embedded System and VLSI provides a unique understanding to develop high-tech, ecological and socially responsible products from concept, to design, to production. Combining the strengths of the School of Engineering this innovative Embedded System and VLSI Program's courses bring together hands-on learning in product and industrial design and product development with product lifecycle management. Through interdisciplinary, collaborative group projects, student develop creative design problem-solving abilities and innovative strategies by applying all stages of the visual design process. Students acquire a wide range of skills in this Program, including idea generation, creative problem solving, drawing, model-making, the creative design process, 3D CAD advanced computer modelling, rapid prototyping, product development through CAE analysis, reverse engineering technology, materials selection, quality testing, product costing and optimization. Students also develop a strong sense of the functional and aesthetic principles of design, as well as a solid understanding of the technical and business aspects of product development. The M. Tech. Program in Embedded System and VLSI in Presidency University meets the growing need for graduates with a strategic vision of interdisciplinary product design and an understanding of all stages of the product lifecycle, who are ready to work in a variety of exciting careers related to consumer product development, electronics, furniture, transportation and more to cater local, regional, national and global needs.

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2. To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.
3. To prepare graduates who will achieve peer recognition as individuals or in a team through demonstration of good analytical, research, design and implementation skills.
4. To prepare graduates who will thrive to pursue life-long reflective learning to fulfil their goals.

Program Outcomes

1. An ability to analyze, manage and supervise engineering systems and processes with the aid of appropriate advanced tools.
2. An ability to design a system and process within constraints of health, safety, security, economics, manufacturability to meet desired needs.
3. An ability to carry out research in the respective discipline and publish the findings.
4. An ability to effectively communicate and transfer the knowledge/ skill to stakeholders.
5. An ability to realize the impact of engineering solutions in a contemporary, global, economical, environmental, and societal context for sustainable development.

Program Specific Outcomes

After the successful completion of the program, the graduate shall have:

1. An ability to be a successful engineer by applying the knowledge of Embedded System Design, Software for Embedded Systems, CMOS VLSI Design and Advanced Digital System Design.

2. An ability to be a successful entrepreneur by understanding the impact of Embedded Systems and provide solutions to real world problems related to global, environmental and socio-economic context specially related to IOT.

3. An ability to be a successful researcher by identifying, formulating and solving the security, Defence and VLSI Design related problems.

4. An ability to identify, formulate and solve the communication engineering problems from knowledge gained during the course to work in a team as well as to lead a team.

Learning Objectives

1. Identify and analyze the Embedded System and VLSI processes in the manufacturing industry.
2. Define the components and their functions of Embedded System and VLSI processes and their relationships from concept to customer over whole product lifecycle.
3. Analyze, evaluate and apply the methodologies for product design, development and management.
4. Undertake a methodical approach to the management of product development to satisfy customer needs.
5. Carry out cost and benefit analysis through various cost models.
6. Be familiar with the design protection and Intellectual Property.

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3.1 MANDATORY COURSES AND CREDITS

The M. Tech. Degree Program in Embedded System and VLSI 2021-2023 comprises of 68 mandatory credits. Table 3.1.1 summarizes the Courses and their associated credits that are mandatorily required for the completion of the M. Tech. Degree.

TABLE 3.1.1: Summary of Courses and Credits

S. No	BASKET	CREDITS
1	SCHOOL CORE	32
2	PROGRAM CORE	15
3	DISCIPLINE ELECTIVE*	15
4	OPEN ELECTIVE	6
TOTAL		**68**

The Table 3.1.1 is indicative of various components such as Foundation Courses, Core (Professional) Courses, Discipline (Professional) Elective, Interdisciplinary Elective Courses, Seminars and Project Work.

3.2 SUGGESTED PROGRAM STRUCTURE

A suggested structure of the M. Tech. Program in Embedded System and VLSI is as shown in the Tables 3.2.1-3.2.4 that follow. These tables list the courses students may cover in the four semesters of their M. Tech. Program. Table 3.2.5 lists the Discipline Elective Courses that may be offered by the Department of Electronics and Communication Engineering.

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M. Tech. EMBEDDED SYSTEM & VLSI

TABLE 3.2.1: I SEMESTER						
Sl. No.	**Course Code**	**Course Name**	**L**	**P**	**C**	**Basket**
1	MAT6001	Advanced Engineering Mathematics	3	0	3	School Core
2	ENG5001	English for Employability	2	2	3	School Core
3	ECE6001	Embedded System Design	2	2	3	Program Core
4	ECE6002	CMOS VLSI Design	2	2	3	Program Core
5	ECE5005	Advanced Digital System Design	3	0	3	Program Core
6	ECEXXXX	Discipline Elective - I	3	0	3	Discipline Elective
7	XXX XXXX	Open Elective - I	3	0	3	Open Elective
8	SEM5001	Seminar – I	-	-	1	School Core
		TOTAL			**22**	

TABLE 3.2.2: II SEMESTER						
Sl. No.	**Course Code**	**Course Name**	**L**	**P**	**C**	**Basket**
1	ECE5006	Hardware Software Co-Design	3	0	3	Program Core
2	ECE5007	Embedded Real Time Operating System	3	0	3	Program Core
3	ECE XXXX	Discipline Elective - II	3	0	3	Discipline Elective
4	ECE XXXX	Discipline Elective - III	3	0	3	Discipline Elective
5	ECE XXXX	Discipline Elective - IV	3	0	3	Discipline Elective
6	ECE XXXX	Discipline Elective - V	3	0	3	Discipline Elective
7	XXX XXXX	Open Elective - II	3	0	3	Open Elective
8	SEM5002	Seminar – II	-	-	1	School Core
		TOTAL			**22**	

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TABLE 3.2.3: III SEMESTER						
Sl. No.	**Course Code**	**Course Name**	**L**	**P**	**C**	**Basket**
1	PIP6001	Dissertation/ Internship - I	-	-	10	School Core
		TOTAL			**10**	

TABLE 3.2.4: IV SEMESTER						
Sl. No.	**Course Code**	**Course Name**	**L**	**P**	**C**	**Basket**
1	PIP6002	Dissertation/ Internship - II	-	-	14	School Core
		TOTAL			**14**	

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