SAHRDAYA AUTONOMOUS
COLLEGE OF ENGINEERING & TECHNOLOGY
A CENTRE OF EXCELLENCE IN SCIENCE & TECHNOLOGY | MANAGED BY IRINJALAKUDA DIOCESAN EDUCATION TRUST
Approved by AICTE & Affiliated to APJ Abdul Kalam Technological University | Accredited by:
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M. Tech

Curriculum (2024)- Semester I to IV

Discipline: Electronics and Communication Engineering

Stream: Embedded Systems

(SHR/AC/Auto/Acad. Council/M.Tech/2/Curri. /ES)

Recommended by Board of Studies on 30/08/2024

Approved by Academic Council on 31/08/2024

The M.Tech Embedded Systems (ES) curriculum is meticulously drafted to cultivate industry-ready professionals endowed with creativity and innovative thinking. This comprehensive curriculum encompasses various components, including course work, miniproject, lab and dissertation work as specified for the programme. The curriculum is so drawn up that the minimum number of credits for successful completion of the M. Tech programme is 68. The curriculum ensures a holistic education that prepares students for the dynamic field of Embedded Systems. Below is a detailed overview of the curriculum:

- Core courses (Discipline core courses and Programme core courses)
- Elective courses (Programme electives and Interdisciplinary electives)
- Audit course
- Research Methodology & IPR
- Mini project
- Laboratory work
- Dissertation/Research work

This curriculum is designed to seamlessly blend theoretical knowledge with practical experience and enhance employability through hands-on projects and internships, thereby preparing students for successful careers in Embedded Systems.

Table 1: *Distribution of credits among the Semesters*

Sem	Course work content	Total credits allotted	Credits allotted semester -wise
I	Core courses: 3 nos	3x3 = 9	18
	Programme electives: 2 nos	2x3 = 6	
	Laboratory: 1 no	1x1 = 1	
	Research Methodology & IPR: 1no	1x2 = 2	
II	Core courses: 2 nos	2x3 = 6	18
	Industry/Interdisciplinary Elective1 no	1 x3 =3	
	Programme electives: 2 nos	2x3 = 6	
	Laboratory: 1 no	1x1 = 1	
	Miniproject: 1 no	1x2 = 2	
III	MOOC: 1 no	1x2 = 2	16
	Internship: 1 no	1x3 = 3	
	Audit course: 1 no	No credit	
	Phase 1: Dissertation/ Research Project: 1 no	1x11 = 11	
IV	Phase 2: Dissertation/Research Project: 1 no	1x16 = 16	16
Total credits in all four semesters			**68**

SEMESTER I

SLOT	COURSE CODE	COURSE NAME	MARKS		L-T-P	HOURS	CREDIT
			CIA	ESE			
A	241TEC000	Advanced Engineering Mathematics	40	60	3-0-0	3	3
B	241TEC001	System Design Using Embedded Processors	40	60	3-0-0	3	3
C	241TEC002	Embedded Programming	40	60	3-0-0	3	3
D	241EECXXX	Program Elective 1	40	60	3-0-0	3	3
E	241EECXXX	Program Elective 2	40	60	3-0-0	3	3
S	241RGE000	Research Methodology and IPR	40	60	2-0-0	2	2
T	241LEC000	Embedded Programming Lab	100	--	0-0-2	2	1
Total			**340**	**360**		**19**	**18**

- L-T-P: Lecture-Tutorial-Practical
- CIA: Continuous Internal Assessment, ESE: End Semester Examination

PROGRAM ELECTIVE 1

PROGRAM ELECTIVE 1						
SLOT	**SL NO**	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**HOURS**	**CREDIT**
D	1	241EEC000	Advanced Digital System Design	3-0-0	3	3
	2	241EEC001	Advanced Data Communication And Networking	3-0-0	3	3
	3	241EEC002	Cloud Computing	3-0-0	3	3
	4	241EEC003	Electronic Design Automation	3-0-0	3	3
	5	241EEC004	Power Electronics And System Design	3-0-0	3	3
	6	241EEC005	VLSI System Design	3-0-0	3	3

PROGRAM ELECTIVE 2

PROGRAM ELECTIVE 2						
SLOT	**SL NO**	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**HOURS**	**CREDIT**
E	1	241EEC006	Electronic System Design	3-0-0	3	3
	2	241EEC007	Electronic Packaging	3-0-0	3	3
	3	241EEC008	Data Structures And Algorithms	3-0-0	3	3
	4	241EEC009	Sensor Technologies And MEMS	3-0-0	3	3
	5	241EEC010	Flexible Electronics	3-0-0	3	3
	6	241EEC011	Additive Manufacturing and 3D Printing	3-0-0	3	3

SEMESTER II

SLOT	COURSE CODE	COURSE NAME	MARKS		L-T-P	HOURS	CREDIT
			CIA	ESE			
A	242TEC000	Foundations OfData Science	40	60	3-0-0	3	3
B	242TEC001	Embedded OS and RTOS	40	60	3-0-0	3	3
C	242EECXXX	Program Elective 3	40	60	3-0-0	3	3
D	242EECXXX	Program Elective 4	40	60	3-0-0	3	3
E	242EECXXX	Industry/ Interdisciplinary Elective	40	60	3-0-0	3	3
S	242PEC000	Mini Project	100	--	0-0-4	4	2
T	242LEC000	Embedded OS and RTOS Lab	100	--	0-0-2	2	1
Total			**400**	**300**		**21**	**18**

PROGRAM ELECTIVE 3

PROGRAM ELECTIVE 3						
SLOT	**SL NO**	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**HOURS**	**CREDIT**
C	1	242EEC000	Reconfigurable Computing	3-0-0	3	3
	2	242EEC001	IOT	3-0-0	3	3
	3	242EEC002	AI & ML	3-0-0	3	3
	4	242EEC003	Wireless Technologies	3-0-0	3	3
	5	242EEC004	Data Analytics	3-0-0	3	3
	6	242EEC005	FPGA Based System Design	3-0-0	3	3

PROGRAM ELECTIVE 4

PROGRAM ELECTIVE 4						
SLOT	**SL NO**	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**HOURS**	**CREDIT**
D	1	242EEC006	Product Design and Quality Management	3-0-0	3	3
	2	242EEC007	Python Programming For Embedded Applications	3-0-0	3	3
	3	242EEC008	Hardware Design Verification	3-0-0	3	3
	4	242EEC009	Mixed Signal System Design	3-0-0	3	3
	5	242EEC010	Electric Vehicle Technology	3-0-0	3	3
	6	242EEC011	VLSI Signal Processing	3-0-0	3	3

INTERDISCIPLINARY ELECTIVE

INTERDISCIPLINARY ELECTIVE						
SLOT	**SL NO**	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**HOURS**	**CREDIT**
E	1	242EEC083	Automotive Electronics	3-0-0	3	3
	2	242EEC084	Renewable Energies	3-0-0	3	3
	3	242EEC085	Highspeed Digital System Design	3-0-0	3	3

INDUSTRY ELECTIVE

INDUSTRY ELECTIVE						
SLOT	**SL NO**	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**HOURS**	**CREDIT**
E	1	242EEC086	Industrial Internet Of Things	3-0-0	3	3
	2	242EEC087	Information Security	3-0-0	3	3
	3	242EEC088	Industrial Automation System Design	3-0-0	3	3

SEMESTER III

SLOT	COURSE CODE	COURSE NAME	MARKS		L-T-P	HOURS	CREDIT
			CIA	ESE			
TRACK 1							
A	243MEC000	MOOC	To be completed successfully		--	--	2
B	243AGEXXX	Audit Course	40	60	3-0-0	3	-
C	243IEC000	Internship	50	50	--	--	3
D	243PEC000	Dissertation Phase1	100	--	0-0-17	17	11
TRACK 2							
A	243MEC000	MOOC	To be completed successfully		--	--	2
B	243AGEXXX	Audit Course	40	60	3-0-0	3	-
C	243IEC000	Internship	50	50	---	--	3
D	243PEC001	Research Project Phase 1	100	--	0-0-17	17	11
Total			**190**	**110**		**20**	**16**

AUDIT COURSE

AUDIT COURSE						
SLOT	**SL NO**	**COURSE CODE**	**COURSE NAME**	**L-T-P**	**HOURS**	**CREDIT**
B	1	243AGE000	Academic Writing	3-0-0	3	3
	2	243AGE001	Advanced EngineeringMaterials	3-0-0	3	3
	3	243AGE002	Forensic Engineering	3-0-0	3	3
	4	243AGE003	Data Science For Engineers	3-0-0	3	3
	5	243AGE004	Design Thinking	3-0-0	3	3
	6	243AGE005	Functional Programmingin Haskell	3-0-0	3	3
	7	243AGE006	French Language (A1Level)	3-0-0	3	3
	8	243AGE007	German Language (A1Level)	3-0-0	3	3
	9	243AGE008	Japanese Language (N5Level)	3-0-0	3	3
	10	243AGE009	Principles of Automation	3-0-0	3	3
	11	243AGE010	Reuse And Recycle Technology	3-0-0	3	3
	12	243AGE011	System Modeling	3-0-0	3	3
	13	243AGE012	Expert Systems	3-0-0	3	3

SEMESTER IV

SLOT	COURSE CODE	COURSE NAME	MARKS		L-T-P	HOURS	CREDIT
			CIA	ESE			
TRACK 1							
A	244PEC000	Dissertation Phase II	100	100	0-0-22	22	16
TRACK 2							
A	244PEC001	Research Project Phase II	100	100	0-0-22	22	16
Total			**100**	**100**		**22**	**16**

ASSESSMENT PATTERN

(i) CORE COURSES

Evaluation shall only be based on application, analysis or design based questions (forboth internal and end semester examinations).

Continuous Internal Evaluation: 40 marks

Micro project/Course based project: 20 marks

Course based task/Seminar/Quiz: 10 marks

Test paper, 1 no: 10 marks

The project shall be done individually. Group projects not permitted. Test paper shallinclude minimum 80% of the syllabus.

End Semester Examination: 60 marks

The end semester examination question paper will have two parts; Part A and Part B. PartA contain 5 numerical questions (such questions shall be useful in the testing of knowledge, skills, comprehension, application, analysis, synthesis,

evaluation and understanding of the students), with 1 question from each module, having 5 marks for each question. Students shall answer all questions. Part B contains 7 questions (such questions shall be useful in the testing of overall achievement and maturity of the students in a course, through long answer questions relating to theoretical/practical knowledge, derivations, problem solving and quantitative evaluation), with minimum one question from each module of which student shall answer any five. Each question can carry 7 marks. Total duration of the examination will be 150 minutes.

(ii) ELECTIVE COURSES

Evaluation shall only be based on application, analysis or design based questions (for both internal and end semester examinations).

Continuous Internal Evaluation: 40 marks

Preparing a review article based on peer reviewedOriginal publications (minimum 10 publications shall be referred) : 15 marks

Course based task/Seminar/Data collection and interpretation : 15 marks

Test paper, 1 no. : 10 marks

Test paper shall include minimum 80% of the syllabus.

End Semester Examination: 60 marks

The end semester examination question paper will have two parts; Part A and Part B.Part A will contain 5 numerical/short answer questions with 1 question from each module, having 5 marks for each question (such questions shall be useful in the testing of knowledge, skills, comprehension, application, analysis,

synthesis, evaluation and understanding of the students). Students should answer all questions. Part B will contain 7 questions (such questions shall be useful in the testing of overall achievement and maturity of the students in a course, through long answer questions relating to theoretical/practical knowledge, derivations, problem solving and quantitative evaluation), with minimum one question from each module of which student should answer any five. Each question can carry 7 marks.

Note: The marks obtained for the ESE for an elective course shall not exceed 20% over the average ESE mark % for the core courses. ESE marks awarded to a student foreach elective course shall be normalized accordingly. For example, if the average end semester mark % for a core course is 40, then the maximum eligible mark % for an elective course is 40+20 = 60 %.

(iii) **RESEARCH METHODOLOGY & IPR/AUDIT COURSEContinuous Internal**

Evaluation: 40 marks

Course based task : 15 marks

Seminar/Quiz : 15 marks

Test paper, 1 no. : 10 marks

Test paper shall include minimum 80% of the syllabus.

End Semester Examination: 60 marks

The examination will be conducted for 150 minutes and will contain 7 questions, with minimum one question from each module of which student should answer any five. Each question can carry 12 marks.

(iv) **LABORATORY COURSES**

The laboratory courses will be having only Continuous Internal Evaluation and

carries 100 marks. Final assessment shall be done by two examiners; one examiner will be a seniorfaculty from the same department.

(v) INTERDISCIPLINARY ELECTIVE

Engineering students frequently aspire to work in areas and domains that are key topics in the industry. There are concerns by recruiters that skill sets of engineering students did not match with the Industry requirements, especially in the field of latest topics. In response to their desires, the University has incorporated Industry/Interdisciplinary electives in the curriculum. Interdisciplinary knowledge is critical for connecting students with current industry trends, where multitasking is the norm. Interdisciplinaryknowledge aids in the bridge- building process between academic institutions and industry. It aids pupils in expanding their knowledge and innovating by allowing them to create something new. While core engineering courses provide students with a strong foundation, evolving technology necessitates new methods and approaches to progress, prosperity, and the inculcation of problem- solving techniques. Other courses' knowledge, on the other hand, can assist them to deal with any scenario more effectively. Interdisciplinary courses may be one approach to address such needs, as they can aid in the enhancement of engineering education and the integration of desirable specialized subjects into the current engineering education system. This will enable students to fulfill the current industry demands. Students with multidisciplinary knowledge and projects are more likely to be placed in top industries, according to the placement trend. The future of developing engineers will be influenced by their understanding of emerging technology and inter disciplinary approaches such as big data, machine learning, and 3-D printing.

Continuous Internal Evaluation: 40 marks

Preparing a review article based on peer reviewed Original publications (minimum 10

publications shall be referred) : 15 marks

Course based task/Seminar/Data collection and interpretation : 15 marks

Testpaper, 1 no. : 10 marks

Test paper shall include minimum 80% of the syllabus.

End Semester Examination: 60 marks

The end semester examination question paper will havetwo parts; Part A and Part B.Part A will contain 5 numerical/short answer questions with 1 question from each module, having 5 marks for each question (such questions shall be useful in the testing of knowledge, skills, comprehension, application, analysis, synthesis, evaluation and understanding of the students). Students should answer all questions. Part B will contain 7 questions (such questions shall be useful in the testing of overallachievement and maturity of the students in a course, through long answer questions relating to theoretical/practical knowledge, derivations, problem solving and quantitative evaluation), with minimum one question from each module of which student should answer any five. Each question can carry 7 marks.

(vi) **MOOCs**

The MOOCs shall be considered only if it is conducted by the agencies namely AICTE/NPTEL/SWAYAM or NITTTR. The MOOC course should have a minimum duration of 8 weeks and the content of the syllabus shall be enough for at least 40 hours of teaching. The course should have a proctored/offline end semester examination. Thestudents can do the MOOC according to their convenience, but shall complete it by third semester. The list of MOOCs will be provided by the concerned BoS if at least 70% of thecourse content match with the area/stream of study. The course shall not be consideredif its content has more than 50% of overlap with a core/elective course in the concerned discipline or with an open elective.

MOOC is to be successfully completed before the commencement of fourth semester (starting from semester 1). A credit of 2 will be awarded to all students whoever successfully completes the MOOC course as per the evaluation pattern of the respectiveagency conducting the MOOC.

(vii) **MINIPROJECT**

Total marks: 100, only CIA

Mini project can help to strengthen the understanding of student's fundamentals through application of theoretical concepts and to boost their skills and widen the horizon of their thinking. The ultimate aim of an engineering student is to resolve a problem by applying theoretical knowledge. Doing more projects increases problem- solving skills. The introduction of mini projects ensures preparedness of students to undertake dissertation. Students should identify a topic of interest in consultation withPG Programme Coordinator that should lead to their dissertation/research project. Demonstrate the novelty of the project through the results and outputs. The progress of themini project is evaluated based on three reviews, two interim reviews and a final review. A report is required at the end of the semester.

Interim evaluation: 40 (20 marks for each review), final evaluation by a committee (will be evaluating the level of completion and demonstration of functionality/specifications, clarity of presentation, oral examination, work knowledgeand involvement): 35, Report (the committee will be evaluating for the technical content, adequacy of references, templates followed and permitted plagiarism level is not more than 25%): 15, Supervisor/Guide: 10

TEACHING ASSISTANCESHIP (TA)

All M Tech students irrespective of their category of admission shall undertake TA duties for a minimum duration as per the curriculum. Being a TA, the student will

get an excellent opportunity to improve their expertise in the technical content of the course, enhance communication skills, obtain a hands-on experience in handling the experiments in the laboratory and improve peer interactions.

The possible TA responsibilities include the following: facilitate a discussion section or tutorial for a theory/ course, facilitate to assist the students for a laboratory course, serve as a mentor for students, and act as the course web-master. TAs may be required to attend the instructor's lecture regularly. A TA shall not be employed as a substitute instructor, where the effect is to relieve the instructor of his or her teaching responsibilities.

For the tutorial session:

(i) Meet the teacher and understand your responsibilities well in advance, attend the lectures of the course for which you are a tutor, work out the solutions for all the tutorial problems yourself, approach the teacher if you find any discrepancy or if you need help in solving thetutorial problems, use reference text books, be innovative and express everything in English only.

(ii) Try to lead the students to the correct solutions by providing appropriate hints rather than solving the entire problem yourself, encourage questions from the students, lead the group to a discussion based on their questions, plan to ask them some questions befriendly and open with the students, simultaneously being firm with them.

(iii) Keep track of the progress of each student in your group, give periodic feedback to the student about his/her progress, issue warnings if the student is consistently under-performing, report to the faculty if you find that a particular student is consistently underperforming, pay special attention to slow-learners and be open to the feedback and comments from the students and faculty.

(iv) After the tutorial session you may be required to grade the tutorials/assignments/tests. Make sure that you work out the solutions to the questions yourself, and compare it with the answer key, think and work out

possible alternate solutions to the same question, understand the marking scheme from the teacher. Consult the teacher if are and make sure that you are not partial to some student/students while grading. Follow basic ethics.

Handling a laboratory Session:

(i) Meet the faculty – in- charge a few days in advance of the actual lab class and get the detailsof the experiment, get clarifications from him/her regarding all aspects of the experiment and the expectations, prepare by reading about the theoretical background of the experiment, know the physical concepts involved in the experiment, go to the laboratory and check out the condition of the equipment/instrumentation, perform the laboratory experiment at least once one or two days before the actual laboratory class, familiarize with safety/ security aspects of the experiment / equipment/laboratory, prepare an instruction sheet for the experiment in consultation with the faculty, and keep sufficient copies ready for distribution to students for their reference.

(ii) Verify condition of the equipment/set up about 30 minutes before the students arrive in the class and be ready with the hand outs, make brief introductory remarks about theexperiment, its importance, its relevance to the theory they have studied in the class, ask the students suitable questions to know the level of preparation for the experiment, discuss how to interpret results, ask them comment on the results.

(iii) Correct/evaluate/grade the submitted reports after receiving suitable instructions from the faculty in charge, continue to interact with students if they have any clarifications regarding any aspect of the laboratory session, including of course grading, Carefully observe instrument and human safety in laboratory class, Preparing simple questions for short oral quizzing during explanation of experiments enables active participation of students, facilitate attention, provides feedback and formative assessment