

CURRICULUM
&
SYLLABUS
2022
(Autonomous)

M Tech
Power Control and Drives

MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY

Mar Ivanios Vidyanagar, Nalanchira, Thiruvananthapuram – 695 015

April 2022

CURRICULUM AND DETAILED SYLLABI
FOR
M.TECH DEGREE PROGRAMME
IN
ELECTRICAL AND ELECTRONICS ENGINEERING

POWER CONTROL AND DRIVES

SEMESTERS I TO IV

2022 SCHEME
(AUTONOMOUS)



MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY

(Approved by AICTE, Autonomous Institution Affiliated to APJ Abdul Kalam Technological University)
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MAR BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Vision and Mission of the Institution

Vision:

To be an Institution moulding globally competent professionals as epitomes of Noble Values.

Mission:

To transform the Youth as technically competent, ethically sound and socially committed professionals, by providing a vibrant learning ambience for the welfare of humanity.

Vision and Mission of the Department

Vision:

To be a Centre of Excellence in Electrical and Electronics Engineering Education, Research and Application of knowledge to benefit the society at large.

Mission:

To mould quality Electrical Engineers, fostering creativity and innovation to address global issues.

PART A

DRAFT

M TECH IN POWER CONTROL AND DRIVES

CURRICULUM UNDER AUTONOMY STATUS

Medium of Instruction: English

i) Knowledge Segments and Credits

Every course of M. Tech Programme is placed in one of the seven categories as listed in table below. No semester shall have more than six lecture-based courses and two laboratory courses, and/or drawing/seminar/project courses in the curriculum.

| Sl. No. | Category | Category Code | Number of Courses | Total Credits |
|--------------------------------|--|---------------|-------------------|---------------|
| 1 | Discipline Core Courses | DCC | 2 | 6 |
| 2 | Programme Core Courses | PCC | 3 | 9 |
| 3 | Programme Elective Courses | PEC | 4 | 12 |
| | MOOC | | 1 | 2 |
| 4 | Industry/Interdisciplinary Elective | IEC | 1 | 3 |
| 5 | Mandatory Credit Course (Research Methodology) | RM | 1 | 2 |
| 6 | Laboratory Courses | LBC | 2 | 2 |
| 7 | Mini Project | PR | 1 | 2 |
| 8 | Project | | 2 | 27 |
| 9 | Internship | | 1 | 3 |
| Total Mandatory Credits | | | | 68 |

Programme Core: Modelling of Electrical Machines, Power Converter Circuits, Design Principles of Power Converters.

Discipline Core: Linear Algebra and Optimization Techniques, Electric Drives.

Lab Courses: Power Electronics Lab, Drives and Simulation Lab.

ii) Semester-wise Credit Distribution

| Semester | <i>I</i> | <i>II</i> | <i>III</i> | <i>IV</i> | Total Credits |
|---------------------|----------|-----------|------------|-----------|---------------|
| Credits for Courses | 18 | 18 | 16 | 16 | 68 |

iii) Weightage of the CIA and ESE for various categories of the courses

| Sl. No. | Category | CIA weightage | ESE weightage | Pass minimum |
|---------|---|---------------|---------------|--|
| 1 | Discipline Core Courses | 40% | 60% | 45% for ESE and 50% for (CIA & ESE) put together |
| 2 | Programme Core Courses | 40% | 60% | 45% for ESE and 50% for (CIA & ESE) put together |
| 3 | Programme Elective Courses | 40% | 60% | 45% for ESE and 50% for (CIA & ESE) put together |
| 4 | Lab Courses/ Mini Project | 100% | --- | 50% for CIA |
| 5 | MOOC | --- | --- | As stipulated by the agency conducting MOOC |
| 6 | Research Methodology & IPR | 40% | 60% | 45% for ESE and 50% for (CIA & ESE) put together |
| 7 | Internship | 50% | 50% | 45% for ESE and 50% for (CIA & ESE) put together |
| 8 | Dissertation/ Research Project Phase I | 100% | --- | 50% for CIA |
| 9 | Dissertation/ Research Project Phase II | 50% | 50% | 45% for ESE and 50% for (CIA & ESE) put together |

iv) PATTERN OF ASSESSMENT

1. CORE COURSES

a) Continuous Internal Assessment: 40 Marks

| | |
|---|-----------------|
| Micro project/ Course based project: The project shall be done individually. Group projects not permitted. | 20 Marks |
| Course based task/ Seminar/ Quiz: | 10 Marks |
| One Continuous assessment Test (CAT): (CAT shall include minimum 80% of the syllabus) | 10 Marks |
| Total | 40 marks |

Pattern of Continuous Assessment Test

- The maximum marks for Continuous assessment test is 50 and duration is 2 hours.
- The question paper will have two parts: Part A and Part B.

Part A contain 4 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 6 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 6 marks. Total duration of the examination will be 120 minutes.

b) Pattern of End Semester Examination

- The maximum marks for End semester examination is 60 and duration is 2½ hours.
- The question paper will have two parts: Part A and Part B.

Part A contain 5 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.

2. ELECTIVE COURSES

a) Continuous Internal Assessment : 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 |
| One Continuous assessment Test (CAT): CAT shall include the first four modules of the syllabus | 10 Marks |
| Total | 40 Marks |

Pattern of Continuous Assessment Test

- The maximum marks for Continuous assessment test is 50 and duration is 2 hours.

- The question paper will have two parts: Part A and Part B.

Part A contain 4 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 6 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 6 marks. Total duration of the examination will be 120 minutes.

b) Pattern of End Semester Examination

- The maximum marks for End semester examination is 60 and duration is 2½ hours.
- The 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.

3. RESEARCH METHODOLOGY & IPR/AUDIT COURSE

a) Continuous Internal Assessment : 40 Marks

| | |
|---|-----------------|
| Course based task: | 15 Marks |
| Seminar/ Quiz: | 15 Marks |
| Continuous assessment Test (CAT), 1 No: CAT shall include the first four modules of the syllabus | 10 Marks |
| Total | 40 Marks |

Pattern of Continuous Assessment Test

- The maximum marks for Continuous assessment test is 50 and duration is 2 hours.

The question paper shall contain 6 questions, with minimum one question from each module, of which student should answer any four. Each question shall carry 12½ marks.

b) Pattern of End Semester Examination

- The maximum marks for End semester examination is 60 and duration is 2½ hours.

The question paper shall contain 7 questions, with minimum one question from each module, of which student should answer any five. Each question shall carry 12 marks.

4. INDUSTRY ELECTIVES**a) Continuous Internal Assessment : 40 Marks**

| | |
|---|-----------------|
| Preparing a review article based on peer reviewed Original publications (minimum 10 publications shall be referred) : | 20 Marks |
| Course based task/ Seminar/ Data collection and interpretation: | 10 Marks |
| One Continuous assessment Test (CAT): CAT shall include the first four modules of the syllabus | 10 Marks |
| Total | 40 Marks |

Pattern of Continuous Assessment Test

- The maximum marks for Continuous assessment test is 50 and duration is 2 hours.
- The question paper will have two parts: Part A and Part B.

Part A contain 4 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 6 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 6 marks. Total duration of the examination will be 120 minutes.

The continuous internal evaluation will be done by the expert in the industry/ the faculty handling the course

c) Pattern of End Semester Examination

- The maximum marks for End semester examination is 60 and duration is 2½ hours.
- The question paper will have two parts: Part A and Part B.

Part A will contain 5 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.

5. INTERNSHIP

a) Continuous Internal Assessment : 50 Marks

| | |
|----------------------------------|-----------------|
| Student's diary/ Daily Log: | 25 Marks |
| Evaluation done by the Industry: | 25 Marks |
| Total | 50 Marks |

b) Pattern of End Semester Examination : 50 Marks

| | |
|-------------------------|-----------------|
| Internship Report | 25 Marks |
| Comprehensive Viva Voce | 25 Marks |
| Total | 50 Marks |

b) LABORATORY COURSES

- The laboratory courses will be having only Continuous Internal Assessment and carries 100 marks.
- Final assessment shall be done by two examiners; one examiner will be a senior faculty from the same department.

c) MINI PROJECT

a) Interim Evaluation: 40 Marks

- 20 marks for each review

b) Final Evaluation : 60 Marks

| | |
|---|-----------------|
| Evaluation by a Committee: (The committee will evaluate the level of completion and demonstration of functionality/specifications, clarity of presentation, oral examination, work knowledge and involvement). | 35 Marks |
|---|-----------------|

| | |
|---|-----------------|
| Report: (The committee will evaluate the technical content, adequacy of references, templates followed and permitted plagiarism level is not more than 25%). | 15 Marks |
| Supervisor/ Guide: | 10 Marks |
| Total | 60 Marks |

d) RESEARCH PROJECT/DISSERTATION

| | |
|--------------|--|
| Phase I: | Total marks: 100 marks, CIA = 100 marks |
| Phase II: | Total marks: 200 marks, CIA = 100 marks ESE = 100 marks |
| Total | 300 Marks |

vi) Minimum Cumulative Credit Requirements for Registering to Higher Semesters

| Semester | Allotted credits | Cumulative credits | Minimum credits required |
|-----------|------------------|--------------------|--------------------------|
| M1 | 18 | 18 | Not Applicable |
| M2 | 18 | 36 | Not Insisted |
| M3 | 16 | 52 | 12 credits from M1 |
| M4 | 16 | 68 | Not Insisted |

vii) Grade and Grade Points

| Grade | Grade Point (GP) | % of Total marks obtained in the Course |
|----------|------------------|--|
| S | 10 | 90% and above |
| A+ | 9 | 85% and above but less than 90% |
| A | 8.5 | 80% and above but less than 85% |
| B+ | 8 | 75% and above but less than 80% |
| B | 7.5 | 70% and above but less than 75% |
| C+ | 7 | 65% and above but less than 70% |
| C | 6.5 | 60% and above but less than 65% |
| D | 6 | 55% and above but less than 60% |
| P (Pass) | 5.5 | 50% and above but less than 55% |
| F (Fail) | 0 | Below 50% (CIA + ESE) or below 45% for ESE |
| FE | 0 | Failed due to lack of eligibility criteria |

| | | |
|----|---|---|
| AB | 0 | Could not appear for the ESE, but fulfils the eligibility criteria |
| I | 0 | Failure to submit the certificate of successful completion of MOOC by the end of Semester 3 |

Calculation of SGPA/CGPA

SGPA is calculated as below:

$$SGPA = \frac{\sum(C_i \times GP_i)}{\sum C_i}$$

where 'C_i' is the credit assigned for the course 'I' and 'GP_i' is the grade point for that course. Summation is done for all courses registered by the student in the semester. The failed and incomplete courses shall also be considered in the calculation.

CGPA is calculated as below:

$$CGPA = \frac{\sum(C_i \times GP_i)}{\sum C_i}$$

where 'C_i' is the credit assigned for the course 'I' and 'GP_i' is the grade point for that course. Summation is done for all courses specified in the Mar Baselios College of Engineering and Technology M.Tech Regulations 2022 13 curriculum up to that semester for which the 'CGPA' is needed. Here the failed courses shall also be accounted. CGPA for the M.Tech programme is arrived at by considering all course credits that are needed for the degree and their respective grade points.

| SEMESTER I | | | | | | | |
|--------------|-------------|---------------|--|------------|------------|-----------------|-----------|
| Slot | Course Type | Course Number | Course | Marks | | Hours L - T - P | Credit |
| | | | | CIA | ESE | | |
| A | DCC | 22MA060B | Linear Algebra and Optimization Techniques | 40 | 60 | 3 - 0 - 0 | 3 |
| B | PCC | 22EE161A | Power Converter Circuits | 40 | 60 | 3 - 0 - 0 | 3 |
| C | PCC | 22EE161B | Modelling of Electrical Machines | 40 | 60 | 3 - 0 - 0 | 3 |
| D | PEC | 22EE1XXX | Program Elective 1 | 40 | 60 | 3 - 0 - 0 | 3 |
| E | PEC | 22EE1XXX | Program Elective 2 | 40 | 60 | 3 - 0 - 0 | 3 |
| S | RM | 22MC061A | Research Methodology & IPR | 40 | 60 | 2 - 0 - 0 | 2 |
| T | LBC | 22EE169A | Power Electronics Lab | 100 | - | 0 - 0 - 2 | 1 |
| Total | | | | 340 | 360 | 19 | 18 |

Teaching Assistance: 6 hours

| SEMESTER II | | | | | | | |
|--------------|-------------|---------------|---------------------------------------|------------|------------|-----------------|-----------|
| Slot | Course Type | Course Number | Course | Marks | | Hours L - T - P | Credit |
| | | | | CIA | ESE | | |
| A | DCC | 22EE160A | Electric Drives | 40 | 60 | 3 - 0 - 0 | 3 |
| B | PCC | 22EE161C | Design Principles of Power Converters | 40 | 60 | 3 - 0 - 0 | 3 |
| C | PEC | 22EE1XXX | Program Elective 3 | 40 | 60 | 3 - 0 - 0 | 3 |
| D | PEC | 22EE1XXX | Program Elective 4 | 40 | 60 | 3 - 0 - 0 | 3 |
| E | IEC | 22EE1XXX | Industry/Interdisciplinary Elective | 40 | 60 | 3 - 0 - 0 | 3 |
| S | PR | 22EE167A | Mini project | 100 | - | 0 - 0 - 4 | 2 |
| T | LBC | 22EE169B | Electric Drives and Simulation Lab | 100 | - | 0 - 0 - 2 | 1 |
| Total | | | | 400 | 300 | 21 | 18 |

Teaching Assistance: 6 hours

PROGRAMME ELECTIVES

| Slot | Category | Course Code | Course | L | T | P | Credit |
|---------------|---|-------------|---|---|---|---|--------|
| C, D, E | PEC | 22EE162A | Advanced Signal Processing | 3 | 0 | 0 | 3 |
| | | 22EE162B | Renewable Energy Technologies | 3 | 0 | 0 | 3 |
| | | 22EE162C | Flexible AC Transmission Systems | 3 | 0 | 0 | 3 |
| | | 22EE162D | Microcontroller Applications in Power Electronics | 3 | 0 | 0 | 3 |
| | | 22EE162E | Soft Computing Techniques | 3 | 0 | 0 | 3 |
| | | 22EE162F | PWM Schemes for Power Converters | 3 | 0 | 0 | 3 |
| | | 22EE162G | Dynamics of Linear Systems | 3 | 0 | 0 | 3 |
| | | 22EE162H | Application of Power Electronics in Power Systems | 3 | 0 | 0 | 3 |
| | | 22EE162I | Power System Protection | 3 | 0 | 0 | 3 |
| | | 22EE162J | Switch Mode Power Converters | 3 | 0 | 0 | 3 |
| | | 22EE162K | Power Electronics for Renewable Energy Systems | 3 | 0 | 0 | 3 |
| | | 22EE162L | Advanced Instrumentation | 3 | 0 | 0 | 3 |
| | | 22EE162M | Finite Element Methods for Electrical Machines | 3 | 0 | 0 | 3 |
| | | 22EE162N | EHVAC and DC Transmission | 3 | 0 | 0 | 3 |
| | | 22EE162O | Power Quality in Electrical Systems | 3 | 0 | 0 | 3 |
| | | 22EE162P | Hybrid and Electric Vehicles | 3 | 0 | 0 | 3 |
| | | 22EE162Q | SCADA Systems and Applications | 3 | 0 | 0 | 3 |
| 22EE162R | Special Electrical Machines and Drives | 3 | 0 | 0 | 3 | | |
| 22EE162S | Analysis, Design and Grid Integration of Photovoltaic Systems | 3 | 0 | 0 | 3 | | |

INTERDISCIPLINARY ELECTIVE

| Slot | Category Code | Course Number | Course Name | L | T | P | Credit | Offering Department |
|------|---------------|---------------|--|---|---|---|--------|---------------------|
| E | IEC | 22EE165A | Solar and Wind Energy Conversion Systems | 3 | 0 | 0 | 3 | EED |
| | | 22EE165B | Electric Vehicle Technology | 3 | 0 | 0 | 3 | EED |
| | | 22EE165C | Process Control and Industrial Automation | 3 | 0 | 0 | 3 | EED |
| | | 22EE165D | Embedded Systems and Real Time Applications | 3 | 0 | 0 | 3 | EED |
| | | 22EE165E | Smart Grid and Energy Storage Systems | 3 | 0 | 0 | 3 | EED |
| | | 22EE165F | Electrical System Design and Building Services | 3 | 0 | 0 | 3 | EED |

| SEMESTER III | | | | | | | |
|----------------|-------------|---------------|--------------------------|------------------------------|------------|-----------------|-----------|
| Slot | Course Type | Course Number | Course | Marks | | Hours L - T - P | Credit |
| | | | | CIA | ESE | | |
| TRACK 1 | | | | | | | |
| A* | MOOC | ---- | MOOC | To be successfully completed | | - | 2 |
| B | AC | 22AC071A | Audit Course | 40 | 60 | 3 - 0 - 0 | - |
| C | PR | 22EE178A | Internship | 50 | 50 | - | 3 |
| D | PR | 22EE178B | Dissertation Phase I | 100 | - | 0 - 0 - 17 | 11 |
| TRACK 2 | | | | | | | |
| A* | MOOC | ---- | MOOC | To be successfully completed | | - | 2 |
| B | AC | 22AC171A | Audit Course | 40 | 60 | 3 - 0 - 0 | - |
| C | PR | 22EE178A | Internship | 50 | 50 | - | 3 |
| D | PR | 22EE178B | Research project Phase I | 100 | - | 0 - 0 - 17 | 11 |
| Total | | | | 190 | 110 | 20 | 16 |

Teaching Assistance: 6 hours

***MOOC** must be successfully completed before the commencement of fourth semester. This course can be carried out at any time from M1 to M3.

AUDIT COURSES (we may think of adding more courses to this list)

- English for Research Paper Writing
- Business Communication and Presentation Skills
- Ethics & Human Values
- Pedagogy Studies
- Stress Management by Yoga
- Personality Development through Life Enlightenment Skills
- Cost Management of Engineering Projects
- Operations Research
- Composite Materials
- Energy from Waste
- Entrepreneurship Development

Track 1/ Track 2

- In second year, the students can choose either of the two tracks: Track 1 or Track 2.
- Track 1 is conventional M.Tech programme

- Track 2 is M.Tech programme designed for students with scientific vigor for pursuing research and scientific knowledge.
- An aspirant in Track 2 needs to have a flavor for research and passion for the topic.
- The candidates should also be good with performing in-depth research and corroborating the conclusions of research conducted by them.
- Such students are expected to have the reasonable mastery of the following skills at the end of the M.Tech programme
 - Technical Skills
 - Research Skills
 - Communication Skills
 - Critical Thinking Skills
 - Problem Solving Skills.

The eligibility for Track 2:

- Shall have qualified in the GATE or have a SGPA above 8.5 during the first semester of the M.Tech
- Qualify an interview during the end of second semester by an expert committee constituted for this purpose
- In the Research project track, the innovations in the research work shall be accepted or published in a journal (indexed in SCI/Unpaid SCOPUS) before the final evaluation. In case the student fails to satisfy this requirement, he/she will be evaluated only under Track 1.

| SEMESTER IV | | | | | | | |
|----------------|-------------|---------------|---------------------------|------------|------------|--------------------|-----------|
| Slot | Course Type | Course Number | Course | Marks | | Hours L - T - P | Credit |
| | | | | CIA | ESE | | |
| TRACK 1 | | | | | | | |
| D | PR | 22EE178C | Dissertation Phase II | 100 | 100 | 0 – 0 - 24 | 16 |
| TRACK 2 | | | | | | | |
| D | PR | 22EE178C | Research project Phase II | 100 | 100 | 0 – 0 - 24 | 16 |
| Total | | | | 100 | 100 | 24 | 16 |

Teaching Assistance: 5 hours



{Subject to Approval by the competent Authorities}