

APJ ABDUL KALAM
TECHNOLOGICAL
UNIVERSITY

MTECH 2022



Discipline: Biomedical Engineering

Stream: BM1 (Biomedical Engineering)

PROGRAM OUTCOMES - PO

Outcomes are the attributes that are to be demonstrated by a graduate after completing the programme

- PO1:** An ability to independently carry out research/investigation and development work in engineering and allied streams
- PO2:** An ability to communicate effectively, write and present technical reports on complex engineering activities by interacting with the engineering fraternity and with society at large.
- PO3:** An ability to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
- PO4:** An ability to apply stream knowledge to design or develop solutions for real world problems by following the standards
- PO5:** An ability to identify, select and apply appropriate techniques, resources and state-of-the-art tool to model, analyse and solve practical engineering problems.
- PO6:** An ability to engage in life-long learning for the design and development related to the stream related problems taking into consideration sustainability, societal, ethical and environmental aspects
- PO7:** An ability to develop cognitive load management skills related to project management and finance which focus on Entrepreneurship and Industry relevance.

The departments conducting the M.Tech programme shall define their own PSOs, if required, and assessment shall also be done for the same.



SEMESTER I

SLOT	COURSE CODE	COURSE NAME	MARKS		L-T-P	HOURS	CREDIT
			CIA	ESE			
A	221TIC100	MATHEMATICS FOR BIOMEDICAL ENGINEERS	40	60	3-0-0	3	3
B	221TIC001	PHYSIOLOGY FOR ENGINEERS	40	60	3-0-0	3	3
C	221TIC002	BIOMEDICAL SIGNALS-MEASUREMENT AND INSTRUMENTATION	40	60	3-0-0	3	3
D	221EICXXX	PROGRAM ELECTIVE 1	40	60	3-0-0	3	3
E	221EICXXX	PROGRAM ELECTIVE 2	40	60	3-0-0	3	3
S	221RGE100	RESEARCH METHODOLOGY AND IPR	40	60	2-0-0	2	2
T	221LIC100	PHYSIOLOGICAL MEASUREMENTS AND INSTRUMENTATION LAB	100	--	0-0-2	2	1
Total			340	360		19	18

Teaching Assistance: 6 hours



PROGRAM ELECTIVE 1

SLOT	SL NO	COURSE CODE	COURSE NAME	L-T-P	HOURS	CREDI T
D	1	221EIC011	APPLIED BIOMECHANICS	3-0-0	3	3
	2	221EIC012	PYTHON PROGRAMMING FOR BIOMEDICAL APPLICATIONS	3-0-0	3	3
	3	221EIC013	DYNAMICAL SYSTEMS	3-0-0	3	3
	4	221EIC014	BIOPHOTONICS	3-0-0	3	3
	5	221EIC015	MEDICAL ROBOTICS	3-0-0	3	3
	6	221EIC016	BIOMATERIALS	3-0-0	3	3

PROGRAM ELECTIVE 2

SLOT	SL NO	COURSE CODE	COURSE NAME	L-T-P	HOURS	CREDI T
E	1	221EIC021	ASSISTIVE TECHNOLOGY AND REHABILITATION ENGINEERING	3-0-0	3	3
	2	221EIC022	MACHINE LEARNING TECHNIQUES	3-0-0	3	3
	3	221EIC023	SYSTEM IDENTIFICATION	3-0-0	3	3
	4	221EIC024	BIO MEMS	3-0-0	3	3
	5	221EIC025	THERAPEUTIC AND DIAGNOSTIC EQUIPMENT	3-0-0	3	3
	6	221EIC026	COMPUTATIONAL METHODS FOR BIOMEDICAL ENGINEERS	3-0-0	3	3

SEMESTER II

SLOT	COURSE CODE	COURSE NAME	MARKS		L-T-P	HOURS	CREDIT
			CIA	ESE			
A	222TIC100	BIOMEDICAL SIGNAL PROCESSING	40	60	3-0-0	3	3
B	222TIC001	BIOMEDICAL IMAGING AND IMAGE PROCESSING	40	60	3-0-0	3	3
C	222EICXXX	PROGRAM ELECTIVE 3	40	60	3-0-0	3	3
D	222EICXXX	PROGRAM ELECTIVE 4	40	60	3-0-0	3	3
E	222EICXXX	INDUSTRY/INTERDISCIPLINARY ELECTIVE	40	60	3-0-0	3	3
S	222PIC100	MINI PROJECT	100	60	0-0-4	4	2
T	222LIC100	BIOMEDICAL SIGNAL AND IMAGE PROCESSING LAB	100	--	0-0-2	2	1
Total			400	300		21	18

Teaching Assistance: 6 hours



PROGRAM ELECTIVE 3

SLOT	SL NO	COURSE CODE	COURSE NAME	L-T-P	HOURS	CREDIT
C	1	222EIC031	MODERN CLINICAL ENGINEERING	3-0-0	3	3
	2	222EIC032	DATA ANALYTICS IN BIOMEDICAL ENGINEERING	3-0-0	3	3
	3	222EIC033	TIME SERIES ANALYSIS	3-0-0	3	3
	4	222EIC034	MEDICAL DEVICE DESIGN AND REGULATIONS	3-0-0	3	3
	5	222EIC035	TELEMEDICINE	3-0-0	3	3
	6	222EIC036	ADVANCED BIOMEDICAL IMAGE PROCESSING	3-0-0	3	3

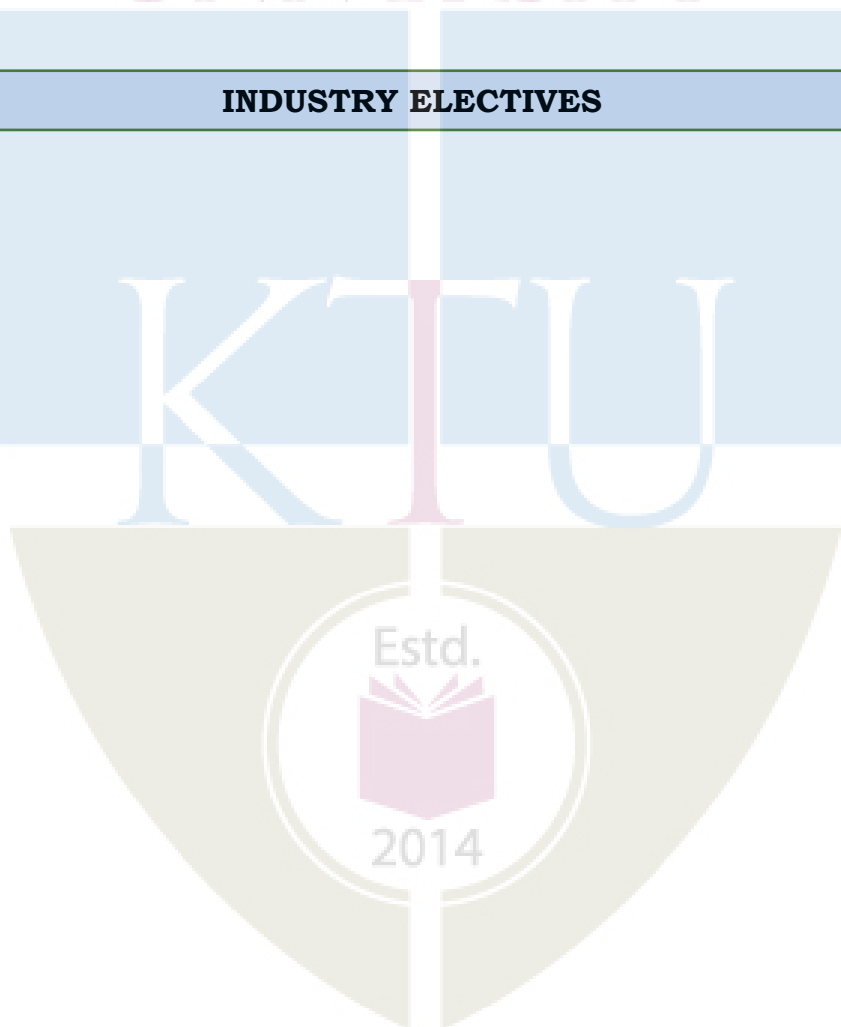
PROGRAM ELECTIVE 4

SLOT	SL NO	COURSE CODE	COURSE NAME	L-T-P	HOURS	CREDIT
D	1	222EIC041	ARTIFICIAL ORGANS AND IMPLANTS	3-0-0	3	3
	2	222EIC042	DEEP LEARNING TECHNIQUES	3-0-0	3	3
	3	222EIC043	ADVANCED SIGNAL PROCESSING FOR BIOMEDICAL ENGINEERS	3-0-0	3	3
	4	222EIC044	HOSPITAL PLANNING AND RISK MANAGEMENT	3-0-0	3	3
	5	222EIC045	EMBEDDED SYSTEMS AND IOT IN HEALTHCARE	3-0-0	3	3
	6	222EIC046	PHYSIOLOGICAL CONTROL SYSTEMS	3-0-0	3	3

INTERDISCIPLINARY ELECTIVE

SLOT	SL NO	COURSE CODE	COURSE NAME	L-T-P	HOURS	CREDIT
E	1	222EIC051	ASSISTIVE TECHNOLOGY AND REHABILITATION ENGINEERING	3-0-0	3	3
	2	222EIC052	ADVANCED SIGNAL PROCESSING FOR BIOMEDICAL ENGINEERS	3-0-0	3	3
	3	222EIC053	EMBEDDED SYSTEMS AND IOT IN HEALTHCARE	3-0-0	3	3

INDUSTRY ELECTIVES



SEMESTER III

SLO T	COURSE CODE	COURSE NAME	MARKS		L-T-P	HOUR S	CREDIT
			CIA	ESE			
TRACK 1							
A*	223MICXXX	MOOC	To be completed successfully		--	--	2
B	223AGEXXX	AUDIT COURSE	40	60	3-0-0	3	--
C	223IIC100	INTERNSHIP	50	50	--	--	3
D	223PIC100	DISSERTATION PHASE I	100	--	0-0-17	17	11
TRACK 2							
A*	223MICXXX	MOOC	To be completed successfully		--	--	2
B	223AGEXXX	AUDIT COURSE	40	60	3-0-0	3	--
C	223IIC100	INTERNSHIP	50	50	--	--	3
D	223PIC001	RESEARCH PROJECT PHASE I	100	--	0-0-17	17	11
Total			190	110		20	16

Teaching Assistance: 6 hours

*MOOC Course to be successfully completed before the commencement of fourth semester (starting from semester 1).



AUDIT COURSES

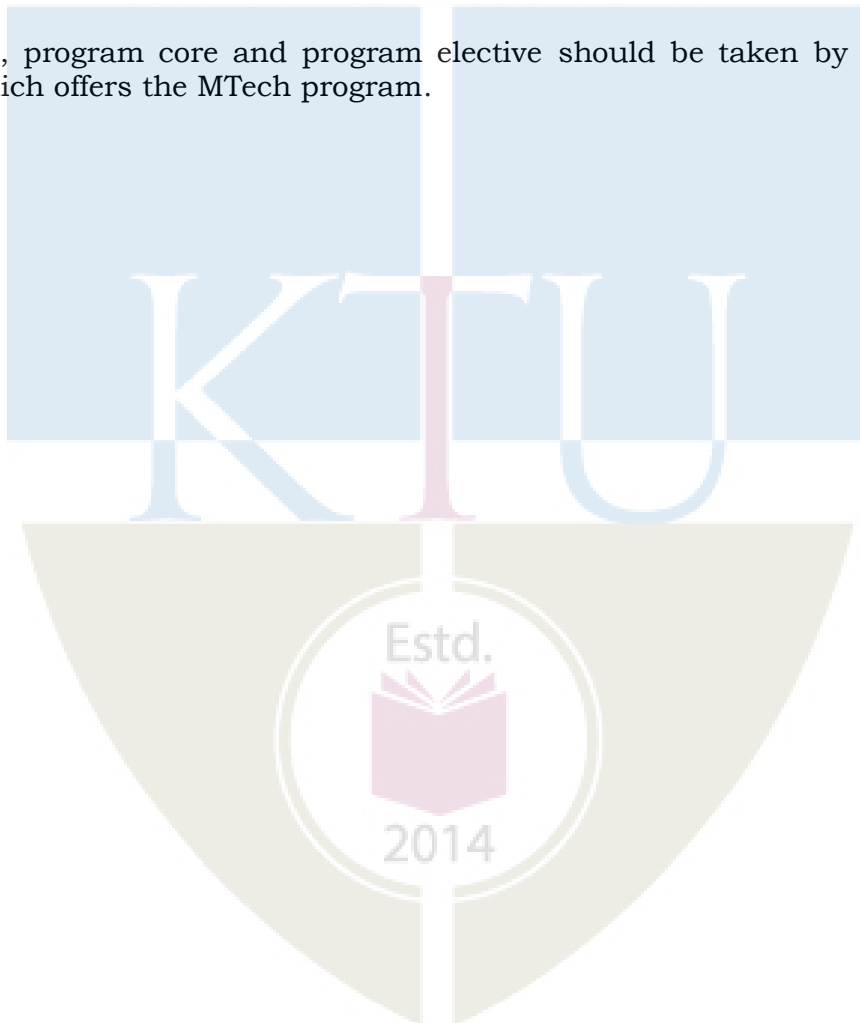
SLOT	SL NO	COURSE CODE	COURSE NAME	L-T-P	HOURS	CREDIT
B	1	223AGE100	ACADEMIC WRITING	3-0-0	3	--
	2	223AGE001	ADVANCED ENGINEERING MATERIALS	3-0-0	3	--
	3	223AGE002	FORENSIC ENGINEERING	3-0-0	3	--
	4	223AGE003	DATA SCIENCE FOR ENGINEERS	3-0-0	3	--
	5	223AGE004	DESIGN THINKING	3-0-0	3	--
	6	223AGE005	FUNCTIONAL PROGRAMMING IN HASKELL	3-0-0	3	--
	7	223AGE006	FRENCH LANGUAGE (A1 LEVEL)	3-0-0	3	--
	8	223AGE007	GERMAN LANGUAGE (A1 LEVEL)	3-0-0	3	--
	9	223AGE008	JAPANESE LANGUAGE (N5 LEVEL)	3-0-0	3	--
	10	223AGE009	PRINCIPLES OF AUTOMATION	3-0-0	3	--
	11	223AGE010	REUSE AND RECYCLE TECHNOLOGY	3-0-0	3	--
	12	223AGE011	SYSTEM MODELING	3-0-0	3	--
	13	223AGE012	EXPERT SYSTEMS	3-0-0	3	--

SEMESTER IV

SLO T	COURSE CODE	COURSE NAME	MARKS		L-T-P	HOUR S	CREDIT
			CIA	ESE			
TRACK 1							
A	224PIC100	DISSERTATION PHASE II	100	100	0-0-24	24	16
TRACK 2							
A	224PIC001	RESEARCH PROJECT PHASE II	100	100	0-0-24	24	16
Total			100	100		24	16

Teaching Assistance: 5 hours

Discipline core, program core and program elective should be taken by faculties of the department which offers the MTech program.



ASSESSMENT PATTERN

(i) CORE 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

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 shall include minimum 80% of the syllabus

End Semester Examination: 60 marks

The end semester examination will be conducted by the University. There will be two parts; Part A and Part B. Part A 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 reviewed

Original 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 will be conducted by the respective College. There will be 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 for each 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 COURSE

Continuous 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 by the respective College. The examination will be 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 senior faculty 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. Interdisciplinary knowledge 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 interdisciplinary 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

Test paper, 1 no. : 10 marks

Test paper shall include minimum 80% of the syllabus.

End Semester Examination: 60 marks

The end semester examination will be conducted by the respective College. There will be 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.

(vi). MOOC COURSES

The MOOC course 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. The students can do the MOOC according to

their convenience, but shall complete it by third semester. The list of MOOC courses will be provided by the concerned BoS if at least 70% of the course content match with the area/stream of study. The course shall not be considered if its content has more than 50% of overlap with a core/elective course in the concerned discipline or with an open elective.

MOOC Course 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 respective agency 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 with PG Programme Coordinator that should lead to their dissertation/research project. Demonstrate the novelty of the project through the results and outputs. The progress of the mini 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 knowledge and 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 MTech 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 (specifically prohibited by University Policy).

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 the tutorial 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 be friendly 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 details of 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 the experiment, its importance, its relevance to the theory they have studied in the class, ask the students suitable questions to know their 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.

Students should refer the MTech 2022 regulations for further details.

