B.S. Abdur Rahman®
Crescent
Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2025
Curriculum and Syllabi
(As approved by the 24th Academic Council)
August - 2025

M.Tech. (CAD-CAM)

B.S. Abdur Rahman® Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2025 CURRICULUM AND SYLLABI

(As approved by 24th Academic Council)

August - 2025

M.TECH. CAD-CAM

VISION AND MISSION OF THE INSTITUTION

VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio- Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION AND MISSION

VISION

To excel in providing quality education and training through Undergraduate and Postgraduate programs and carryout quality research in the field of Mechanical Engineering.

MISSION

- To provide a good learning experience through appropriate design of curriculum and syllabi that facilitate students to gain thorough understanding of the fundamental concepts and applications in Mechanical Engineering
- To equip students to solve challenging problems in Mechanical Engineering and related areas taking in to account their impact on the society
- To facilitate students to develop good communication, leadership and managerial skills through team approach in conducting experiments and projects
- To pursue academic and collaborative research activities with industry and other research institutions ensuring high quality in publications and other research outputs

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES
M.Tech. (CAD – CAM)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To provide a holistic approach in learning through well designed courses involving fundamental concepts and state-of-the-art techniques in the field of CAD – CAM
- To equip the graduates, with knowledge and skill to undertake design, analysis, evaluation of systems, processes and components
- To supplement course work through seminars, workshops, case studies, value added programmes and through paper presentation
- To inculcate research culture by way of solving typical problems, Project works from real life situation and innovative assignments
- To develop team spirit, problem solving skill and appreciation for ethical and social relevance of the technologies used

PROGRAMME OUTCOMES

Graduates will be able to

- Apply the knowledge of mechanical engineering fundamentals, and specialization in CAD-CAM to solve complex engineering problems.
- Identify, formulate, review literature, and analyze complex engineering problems to arrive at substantiated conclusions using principles of mathematics and mechanical engineering sciences.
- Design solutions for engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, society, culture and environment.
- Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- Create, select, and apply appropriate techniques, resources, and modern engineering tools including prediction and modelling to engineering

activities with an understanding of the limitations.

- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work to manage projects.
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES:

Graduates will be able to

- Design, analyse and manufacture real life components and systems using latest software in the field of computer aided design and computer aided manufacturing.
- Undertake academic and research role to address open ended problems with conceptual knowledge and computational skill in the area of design and manufacturing.

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY, CHENNAI – 600 048.

REGULATIONS 2025

M.Tech. / MCA / M.Sc. / M.Com. / M.A. DEGREE PROGRAMMES

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i) **"Programme"** means post graduate degree programme (M.Tech. / MCA / M.Sc. / M.Com. / M.A.)

ii) **"Branch"** means specialization or discipline of programme like M.Tech. in Structural Engineering, Food Biotechnology etc., M.Sc. in Physics, Chemistry, Actuarial Science, Biotechnology etc.

iii) **"Course"** means a theory / practical / laboratory integrated theory / mini project / seminar / internship / project and any other subject that is normally studied in a semester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting, Analytical Chemistry, etc.

iv) **"Institution"** means B.S. Abdur Rahman Crescent Institute of Science and Technology.

v) **"Academic Council"** means the Academic Council, which is the apex body on all academic matters of this Institute.

vi) **"Dean (Academic Affairs)"** means the Dean (Academic Affairs) of the Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.

vii) **"Dean (Student Affairs**)" means the Dean (Students Affairs) of the Institution who is responsible for activities related to student welfare, conduct of co-curricular, extra-curricular events and discipline in the campus.

viii)**"Controller of Examinations"** means the Controller of Examinations of the Institution who is responsible for the conduct of examinations and declaration of results.

ix) **"Dean of the School"** means the Dean of the School of the department concerned.

x) **"Head of the Department"** means the Head of the Department concerned.

2.0 ADMISSION REQUIREMENTS

2.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination as specified in the clause 3.2 [Eligible entry qualifications for admission to programmes] of this Institution or any other University or authority accepted by this Institution.

2.2 The other conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by the Institution from time to time.

3.0 BRANCHES OF STUDY

3.1 The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	
M.Com.	
M.A.	

3.2 Programmes offered

S. No.	Name of the Department	Programmes offered
1.	Aeronautical Engineering	M.Tech. (Avionics)
2.	Civil Engineering	M.Tech. (Structural Engineering)
		M. Tech. (Construction Engineering and Project Management)
3.	Mechanical Engineering	M.Tech. (CAD/CAM)

S. No.	Name of the Department	Programmes offered
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engineering)
5.	Electronics and Communication Engineering	M.Tech. (VLSI and Embedded Systems)
6.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)
		M.Tech. (Artificial Intelligence and Data Science)
7.	Information Technology	M.Tech. (Information Technology)
8.	Computer Applications	MCA
9.	Mathematics	M.Sc. (Actuarial Science)
10.	Physics	M.Sc.(Physics)
11.	Chemistry	M.Sc.(Chemistry)
12.	Life Sciences	M.Sc. Biochemistry & Molecular Biology
		M.Sc. Biotechnology
		M.Sc. Microbiology
		M.Sc. Stem Cell Technology
		M.Sc. Clinical Embryology
		M.Tech. Biotechnology
		M.Tech. Food Biotechnology
13.	Commerce	M.Com
14.	Arabic and Islamic Studies	M.A. Islamic Studies

3.3 Eligible entry qualifications for admission to programmes

Sl. No.	Programme	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
1.	M.Tech. (Avionics)	B.E. / B.Tech. in Aeronautical Engineering / Aerospace Engineering / Mechanical

Sl. No.	Programme	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
		Engineering / Mechatronics / EEE / ECE / EIE / or Equivalent degree in relevant field.
2.	M.Tech. (Structural Engineering)	B.E. / B.Tech. in Civil Engineering / Structural Engineering or Equivalent degree in relevant field.
	M. Tech. (Construction Engineering and Project Management)	B.Tech. in Mechanical / Civil / Electrical and Electronics / Geo Informatics / B Plan / B. Des, and B.Arch.
3.	M.Tech. (CAD/CAM)	B.E. / B.Tech. in Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace / Aeronautical / Material Science / Polymer / Plastics / Marine Engineering or Equivalent degree in relevant field.
4.	M.Tech. (Power Systems Engineering)	B.E. / B.Tech. in EEE / ECE / EIE / ICE / Electronics / Instrumentation Engineering or Equivalent degree in relevant field.
5.	M.Tech. (VLSI and Embedded Systems)	B.E. / B.Tech. in ECE / EIE / ICE / EEE / IT or Equivalent degree in relevant field.
6.	M.Tech. (Computer Science and Engineering)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
	M.Tech. (Artificial Intelligence and Data Science)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
7.	M.Tech. (Information Technology)	B.E. / B.Tech. in IT / CSE / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
8.	MCA	BCA / B.Sc. Computer Science / B.E. / B.Tech. / B.Sc. Mathematics, B.Sc. Physics / Chemistry / B.Com. / BBA / B.A. with Mathematics at graduation level or at 10 + 2level or equivalent degree in relevant field.

Sl. No.	Programme	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
9.	M.Sc. (Actuarial Science)	Any under graduate degree with Mathematics / Statistics as one of the subjects of study at 10 + 2 level.
10.	M.Sc.(Physics)	B.Sc. in Physics / Applied Science / Electronics /Electronics Science / Electronics & Instrumentation or Equivalent degree in relevant field.
11.	M.Sc.(Chemistry)	B.Sc. in Chemistry / Applied Science or Equivalent degree in relevant field.
12.	M.Sc. Biochemistry & Molecular Biology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Sc. Biotechnology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Sc. Microbiology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Sc. Stem Cell Technology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Sc. Clinical Embryology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Tech. Biotechnology	B.Tech. / B.E. in Biotechnology or Equivalent degree in relevant field.
	M.Tech. Food Biotechnology	B.E. / B.Tech. in Biotechnology / Food Biotechnology / Chemical Engineering / Biochemical Engineering / Industrial

Sl. No.	Programme	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
		Biotechnology or Equivalent degree in relevant field.
13. .	M.Com	B.Com. / BBA
14. .	M.A. Islamic Studies	B.A. in Islamic Studies / Arabic (or) Afzal-ul-Ulama (or) Any under graduate degree with Part 1 Arabic (or) Any under graduate degree with Aalim Sanad / Diploma / Certificate in Arabic or Islamic Studies.

4.0. STRUCTURE OF THE PROGRAMME

4.1. The PG. programmes consist of the following components as prescribed in the respective curriculum:

i. Core courses

ii. Elective courses

iii. Laboratory integrated theory courses

iv. Project work

v. Laboratory courses

vi. Open elective courses

vii. Seminar

viii. Mini Project

ix. Industry Internship

x. MOOC courses (NPTEL- Swayam, Coursera etc.)

xi. Value added courses

4.1.1. The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

4.1.2. For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

4.1.3. The curriculum of programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Range of credits
M.Tech.	80 - 86
MCA	80 - 86
M.Sc.	80 - 85
M.Com.	80 - 88
M.A.	80 - 84

4.1.4. Credits will be assigned to the courses for all programmes as given below:

- ❖ One credit for one lecture period per week or 15 periods of lecture per semester.
- ❖ One credit for one tutorial period per week or 15 periods per semester.
- ❖ One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester.
- ❖ One credit for 160 hours of industry internship per semester for all programmes (except M.Com.)
- ❖ Four credits for 160 hours of industry internship per semester for M.Com.

4.1.5. The number of credits the student shall enroll in a non-project semester and project semester is as specified below to facilitate implementation of Choice Based Credit System.

Programme	Non-project semester	Project semester
M.Tech.	9 to 32	18 to 26
MCA	9 to 32	18 to 26
M.Sc.	9 to 32	10 to 26
M.Com.	9 to 32	16 to 28

M.A.	9 to 32	NA

4.1.6 The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

4.1.7 The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

4.1.8 Apart from the various elective courses listed in the curriculum for each specialization of programme, the student can choose a maximum of two electives from any other similar programmes across departments, alter to open electives, during the entire period of study, with approval of Head of the department offering the course and parent department.

4.1.9. Online courses

Students are permitted to undergo department approved online courses under SWAYAM up to 40% of credits of courses in a semester excluding project semester (in case of M.Tech. M.Sc. & MCA programmes) with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

Students shall undergo project related online course on their own with the mentoring of the project supervisor.

3.5 Project work

3.5.1 Project work shall be carried out by the student under the supervision of a faculty member in the department with similar specialization.

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research organization, with the approval of the Head of the Department/ Dean of School. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist / Competent authority from the organization and the student shall be instructed to meet the faculty periodically and to attend the review meetings for evaluating the progress.

3.5.3 The timeline for submission of final project report / dissertation is within 30 calendar days from the last instructional day of the semester in which project is done.

3.5.4 If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work and shall re-register in the subsequent semester.

5.0 DURATION OF THE PROGRAMME

5.1. The minimum and maximum period for completion of the programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech.	4	8
MCA	4	8
M.Sc.	4	8
M.Com.	4	8
M.A.	4	8

5.2 Each academic semester shall normally comprise of 90 working days. Semester end examinations shall follow within 10 days of the last Instructional day.

5.3 Medium of instruction, examinations and project report shall be in English.

6.0 REGISTRATION AND ENROLLMENT

6.1 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees. For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

6.2 Change of a Elective Course

A student can change an enrolled elective course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

6.3 Withdrawal from a Course

A student can withdraw from an enrolled course at any time before the first continuous assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

6.4 A student can enroll for a maximum of 36 credits during a semester including Redo / Predo courses.

7.0 BREAK OF STUDY FROM PROGRAMME

7.1 A student may be allowed / enforced to take a break of study for two semesters from the programme with the approval of Dean (Academic Affairs) for the following reasons:

7.1.1 Medical or other valid grounds

7.1.2 Award of 'I' grade in all the courses in a semester due to lack of attendance

7.1.3 Debarred due to any act of indiscipline

7.2 The total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

7.3 A student who has availed a break of study in the current semester (odd/even) can rejoin only in the subsequent corresponding (odd/even) semester in the next academic year on approval from the Dean (Academic affairs).

7.4 During the break of study, the student shall not be allowed to attend any regular classes or participate in any activities of the Institution. However, he / she shall be permitted to enroll for the 'I' grade courses and appear for the arrear examinations.

8.0 CLASS ADVISOR AND FACULTY ADVISOR

8.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD/ Dean of School as Class Advisor for the class throughout their period of study.

The class advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

8.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling, the Head of the Department / Dean of School of the students shall attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

9.0 COURSE COMMITTEE

9.1 Each common theory / laboratory course offered to more than one group of students shall have a “Course Committee” comprising all the teachers handling the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

10.0 CLASS COMMITTEE

10.1 A class committee comprising faculty members handling the courses, student representatives and a senior faculty member not handling any courses for that class as chairman will be constituted in every semester:

10.2 The composition of the class committee will be as follows:

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

ii) Faculty members of all courses of the semester

iii) All the students of the class

iv) Faculty advisor and class advisor

v) Head of the Department – Ex officio member

10.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

10.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabi of courses.

10.5 The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

11.0 CREDIT REQUIREMENTS TO REGISTER FOR PROJECT WORK

11.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum no. of credits to be earned to enroll for project semester
M.Tech.	18
MCA	22
M.Sc.	18
M.Com	NA
M.A.	NA

11.2 If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the extent of

minimum credits specified in clause 9.1 and then register for the project semester.

12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Weightage of Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

12.2 Theory Course

Appearing for semester end theory examination for each course is mandatory and a student shall secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

12.3 Laboratory Course

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However, a student shall have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.4 Laboratory Integrated Theory (LIT) Courses

For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component (for a 4 credit LIT Course). Grading shall be done for this consolidated mark. Assessment of theory components shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a

separate minimum of 40% in the semester end theory examination. The evaluation of practical components shall be through continuous assessment.

Component	Maximum Marks	Weightage for Final Grade	Mode of Assessment
Theory Component	100	75%	CAT1 (25%) + CAT2 (25%) + SEE (50%)
Practical Component	100	25%	Continuous assessment only
Final Grade Basis	Consolidated	100%	75% Theory + 25% Practical
Pass Requirement	-	-	Minimum 40% in Semester-End Theory Exam (SEE)

Note:

1. Proportionate weightage shall be assigned to LIT courses based on their credit value, whether 2 or 3 credits.
2. In Lab-Integrated Professional Elective courses, the laboratory component shall be assessed by the course faculty.

12.5 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.6 Industry Internship

In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research / academic organisation. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.

12.7 Project Work

Mini project work, shall be carried out individually or as a group activity involving a maximum of three students.

Each group shall identify a suitable topic within their domain, either

disciplinary or interdisciplinary, based on the students' abilities and in consultation with the faculty mentor. The topic must lead to the development of a small-scale system or application.

The progress of the mini project shall be evaluated through three periodic reviews: two interim reviews and one final review. A project report shall be submitted by the end of the semester. The reviews shall be conducted by a committee of faculty members constituted by the Head of the Department / Dean of the School.

An oral examination (viva voce) shall be conducted as the semester-end examination by an internal examiner approved by the Controller of Examinations, based on the project report.

The weightage for assessment shall be as follows:

• Periodic Reviews: 50%

- 25% by the Project Guide
- 25% by the Review Committee

• Project Report: 20%

• Viva Voce Examination: 30%

The Project shall be carried out individually or as a group activity, involving a maximum of two or three students.

A committee of faculty members, constituted by the Head of the Department / Dean of the School, shall conduct three periodic reviews during the semester to monitor and assess the progress of the project.

At the end of the semester, students shall submit a project report, based on which a semester-end oral examination (viva voce) shall be conducted by an external examiner approved by the Controller of Examinations.

The assessment weightage shall be as follows:

• Periodic Reviews – 50%

- 25% by the Project Guide
- 25% by the Review Committee

• Project Report – 20%

• Viva Voce Examination – 30%

12.8 The assessment of seminar course including its component and its weightage shall be decided by a committee of faculty members constituted by the Head of the Department. This committee shall ensure the conduct of assessment of components and award marks accordingly.

12.9 **For the first attempt of the arrear theory examination**, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end examination for theory component. **There shall be no arrear or improvement examination for lab components**.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of School for that purpose. However, there is no substitute examination for semester end examination.

13.2 A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However, the substitute examination will be conducted only after the last working day of the semester and before the semester end examination.

14.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION

14.1 A student shall earn 100% attendance in the scheduled contact hours (such as lectures, tutorials, labs, etc.) for that course. However, a relaxation of up to 25% in attendance may be granted to account for valid reasons such as medical emergencies, participation in co-curricular or extracurricular activities with prior approval, or other genuine circumstances.

If a student's attendance falls below 75% in a particular course, even after considering the permissible relaxation, they will not be allowed to appear for the semester-end examination in that course. Instead, the student will be awarded an “I” grade (Incomplete) for the course

14.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in the concerned course to the class advisor. The class advisor shall consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of the School. Thereupon, the Dean (Academic Affairs) shall officially notify the names of such students prevented from writing the semester end examination in each course.

14.3 If a student’s attendance in any course falls between 65% and 75% due to medical reasons (e.g., hospitalization, illness) or participation in institution-approved events, they may be granted exemption from the minimum attendance requirement and allowed to appear for the semester-end exam. The student must submit valid documents to the class advisor upon rejoining, with approval from the HoD/Dean. Final approval for **condonation** will be granted by the Vice Chancellor based on the Dean (Academic Affairs)’s recommendation.

14.4 A student who has obtained an “I” grade in all the courses in a semester is not permitted to move to the next higher semester. Such students shall **repeat** all the courses of the semester in the subsequent academic year. However, he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

14.5 The student awarded “I” grade, shall enroll and repeat the course when it is offered next. In case of “I” grade in an elective course either the same

elective course may be repeated or a new elective course may be taken with the approval of the Head of the Department / Dean of the School.

14.6 A student who is awarded "U" grade in a course shall have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to **redo** the course when the course is offered by the department. Marks scored in the continuous assessment in the redo course shall be considered for grading along with the marks scored in the semester end (redo) examination. If any student obtains "U" grade in the redo course, the marks scored in the continuous assessment test (redo) for that course shall be considered as internal mark for further appearance of arrear examination.

14.7 If a student with "U" grade, who **prefers to redo** any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she is not permitted to write the semester end examination and his / her earlier "U" grade and continuous assessment marks shall continue.

15.0 REDO / PRE-DO COURSES

15.1 A student can register for a maximum of three redo courses per semester without affecting the regular semester classes, whenever such courses are offered by the concerned department, based on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

15.2 The number of contact hours and the assessment procedure for any redo course shall be the same as regular courses, except there is **no provision for any substitute examination and withdrawal from a redo course**.

15.3 A student shall be permitted to pre-do a course offered by the concerned department, provided it does not affect the regular semester class schedule. Such permission shall be granted based on the availability of faculty members, the maximum permissible credit limit of the semester, and the student's fulfillment of the necessary prerequisites for the course. The proposal shall be recommended by

the Dean of the School and the Head of the Department, and shall require final approval from the Dean (Academic Affairs).

16.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

16.1 All assessments of a course shall be made on absolute marks basis. The class committee without the student members shall meet to analyse the performance of students in all assessments of a course and award letter grades following the relative grading system. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	-
I	-
PA	-
FA	-

"W"- denotes withdrawal from the course

“I” - denotes “Incomplete” ie. inadequate attendance in the course and prevention from appearance of semester end examination

“U” - denotes unsuccessful performance in the course.

“PA” - denotes the ‘Pass’ of the zero credit courses.

“FA” - denotes the ‘Fail’ of the zero credit courses.

16.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be **repeated by the student for improvement of grade**.

16.3 Upon awarding grades, the results shall be endorsed by the chairman of the class committee and Head of the Department / Dean of the School. The Controller of Examinations shall further approve and declare the results.

16.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to the Controller of Examinations. Subsequently, the Head of the Department / Dean of the School offered the course shall constitute a revaluation committee consisting of chairman of the class committee as convener, the faculty member of the course and a senior faculty member having expertise in that course as members. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

16.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the i^{th} course and GP_i is the Grade Point in the i^{th} course,

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

"I", "W", "PA" and **"FA"** grades are excluded for calculating GPA.

"U", "I", "W", "PA" and **"FA"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks shall be as follows:

Percentage equivalent of marks = CGPA X 10

16.6 After successful completion of the programme, the degree shall be awarded to the students with the following classifications based on CGPA.

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the prescribed period of 8 semesters for all students (except lateral entry students) and 6 semesters for lateral entry students
First Class	6.50 and above and completing the programme within a maximum of 10 semesters for all students (except lateral entry students) and 8 semesters for lateral entry students
Second Class	Others

16.6.1 Eligibility for First Class with Distinction

- A student should not have obtained ‘U’ or ‘I’ grade in any course during his/her study
- A student should have completed the UG programme within the minimum prescribed period of study (except clause 7.1.1)

16.6.2 Eligibility for First Class

- A student should have passed the examination in all the courses not more than two semesters beyond the minimum prescribed period of study (except clause 7.1.1)

16.6.3 The students who do not satisfy clause 16.6.1 and clause 16.6.2 shall be classified as second class.

16.6.4 The CGPA shall be rounded to two decimal places for the purpose of classification. The CGPA shall be considered up to three decimal places for the purpose of comparison of performance of students and ranking.

17.0 SUPPLEMENTARY EXAMINATION

Final year students and passed out students can apply for supplementary examination for a maximum of **three** courses thus providing an opportunity to complete their degree programme. Likewise, students with less credit can also apply for supplementary examination for a maximum of **three** courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semesters.

18.0 DISCIPLINE

18.1 Every student is expected to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

18.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the Head of the Department / Dean of the School concerned shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

19.0 MULTI ENTRY AND MULTI EXIT (MEME) FRAMEWORK *

In accordance with the provisions of the National Education Policy (NEP) 2020, the programme shall support a Multi Entry – Multi Exit (ME-ME) framework to provide flexibility in the academic pathway of students.

*** At present (AY 2025-26), it is applicable only for all M.Tech. Programmes.**

19.1. Exit Option:

19.1.1 Credit Requirement for Award of M.Tech. Degree

To qualify for the award of a M.Tech. degree from the Institute, a student must successfully complete the total credit requirements as prescribed in the approved curriculum of the respective programme. The specific credit requirements are determined by the programme curriculum.

19.1.2 Provision for Multiple Exit

In alignment with NEP 2020 guidelines, the Institute provides students enrolled in postgraduate programmes with the option of multiple exits, subject to the following conditions:

a. Exit at the End of First Year

Students may choose to exit the programme at the end of the first year, provided they have fulfilled the prescribed academic requirements.

b. Application for Exit

A student intending to exit must submit a formal written application in the prescribed format at least **eight weeks prior to the scheduled end of the academic year.**

c. Departmental Recommendation

1. Upon receipt of the application, the concerned Department shall evaluate the academic record of the student and recommend the award of a **Post Graduate Diploma**, based on the credits earned.

2. In the case of arrear courses, the post graduate diploma will be conferred only after successful clearance of all pending arrears.

d. Notification of Completion

Once a student has fulfilled the requirements for the award of post graduate diploma, the Department shall notify the same to controller of examinations for further processing and issuance.

19.1.3 Award of Qualifications under Multiple Exit Scheme

Post graduate diploma: Awarded after successful completion of the first year, subject to earning the prescribed cumulative credits as per the respective programme curriculum (e.g., 44 credits from the first year) along with 3 credits of Skill Based Courses.

19.1.4 Conditions Governing Exit

1. The multiple exit facility is intended strictly for **genuine and exceptional circumstances,** such as prolonged illness, or securing an employment opportunity necessitating a temporary withdrawal from the programme.

2. Students opting for a temporary exit after the first year must obtain **prior approval from the Registrar through Dean (Academics),** based on the recommendation of the respective Head of the Department.

19.1.5 Expectation of Programme Continuity

While the option for multiple exits exists, it is generally expected that students admitted to a post graduate programme shall pursue their studies continuously until completion of the final degree

requirements.

19.2. Entry Option:

Students seeking re-entry into the programme (multi-entry) must submit an application through the proper channel at the beginning of the odd semester. Admission shall be subject to fulfilment of institutional guidelines, credit mapping, and availability of seats.

19.3. Credits Requirement for the Certifications

Name of the Certificate Programme	Required Credits
Post graduate Diploma (Level 6.5 as per NEP 2020)	40* - 45

* The minimum number of credits that a student must earn (as per the respective curriculum) in order to get the above certification program

20.0 ELIGIBILITY FOR THE AWARD OF THE MASTER'S DEGREE

20.1 A student shall be declared to be eligible for the award of the Master's Degree, if he/she has:

i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the maximum period of 8 semesters from the date of admission, including break of study.

ii. No disciplinary action is pending against him/her.

iii. Enrolled and completed at least one value added course.

iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

20.2 The award of the degree must have been approved by the Institute.

21.0 POWER TO MODIFY

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

REGULATIONS 2025

CURRICULUM & SYLLABI FOR

M. TECH. (CAD-CAM)

(Choice Based Credit System)

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MAF 6182	Differential Equations and Numerical Methods	3	1	0	4
2.	MEF 6101	Computer Graphics and Geometric Modelling	2	0	2	3
3.	MEF 6102	Advanced Computer Aided Manufacturing	2	0	2	3
4.	MEF 6103	Smart Manufacturing	3	0	0	3
5.		Professional Elective Courses	3	0	0	3
6.	MEF 6104	Product Design and Life Cycle Management	3	0	0	3
		Credits				**19**

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1.	**GEF 6201**	Research Methodology and IPR for Engineers	2	0	0	2
2.	MEF 6201	Additive Manufacturing	2	0	2	3
3.	MEF 6202	Advanced Finite Element Analysis	3	0	2	4
4.	MEF 6203	Advanced Materials	3	0	0	3
5.		Professional communication	0	0	2	1
6.		Professional Elective Courses				6
7.	MEF 6204	Mini Project				3
		Credits				**22**

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1.		Open Elective	3	0	0	3
2.	MEF 7101	AI and ML	2	0	2	3
3.		Professional Elective Courses				6
4.	MEF 7102	Project Work - Phase I #				8
5.	MEF 7103	Industry Internship *	0	0	4	2
6.		MOOC (Related to project) **				-
		Credits				**14**

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MEF 7102	Project Work-Phase II				18
		Credits		**8+18=26**		

Overall Total Credits – 81

* Industrial training will be undertaken during the summer vacation of first-year for 30 days. The credit will be awarded in the 3rd Semester.

\# Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

** The students shall pursue a MOOC course related to the project in the third semester, and the progress in this regard shall be monitored during Project Phase – I reviews.

Enrollment and completed at least one value-added course is mandatory.

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LIST OF PROFESSIONAL ELECTIVE COURSES

Semester I

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MEFY 01	Advanced Manufacturing Technology	3	0	0	3
2.	MEFY 02	Automotive Manufacturing	3	0	0	3
3.	MEFY 03	Measurements and NDT	3	0	0	3
4.	MEFY 04	Design of Hydraulic and Pneumatic Systems	3	0	0	3

Semester II

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MEFY 11	Advanced Tool Design	3	0	0	3
2.	MEFY 12	Industrial Robotics and Flexible Automation	3	0	0	3
3.	MEFY 13	Optimization Techniques and Applications	3	0	0	3
4.	MEFY 14	Tribology	3	0	0	3
5.	MEFY 15	Precision Engineering	3	0	0	3
6.	MEFY 16	Design and Manufacturing of MEMS	3	0	0	3
7.	MEFY 17	Composite Materials	3	0	0	3

Semester III

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MEFY 21	Fracture Mechanics	3	0	0	3
2.	MEFY 22	Data Communications in CAD/CAM	3	0	0	3
3.	MEFY 23	Industrial Safety	3	0	0	3
4.	MEFY 24	Manufacturing Information Systems	3	0	0	3
5.	MEFY 25	Design of Material Handling Equipment	3	0	0	3
6.	MEFY 26	Computational Fluid Dynamics	3	0	0	3
7.	MEFY 27	Design for Manufacture and Assembly	3	0	0	3

SEMESTER I

MAF 6182	**DIFFERENTIAL EQUATIONS AND**	**L**	**T**	**P**	**C**
SDG: 4	**NUMERICAL METHODS**	**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

COB1: To introduce boundary value problems of partial differential equations relevant to engineering applications.

COB2: To equip students with the foundational knowledge of calculus of variations and its engineering applications.

COB3: To estimate coefficients using linear combinations through interpolation and integration methods.

COB4: To familiarize students with numerical interpolation and integration techniques for solving real-world problems.

COB5: To impart the mathematical understanding and applications of conformal mappings in physical problems.

MODULE I ONE DIMENSIONAL WAVE AND HEAT EQUATIONS 9+3

Laplace transformation for one dimensional wave equation – Displacements in a line string – Longitudinal vibration of an elastic bar – Fourier transformation for one dimensional heat conduction problems in infinite and semi-infinite rods.

MODULE II CALCULUS OF VARIATIONS 9+3

Variation and its properties – Euler’s equation – Functional dependent on first and higher order derivatives – Functional dependent on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems.

MODULE III INTERPOLATION AND NUMERICAL INTEGRATION 9+3

Cubic Spline Interpolation – Newton Cotes formulas – Trapezoidal, Simpson’s one third and three eighth rules – Gaussian quadrature formulae – Double integration.

MODULE IV NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Solution of Laplace and Poisson equations by Liebmann's method – Diffusion

equation by explicit and implicit methods – Stability and convergence criterion – Wave equation by explicit scheme.

MODULE V CONFORMAL MAPPING AND APPLICATIONS 9+3

The Schwarz-Christoffel transformation – Transformation of boundaries in parametric form – Physical applications – Fluid flow and heat flow problems.

L – 45; T – 15; Total Hours:60

TEXT BOOKS:

1. Curtis F. Gerald and Patrick O. Wheatley, "Applied Numerical Analysis", 7th Edition, Pearson Publications, USA, 2003.
2. S.K. Gupta, "Numerical Methods for Engineers", New Age International Publishers (Earlier: Wiley Eastern, New Delhi), 2nd Edition, 2010.
3. Sankar Rao, "Introduction to Partial Differential Equations", 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Lev Elsgolts, "Differential Equations and Calculus of Variations", University Press of the Pacific, 2003.

REFERENCES:

1. Ian N. Sneddon, "Elements of Partial Differential Equations", Dover reprint (c. 2004), 1986.
2. A.S. Gupta, "Calculus of Variations with Applications", 2nd Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2003.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, Singapore, 2011.
4. Darel W. Hardy, Fred Richman, Carol L. Walker, "Applied Algebra: Codes, Ciphers, and Discrete Algorithms", 2nd Edition, CRC Press, New York, 2009.

COURSE OUTCOMES: At the end of the course students will be able to

CO1: apply Fourier transform techniques to solve one-dimensional wave and heat conduction problems.

CO2: formulate and analyze variational problems using Euler's equations and related methods.

CO3: use interpolation and numerical integration techniques to solve

engineering problems.

CO4: solve partial differential equations numerically using finite difference methods and analyze stability.

CO5: apply conformal mapping techniques to model and analyze problems in fluid flow and heat transfer.

Board Of Studies (BOS):
17th BOS of Department of Mathematics and Actuarial Science held on 23.06.2025.

Academic Council:
24th AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-

*** Legend: L – Low (1), M – Medium (2), H – High (3).**

SDG 4 – Quality Education: Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Statement : Ensure inclusive and equitable quality education and promote lifelong opportunities for all. learning of Fourier transform, numerical methods and calculus of variations will lead to knowledge of applications in CAD-CAM.

MEF 6101	COMPUTER GRAPHICS AND	L	T	P	C
SDG: 9	GEOMETRIC MODELLING	2	0	2	3

COURSE OBJECTIVES:

COB1: To introduce the working principles of display devices and the transformation of primitives

COB2: To inculcate the concepts of curves and surfaces generation

COB3: To impart knowledge on the modelling of solids

COB4: To familiarize with modern techniques such as shading, rendering, standards, collaborative design and AR/VR

MODULE I PRIMITIVE GENERATION AND MANIPULATION **L: 07 T: 0 P: 04**

Overview of display devices and systems – Raster scanning – Basic primitives – Generation of primitives – 2D and 3D transformation –Viewing transformation – Projections.

Hands-on Practice

1. Detail drawing of a product with different views.

MODULE II MODELLING OF CURVES AND SURFACES **L: 08 T: 0 P: 06**

Parametric representation – Analytic curves - Synthetic curves: Bicubic, Bezier, B-spline – Continuity conditions – Surfaces: surface patches, Bicubic, Bezier, B-spline, Coons patch – Sweep surfaces.

Hands-on Practice

1. Wireframe model of a Truss
2. Surface model of a water bottle.

MODULE III MODELLING OF SOLIDS **L: 08 T: 0 P: 12**

Fundamentals of Solid modelling – Geometry and topology – Half spaces – Boundary representation (B-rep.) – Constructive Solid Geometry (CSG) – Sweeps – Binary Space Partitioning - Voxel Representation - Feature

representation - Constraints - Parametric relations - Data associativity - Assembly Modelling.

Hands-on Practice

1. Solid Modeling of a real-world product.
2. Assembly of a product.
3. Data associativity between CAD model & assembly.
4. Parametric Modelling of standard components like Bolt & Nut.

MODULE IV	MODERN TECHNIQUES IN COMPUTER GRPAHICS	L: 07	T: 0	P: 08

Introduction to hidden line removal – Shading and rendering – Graphic standards – Product lifecycle management (PLM) - Collaborative design - Computer Graphics in Augmented Reality (AR) and Virtual Reality (VR).

Hands-on Practice

1. Exporting CAD model to another software using standards.
2. Shading & Rendering of a real-life component.
3. Apply AR & VR techniques for a product.

L – 30; T – 0; P – 30; Total Hours – 60

TEXT BOOKS:

1. Ibrahim Zeid, Mastering CAD / CAM, Mc Graw Hill Education Pvt. Limited, Second Edition, 2007.

REFERENCES:

1. Foley, Wan Dam, Feiner and Hughes - "Computer Graphics: Principles & Practice" Pearson Education India - 2013
2. P.N. Rao, “CAD / CAM Principles and Applications” - Tata Mc.Graw Hill, Third Edition, 2017
3. Donald Hearn and Pauline Baker, Computer Graphics – C version, Pearson Education, Second Edition, 2014.
4. Chris Mc Mahon and Jimmie Browne, CAD CAM – Principles, Practice and Manufacturing Management, Pearson Education Asia Ltd, Second Edition, 2005.

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1:	Explain the working principle of display devices and compute the transformation of basic primitives
CO2:	Present an overview on mathematical techniques used for curve and surface modelling
CO3:	Demonstrate basic knowledge on the solid modelling techniques
CO4:	Elucidate modern techniques such as shading, rendering, standards, collaborative design and AR/VR

Board of Studies (BoS):

25th BoS of Mechanical held on 09.07.2025.

Academic Council:

24th AC held on 26.08.2025

	PO1	PO2	PO3	PO4
CO1	-	H	H	H
CO2	-	H	H	H
CO3	-	H	H	H
CO4	-	H	H	H

* Legend: L – Low (1), M – Medium (2), H – High (3).

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement :The knowledge of Computer Graphics and Geometric Modelling shall promote development of product using CAD tools, presentation of ideas and documents that lead to sustainable and quality manufacturing of product for the benefit of society and industry.

MEF 6102	ADVANCED COMPUTER AIDED MANUFACTURING	L	T	P	C
SDG: 9		2	0	2	3

COURSE OBJECTIVES:

COB1:	To impart knowledge on the integration of Computer Aided Design and Computer Aided Manufacturing
COB2:	To learn the structural details and components of CNC machines
COB3:	To impart knowledge on manual part program and generation of CNC part program using Computer Aided Manufacturing packages
COB4:	To introduce the Internet of Things in Computer Aided Manufacturing

MODULE I CAD AND CAM INTEGRATION **L: 06 T: 0 P: 0**

Introduction - Networking - Techniques, components, interface cards, network standards, Graphics standards - Graphical kernel system, Data exchange format - IGES and STEP. Integration of CAD and CAM in CNC turning center, machining center. Process planning, Computer Aided Process Planning (CAPP), Product life cycle management (PLM), Enterprise resource planning (ERP).

MODULE II CNC MACHINES **L: 09 T: 0 P: 0**

CNC Machine building, structural details, guide ways –Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings, Spindle drives and feed drives, Linear Motors- open loop and closed loop control, Axis measuring system, grating, linear scale, encoder, laser interferometer - Axes & Spindle Cooling System - Probing For Zero Offsets and First Offset Inspection – Automatic Tool Changer (ATC) and Automatic Pallet Changer (APC).

MODULE III PROGRAMMING OF CNC MACHINES

L:	T:	P:
08	0	24

Structure of CNC program, Coordinate system, G & M codes, cutter radius compensation, tool nose radius compensation, tool wear compensation, canned cycles, mirroring features, Manual part programming for CNC turning, machining center, macro programming, wire electric discharge machining, Tool path generation and Post Processing using CAM software's.

Hand's on practice:

1. Programming and simulation for various operations using canned cycle for CNC turning Centre.
2. Programming and simulation for machining of internal surfaces in CNC turning Centre
3. Programming and simulation for profile milling operations
4. Programming and simulation for circular and rectangular pocket milling
5. Programming and simulation using canned cycle for CNC Milling such as peck drilling and tapping cycle
6. Dimensional and geometric measurement of machined features using CMM

MODULE IV IMPLEMENTATION OF IOT IN CAM

L:	T:	P:
07	0	06

Introduction, overview of IOT enabled manufacturing system, Real-time and multi-source manufacturing information sensing system - IOT enabled smart assembly station, cloud computing based manufacturing resources configuration method, Real-time key production performances analysis method, Real-time information driven production scheduling system.

Hand's on practice:

1. Predictive Maintenance using Simulated Vibration and Temperature Data in Matlab
2. Modeling and Simulation of Production Line Behavior using Simulink

L – 30; T – 0; P – 30; Total Hours: 60

REFERENCES:

1. Radhakrishnan P., “Computer Numerical Control", New Central Book Agency, India,1992.
2. Nee Y.C., Soh K. Ong, Yun G. Wang., “Computer Applications in Near Net-Shape Operations”, Springer, United Kingdom, 2012.
3. Yingfeng Zhang and Fei Tao, “Optimization of Manufacturing Systems Using the Internet of Things” Academic Press, United Kingdom, 2017.
4. Chang T.C., Wysk, R.A. and Wang.H.P., “Computer Aided Manufacturing”, Pearson Prentice Hall, India ,2009, ISBN: 978-0131429192.
5. HMT, “Mechatronics”, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005. 6. Rao P.N., “CAD/CAM”, 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, India, 2010, ISBN-13: 978-0070681934

COURSE OUTCOMES:

After completion of the course, students should be able to

COB1: Acquire knowledge on the integration of CAD and CAM

COB2: Exhibit competency in manual part program and generation of CNC part program

COB3: Describe the implementation of CAD and CAM in manufacturing processes

COB4: Explain applications of IOT in computer aided manufacturing

Board of Studies (BoS):

25th BoS of Mechanical held on 09.07.2025.

Academic Council:

24th AC held on 26.08.2025

	PO 1	PO 2	PO 3	PO 4
CO 1	L	L	L	H
CO 2	M	M	M	H
CO 3	H	H	H	H
CO 4	H	H	H	H

* Legend: L – Low (1), M – Medium (2), H – High (3).

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Learning CNC machines and computer aided manufacturing support technology development, research and innovation leads to sustainable enhancement in industries.

MEF 6103	SMART MANUFACTURING	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: Understand the fundamentals of industry 3.0

COB2: Know about Smart Manufacturing & Industry 4.0

COB3: Introduce the digital twins and functioning of CPS and IIoT systems.

COB4: Explore the concepts and real-world applications of AI and big data in smart manufacturing

COB5: Learn the fundamentals of Augmented Reality (AR), Virtual Reality (VR), and Cloud Computing and explore their integration within Industry 4.0.

MODULE I **CIM AND FMS/INTRODUCTION TO SMART MANUFACTURING** **L: 10 T: 0 P: 0**

Evolution of manufacturing systems - CIM: Introduction, CIM components – Flexible Manufacturing Systems: Introduction, Components, benefits – Group Technology: Part families, Classification, Coding Systems - Shop Floor Control: Production scheduling, Monitoring, and Data collection - Line Balancing: Line balancing techniques and optimization - AS/RS: Material handling, storage, and retrieval systems – Basics of PLM, MES and ERP.

MODULE II **INTRODUCTION TO INDUSTRY 4.0 AND 5.0** **L: 05 T: 0 P: 0**

Principles of smart manufacturing - Introduction to Industry 4.0, Historical Background, Nine Pillars of Smart Manufacturing, Implementation and Challenges – Introduction to industry 5.0 - Applications and Case Studies in Industry 4.0 and 5.0.

MODULE III **DIGITAL TWINS AND IOT IN MANUFACTURING** **L: 11 T: 0 P: 0**

Digital Twin (DT): Fundamentals, Definition and Evolution, Components, Types, Applications, Simulation Engines and Visualization Tools, Case Studies in Automotive, Aerospace, Electronics, and Discrete Manufacturing - Introduction to CPS

and IIOT - CPS Architecture – Hardware and communication protocols in CPS and IOT - IIOT Architecture - Role in Smart Manufacturing and Industry 4.0 - Key Application Domains: Manufacturing, Healthcare, Energy, Mobility.

MODULE IV BIG DATA AND AI

L:	T:	P:
10	0	0

Big Data: Introduction, Role of Big Data in Smart Manufacturing, Characteristics of Big Data, Big Data Lifecycle, Sources of Industrial Data, Big Data Stack: Data Ingestion, Storage, Processing: Batch vs Stream Processing - Introduction to AI and Machine Learning, Supervised, Unsupervised, and Reinforcement Learning, Common ML Algorithms.

MODULE V AR AND CLOUD COMPUTING

L:	T:	P:
09	0	0

Introduction to Augmented Reality (AR) and Virtual Reality (VR): Definitions, Differences, and Classifications, Mixed Reality (MR) and Extended Reality (XR), Components of AR/VR Systems: Hardware (HMDs, Sensors), Software, and Interfaces, Human-Computer Interaction (HCI) in AR/VR, Case Studies: AR-assisted assembly, VR-based operator training, digital factory walkthroughs - Introduction to Cloud Computing: IaaS, PaaS, SaaS, Cloud Architecture: Public, Private, Hybrid Clouds, Edge vs Cloud vs Fog Computing in Industrial Systems, Industrial Cloud Platforms, Real-Time Data Storage, Analytics, and Visualization in the Cloud

L – 45; T – 0; P – 0; Total Hours: 45

TEXT BOOKS:

1. Automation, Production Systems, and Computer-Integrated Manufacturing, by Mikell P. Groover (Author) Publisher: Pearson Education Fourth Edition 22 July 2016 ISBN-10: 9789332572492
2. Smart Manufacturing by Shoukat Ali; Publisher: LAP LAMBERT Academic Publishing (10 August 2016) ISBN-10: 3659933554 ISBN-13: 978-3659933554
3. Industry 4.0: The Industrial Internet of Things 2016 by Alasdair Gilchrist (Author) Publisher: Apress; 1st ed. edition (30 July 2016) ISBN-10: 1484220463 ISBN-13: 978-1484220467

4. Industry 4.0 Data Analytics 31 July 2016 by Rajesh Agnihotri and Samuel New Publisher: Create Space Independent Publishing Platform (31 July 2016) ISBN-10: 1534778284 ISBN-13: 978-1534778283.

REFERENCES:

1. Computer Integrated Manufacturing system, Yorem koren, McGraw-Hill, New York, 2005.
2. CAD/CAM/CIM, 2nd Edition, Radhakrishnan P and Subramanyan S, New Age International (P) Ltd, New Delhi, 2011.
3. Industry 4.0 Sustainable Industrial Approach, Bansal Dr. Vikram, Deepthi B, Sultan Chand & Sons, 2025.
4. Augmented Reality: Principles and Practice by Dieter Schmalstieg and Tobias Hollerer Publisher: Pearson Education; First edition (5 October 2016) ISBN-10: 9332578494 ISBN-13: 978-9332578494
5. Digital Twins: Internet of Things, Machine Learning, and Smart Manufacturing (Smart Computing Applications, 8) 1st Edition, by Yogini Borole (Author), Pradnya Borkar (Author), Roshani Raut (Author), Vijaya Parag Balpande (Author) Publisher: De Gruyter ISBN-10: 3110778785

COURSE OUTCOMES:

After completion of the course, students should be able to

CO1: Describe the basic concepts of CIM anfd FMS (Industry 3.0)

CO2: Explain about industry 4.0

CO3: Elucidate about digital twins and IOT

CO4: Explain about Big data and AI

CO5: Discuss the concepts of AR and cloud computing

Board of Studies (BoS):	**Academic Council:**
25th BoS of Mechanical held on 09.07.2025.	24th AC held on 26.08.2025

	PO 1	PO 2	PO 3	PO 4
CO 1	-	-	H	H
CO 2	-	H	H	H
CO 3	-	H	H	H
CO 4	-	-	H	H
CO 5	-	-	H	H

* Legend: L – Low (1), M – Medium (2), H – High (3).

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Digital technologies helps to increase the production rate, thereby lead the country through technological advancements (Digital India).

MEF 6104	PRODUCT DESIGN AND LIFE CYCLE MANAGEMENT	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To provide an in-depth understanding of industrial product design practices and their integration with business strategy, innovation, and development processes.

COB2: To equip students with methods to identify customer needs and translate them into product concepts and specifications using systematic and innovative approaches.

COB3: To familiarize students with Design-for-X (DFX) principles for optimizing manufacturing, reliability, sustainability, and overall product lifecycle cost.

COB4: To introduce the fundamentals and architecture of Product Lifecycle Management (PLM) systems including their integration with enterprise-level tools and smart manufacturing technologies.

COB5: To analyze real-world PLM deployment scenarios and industrial case studies, evaluating challenges and strategies for successful implementation.

MODULE I	INTRODUCTION TO PRODUCT DESIGN AND PLANNING	L: 10	T: 0	P: 0

Overview of industrial product design practices and their role in business strategy and innovation. Characteristics of successful product development—time, cost, and quality metrics; common development challenges. Generic product development process; concept development stages and process flows. Organizational models for product development—functional, matrix, and project-based structures; principles of concurrent and collaborative engineering. Methods for identifying and evaluating product opportunities; resource assessment and pre-project planning.

MODULE II	IDENTIFYING CUSTOMER NEEDS AND CONCEPT GENERATION	L: 10	T: 0	P: 0

Identification of customer needs – Raw data collection – Interpretation and

organization of needs – Establishing relative importance – Design thinking and innovation in engineering – Product specifications: Establishing target specifications, metrics development, competitive benchmarking, and final specification setting – Techniques for concept generation: Brainstorming, Morphological Analysis (MA), internal and external search, systematic exploration – Concept selection: Concept screening, concept scoring – Concept testing: Purpose, survey population and format, communication, and response handling – Tools for evaluation and selection: Pugh Matrix, Quality Function Deployment (QFD).

MODULE III	**DESIGN-FOR-X AND LIFECYCLE CONSIDERATIONS**	**L: 09**	**T: 0**	**P: 0**

Introduction to Design-for-X (DFX): Design for Manufacturing (DFM), Design for Assembly (DFA), Design for Reliability (DFR), and Design for Sustainability (DFS) – Manufacturing cost considerations: Reduction in cost of components, assembly, and supporting production – Impact of DFM decisions on other product development factors – Design for Environment (DfE) – Prototyping: Principles, technologies, and planning for prototypes – Quality assurance: Failure Mode and Effects Analysis (FMEA), Design for Quality - Robust design principles and tolerance stack-up – Introduction to lifecycle costing – End-of-Life (EoL) strategies: Disassembly, reuse, recycling.

MODULE IV	**PRODUCT LIFECYCLE MANAGEMENT (PLM) FUNDAMENTALS**	**L: 08**	**T: 0**	**P: 0**

Definitions, functions, and components of Product Lifecycle Management (PLM) systems – Comparison between Product Data Management (PDM) and PLM – Product structures, metadata, and Bill of Materials (BOM) hierarchy – Configuration management and change management (CM) processes – Introduction to digital thread and digital twin concepts – Role of PLM in product traceability, collaboration, and lifecycle optimization.

MODULE V	**PLM IMPLEMENTATION AND INDUSTRY INTEGRATION**	**L: 08**	**T: 0**	**P: 0**

PLM integration with CAD (Computer-Aided Design), CAE (Computer-Aided

Engineering), ERP (Enterprise Resource Planning), and MES (Manufacturing Execution Systems) – Collaboration and workflow management in PLM environments – Organizational and IT challenges in PLM deployment – Role of PLM in Industry 4.0 and smart manufacturing – Case studies on successful and failed PLM implementations in industry.

L – 45; T – 0; P –0; Total Hours: 45

TEXT BOOKS:

1) Ulrich, K.T. & Eppinger, S.D. Product Design and Development, McGraw Hill, 7th ed., 2020
2) Stark, J. Product Lifecycle Management, Springer, 4th ed., 2020

REFERENCES:

1) Dieter, G.E. & Schmidt, L.C. Engineering Design, McGraw Hill, 5th ed., 2013
2) Grieves, M. Product Lifecycle Management, McGraw Hill, 2015
3) ISO 14040/44 – Environmental Management: Life Cycle Assessment Standards
4) Robert G. Cooper (2017), Winning at New Products: Creating Value Through Innovation, Hachette Book Group, New York.
5) John Stark (2015), Product Lifecycle Management (Decision Engineering), Springer Publications.

COURSE OUTCOMES:

After completion of the course, the students should be able to

CO1: Demonstrate knowledge of product design and development processes, including concept generation and project planning techniques.

CO2: Identify, organize, and prioritize customer needs and develop corresponding product specifications using tools like QFD, AHP, and TRIZ.

CO3: Implement DFX methodologies to improve product manufacturability, reliability, sustainability, and cost-efficiency throughout the lifecycle.

CO4: Explain the fundamentals of PLM systems and their role in data management, configuration control, and lifecycle optimization using digital thread and digital twin concepts.

CO5: Analyze PLM integration with enterprise systems and evaluate its role in collaboration, smart manufacturing, and Industry 4.0 through case studies on real-world implementations.

Board of Studies (BoS):
25th BoS of Mechanical held on 09.07.2025.

Academic Council:
24th AC held on 26.08.2025

	PO 1	PO 2	PO 3	PO 4
CO 1	L	L	L	H
CO 2	L	L	L	H
CO 3	L	L	L	H
CO 4	L	L	L	H
CO 5	L	L	L	H

* Legend: L – Low (1), M – Medium (2), H – High (3).

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Promotes sustainable industrialization by teaching innovation-driven design, digital manufacturing integration (e.g., PLM, CAD/CAE, ERP, MES), and smart manufacturing aligned with Industry 4.0.

PROFESSIONAL ELECTIVE COURSES

SEMESTER I

MEFY 01	**ADVANCED MANUFACTURING TECHNOLOGY**	**L**	**T**	**P**	**C**
SDG: 9		**3**	**0**	**0**	**3**

COURSE OBJECTIVES:

COB1: To familiarize with traditional and advanced manufacturing techniques, including Industry 4.0, and the role of CAD/CAM/CAE.

COB2: To impart the principles and applications of various non-traditional and advanced machining processes.

COB3: To learn about digital and intelligent manufacturing systems

COB4: To acquire knowledge about advanced materials and process integration

COB5: To gain knowledge about sustainable manufacturing and recent trends.

MODULE I INTRODUCTION TO ADVANCED MANUFACTURING **L: 08 T: 0 P: 0**

Evolution and significance of advanced manufacturing - Comparison between traditional and advanced techniques - Industry 4.0 and Smart Manufacturing - Micro and Nano-manufacturing overview -Additive vs Subtractive manufacturing- Role of CAD/CAM/CAE in manufacturing.

MODULE II ADVANCED MACHINING PROCESSES **L: 10 T: 0 P: 0**

Non-traditional machining: Electrical Discharge Machining, Electrochemical Machining, Laser beam machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining - Ultrasonic and Plasma-based techniques - Laser-based manufacturing and micromachining.

MODULE III DIGITAL AND INTELLIGENT MANUFACTURING SYSTEMS **L: 09 T: 0 P: 0**

Digital Twin and Cyber-Physical Systems – Data Analytics and Big data in Manufacturing - Machine Learning in Manufacturing- Process monitoring and control- Advanced Robotics, Automation, and Human-Machine Interaction (HMI) – Smart Factory implementation.

MODULE IV ADVANCED MATERIALS AND PROCESS INTEGRATION **L: 10 T: 0 P: 0**

Advanced materials: high-performance alloys, ceramics, functionally graded materials – Microstructure-property relationships in advanced processes - Surface engineering and coating technologies -Principles of process integration –Case studies on process integration.

MODULE V SUSTAINABLE MANUFACTURING AND EMERGING TRENDS **L: 08 T: 0 P: 0**

Introduction to sustainable manufacturing – Life Cycle Assessment (LCA) – Lean and Green Manufacturing – Green Manufacturing strategies – Green Materials and Technologies - Remanufacturing and Recycling – Case studies - Emerging technologies for sustainable production.

L – 45; T – 0; P – 0; Total Hours: 45

TEXT BOOKS:

1. Vijay. K Jain, “Advanced Machining processes”, Allied Publishers, 2019.
2. Sita Rani, Pankaj Bhambri, Sachin Kumar, Piyush Kumar Pareek, “AI-Driven Digital Twin and Industry 4.0: A Conceptual Framework with Applications (Intelligent Manufacturing and Industrial Engineering)” 1st Edition, Kindle Edition, 2024.

REFERENCES:

1) K Kalpakjian, S., & Schmid, S. R., “Manufacturing Engineering and Technology”, Pearson Education, 2020.
2) 2. Agrawal B. Groover, M. P., “Fundamentals of Modern Manufacturing: Materials, Processes, and Systems”, John Wiley & Sons, 2015.

3) Wang, L., Wang, X., & Xu, X., “Digital Twin: Enabling Technologies, Challenges and Opportunities”, CRC Press, 2021.
4) Kapil Gupta, Konstantinos Salonitis, “Sustainable Manufacturing”, Elsevier, 2021.

COURSE OUTCOMES: After completion of the course, the students should be able to

CO1: Differentiate traditional and advanced manufacturing techniques

CO2: Explain various non-traditional and advanced machining processes.

CO3: Describe digital and intelligent manufacturing systems

CO4: Explain about advanced materials and process integration

CO5: Recognize the need for sustainable manufacturing and its recent trends

Board of Studies (BoS):
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Academic Council:
24th AC held on 26.08.2025

	PO1	PO2	PO3	PO4
CO1	M	L	S	M
CO2	M	-	S	M
CO3	M	-	S	S
CO4	M	S	S	M
CO5	M	S	S	L

* Legend: L – Low (1), M – Medium (2), H – High (3).

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: Advanced manufacturing technologies are not just about making things faster or cheaper; they are fundamental drivers for achieving sustainable industrialization, fostering innovation, and building resilient infrastructure – all core tenets of SDG Goal 9.

MEFY 02	AUTOMOTIVE MANUFACTURING	L	T	P	C
SDG: 9,12		3	0	0	3

COURSE OBJECTIVES:

COB1: Learn material selection and manufacturing processes for key engine components including pistons, cylinder blocks, and valve train elements.

COB2: Understand material selection and manufacturing techniques for transmission components, with emphasis on gear production methods.

COB3: Gain knowledge of materials and manufacturing processes for chassis components and related heat treatments.

COB4: Acquire understanding of materials, forming processes, and welding techniques for automotive body components and polymer panels.

COB5: Equip students with knowledge of recent advancements in manufacturing that meet the evolving demands of automotive design and functionality.

MODULE I MANUFACTURING OF AUTOMOTIVE ENGINE COMPONENTS **L: 09 T: 0 P: 0**

Material selection and Manufacturing methods for Piston, Piston rings, Cylinder block, wet and dry liners, Engine head, Oil pan. Thermal barrier coating of Engine head and valves. Material selection and Manufacturing methods for Crank shaft, Connecting rod, Cam shaft, valve, Piston pin, Push rod, Rocker arm, tappets

MODULE II MANUFACTURING OF TRANSMISSION COMPONENTS **L: 09 T: 0 P: 0**

Material selection and Manufacturing methods for Clutch – Clutch lining – Gear Box – Gear – Propeller Shaft – Differential – Axle Shaft – Bearing – fasteners – Wheel drum. Methods of Gear manufacture – Gear hobbing and gear shaping – gear broaching - gear finishing and shaving.

MODULE III MANUFACTURING PROCESS OF CHASSIS COMPONENTS **L: 09 T: 0 P: 0**

Material selection and manufacturing methods for Vehicle Frame, Wheel drum, Brake drum, wheel rim and wheel housing manufacturing. Steering systems, shock absorbers, dead axle – casting, forging, machining and finishing operation- Heat treatment procedures for chassis components. Manufacturing of composite leaf spring and wrap forming of coil spring.

MODULE IV MANUFACTURING OF BODY COMPONENTS **L: 09 T: 0 P: 0**

Plastics in Automobile vehicles – Processing of plastics - Body Panel - Thermoforming and hydro forming, press forming, stretch forming. Emission control system – catalytic converter – Hydro forming of exhaust manifold and lamp housing. Welding – Resistance welding and other welding processes with the use of Robots in Body weldment. Instrument Panel - Principle of injection molding, injection molding of instrument panel. Bumpers - Molding of bumpers.

MODULE V RECENT TRENDS IN MANUFACTURING OF AUTOCOMPONENTS **L: 09 T: 0 P: 0**

Powder injection moulding, Shotpeen hardening of gears, CNC special features, Production of aluminium MMC liners for engine blocks, Plasma spray coated engine blocks and valves, Recent developments in auto body panel forming, Squeeze casting of pistons, 3D printing, Aluminium composite brake rotors.

L – 45; T – 0; P – 0; Total Hours: 45

TEXT BOOKS:

1. Heldt P M, “High Speed Combustion Engines”, Oxford IBH publishing Co., Calcutta, 1996.

2. Serope Kalpakjian and Steven R. Schmid, Manufacturing Processes for Engineering Materials, Fourth Edition, Pearson Education publications – 2013.

REFERENCES:

1. B.P. Bhardwaj, “The Complete Book on Production of Automobile Components & Allied Products”, NIIR Project Consultancy Services, 2014.
2. Degarmo E P, “Materials and process in Manufacturing”, Macmillan Publishing Co, 1997.
3. John A S, “Introduction to Manufacturing Processes”, Tata McGraw -Hill, 2012.

COURSE OUTCOMES: After completion of the course, the students should be able to

CO1: Select materials and apply manufacturing methods for various automotive engine components.

CO2: Analyze material choices and manufacturing processes for automotive transmission components and gears.

CO3: Demonstrate knowledge of chassis component production, including frame and suspension manufacturing techniques.

CO4: Apply forming, welding, and plastic processing techniques in the manufacturing of automotive body components.

CO5: Explain and evaluate recent manufacturing technologies applied to critical automotive components.

Board of Studies (BoS):
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Academic Council:
24th AC held on 26.08.2025

	PO1	PO2	PO3	PO4
CO1	M	L	H	H
CO2	H	L	H	H
CO3	M	L	H	M
CO4	M	L	H	H
CO5	H	M	H	M

* Legend: L – Low (1), M – Medium (2), H – High (3).

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

This course focuses on advanced manufacturing, materials, and engineering processes essential for modern automotive engineering—directly contributing to building resilient infrastructure, promoting inclusive industrialization, and fostering innovation.

SDG 12: Responsible Consumption and Production

Emphasis on material selection, recycling, surface treatments, and sustainable manufacturing aligns with responsible production patterns and aims to reduce environmental impact in automotive engineering.

MEFY 03	MEASUREMENTS AND NDT	L	T	P	C
SDG: 9		3	0	0	3

COURSE OBJECTIVES:

COB1: To impart knowledge on the principle of force and strain measurement.

COB2: To learn the vibration and acoustic measurement principles and its applications

COB3: To familiarize with the liquid penetrant and magnetic testing

COB4: To understand the science of ultrasonic and radiographic testing

COB5: To familiarize with the fundamentals of thermographic non-destructive evaluation

MODULE I	FORCE AND STRAIN MEASUREMENT	L:	T:	P:
		09	0	0

Strain gauge, principle, types, performance and uses. Photo elasticity – Principle and applications - Moire Fringe - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines.

MODULE II	VIBRATION AND ACOUSTIC MEASUREMENT	L:	T:	P:
		12	0	0

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Digital data Acquisition systems - Sound wave characteristics: Frequency, amplitude, phase, wavelength – Sound pressure level (SPL), dB scale – Types of microphones – Sensor placement and environmental effect.

MODULE III	LIQUID PENETRANT AND MAGNETIC PARTICLE TESTING	L:	T:	P:
		07	0	0

Liquid Penetrant Testing Principles – types and properties of liquid penetrants – advantages and limitations of various methods - Preparation of test materials – Application of penetrants to parts – Magnetic particle testing, Basic theory of

magnetism – Magnetization methods – Field indicators, Particle application, Inspection – Advantages and limitations of techniques.

MODULE IV	ULTRASONIC AND RADIOGRAPHIC TESTING	L: 09	T: 0	P: 0

Principle of pulse echo method, through transmission method, resonance method – Advantages, limitations – contact testing, immersion testing, couplants – Data presentation A, B and C scan displays, comparison of contact and immersion method – X-ray film – structure and types for industrial radiography – sensitometric properties – use of film, characteristic curves (H & D curve) – latent image formation on film – radiographic exposure, reciprocity law, photographic density – X-ray and gamma ray exposure charts – exposure time calculations.

MODULE V	THERMOGRAPHIC NON DESTRUCTIVE EVALUATION	L: 08	T: 0	P: 0

Introduction and fundamentals to infrared (IR) and thermal testing– Heat transfer – Active and passive techniques – Lock in and pulse thermography– Contact and non-contact thermal inspection methods– Heat sensitive paints – Heat sensitive papers – thermally quenched phosphors liquid crystals - techniques for applying liquid crystals - Inspection methods - Infrared radiation and infrared detectors- thermo mechanical behavior of materials- Applications of IR imaging.

L – 45; T – 0; P – 0; Total Hours: 45

REFERENCES:

1. Beckwith, Mechanical Measurements, Pearson Education, 2007.
2. Doeblin E.O., Measurement Systems, Mc Graw-Hill, 2004.
3. J. Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata McGraw-Hill Education, 2nd edition, 2011.
4. B. Raj, T. Jayakumar and M. Thavasimuthu, Practical NonDestructive Testing, Alpha Science International Limited, 3rd edition, 2002.
5. Non-Destructive Examination and Quality Control, ASM International, Vol.17, 9th edition, 1989.
6. B. D. Cullity, Elements of X-ray Diffraction, Prentice Hall, 3rd edition, 2001.
7. C.U. Grosse, Acoustic Emission Testing, Springer, 2008.

COURSE OUTCOMES:

After completion of the course, students should be able to

COB1: Measure physical quantities such as forces and strains.

COB2: Apply different vibration and acoustic measurements techniques.

COB3: Describe liquid penetrant, and magnetic particle test for engineering applications

COB4: Apply ultrasonic and radiography techniques in engineering domain

COB5: Appreciate the role of thermography in non destructive evaluation

Board of Studies (BoS):
25th BoS of Mechanical held on 09.07.2025.

Academic Council:
24th AC held on 26.08.2025

	PO 1	PO 2	PO 3	PO 4
CO 1	M	L	M	M
CO 2	M	L	H	M
CO 3	L	L	M	L
CO 4	M	L	H	M
CO 5	M	L	M	M

* Legend: L – Low (1), M – Medium (2), H – High (3).

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Statement: The knowledge of mechanical measurement and NDT techniques enables industry to identify flaws and move towards reliable manufacturing process and increases productivity.

MEFY 04	DESIGN OF HYDRAULIC AND	L	T	P	C
SDG: 9	PNEUMATIC SYSTEMS	3	0	0	3

COURSE OBJECTIVES:

COB1: To provide students with a foundational understanding of fluid power principles, differentiating between hydraulic and pneumatic systems.

COB2: To enable students to analyze, select, and integrate appropriate hydraulic and pneumatic components for the design and implementation of fluid power circuits.

COB3: To empower students to comprehend the synergy of hydraulic and pneumatic principles in hydro-pneumatic systems.

COB4: To educate students to design, analyze, and troubleshoot electro-pneumatic and electro-hydraulic control circuits.

COB5: To enable students to comprehensively apply principles of fluid power system design, installation, maintenance, and troubleshooting.

MODULE I	INTRODUCTION TO FLUID POWER	L:	T:	P:
		07	0	0

Definition - Hydraulics vs Pneumatics – ISO symbols - Application –Pascal's Law-Transmission and multiplication of force - Basic properties of hydraulic fluids - static head pressure-pressure loss – Power - absolute pressure and Temperature - Gas laws- vacuum - Properties of hydraulic fluid - Properties of air – Perfect Gas Laws.

MODULE II	DESIGN OF HYDRAULICS AND PNEUMATICS CIRCUITS	L:	T:	P:
		10	0	0

Selection of Hydraulic devices - Design of circuits: Speed control, Synchronizing, Two handed safety control circuit, Regenerative circuit. Components of Pneumatics: Compressor, Filters, Regulator, Lubricator, Muffler, Air control Valves and Quick Exhaust Valves-Pneumatic actuators -Selection of devices - Design of sequential multi-actuator circuits - Cascade and step counter methods- Integration of start selection, start restriction and emergency stop modules.

MODULE III	DESIGN OF HYDRO - PNEUMATICS CIRCUITS	L:	T:	P:
		06	0	0

Hydro - Pneumatic system-hydro-pneumatic devices-Selection criteria-Design of circuits - Hydro-pneumatic braking system-Pressure boosting water pump system - Case studies.

MODULE IV	DESIGN OF ELECTRO- PNEUMATICS AND ELECTRO-HYDRAULICS CIRCUITS	L:	T:	P:
		11	0	0

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Programmable logic control of hydraulic and pneumatic circuits, PLC ladder diagram for various circuits, motion controllers, Servo systems – fundamentals. Applications in Assembly, Feeding, Metalworking, materials handling and plastic working.

MODULE V	FLUID POWER SYSTEM DESIGN AND MAINTENANCE	L:	T:	P:
		11	0	0

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

L – 45; T – 0; P – 0; Total Hours: 45

TEXT BOOKS:

1. Anthony Esposito, “Fluid Power with Application", 7th Edition, Pearson Education, 2013.

2. Srinivasan R, "Hydraulic and Pneumatic Controls", 2nd Edition, Vijay Nicole Imprints Pvt. Ltd, New Delhi, 2010.

REFERENCES:

1. Majumdar, S.R, "Oil Hydraulic Systems: Principles and Maintenance", 28th Edition, McGraw-Hill, 2017.

2. John R. Hackworth, Programmable Logic Controllers: Programming Methods and Applications, Pearson Education India, 2008.

3. Ronald B. Walters, Hydraulic and Electro-Hydraulic Control Systems, Second edition, Springer Netherlands, 2014.

4. Joji Parambath, Electro-pneumatics and Automation, Kindle Edition, 2020.

5. Hehn Anton, H., “Fluid Power Trouble Shooting”, Marcel Dekker Inc., NewYork, 1995.

COURSE OUTCOMES:

After completion of the course, students should be able to

COB1: Explain the core differences between hydraulic and pneumatic systems, interpret basic ISO symbols and apply Pascal's Law on fluid power system.

COB2: Design complex hydraulic and pneumatic circuits and justify the selection of specific components adhering safety standards

COB3: Design and analyze hydro-pneumatic circuits for specific applications such as braking systems and water pump pressure boosting etc.,

COB4: Develop PLC ladder diagrams for complex hydraulic and pneumatic sequences, apply appropriate electrical control components for circuit implementation.

COB5: Critically evaluate and select appropriate fluid power components and diagnose and propose effective remedies for common faults in hydraulic and pneumatic systems.

Board of Studies (BoS):	**Academic Council:**
25th BoS of Mechanical held on 09.07.2025.	24th AC held on 26.08.2025

	PO1	PO2	PO3	PO4
CO1	2	-	-	3
CO2	2	-	2	3
CO3	2	-	2	3
CO4	2	-	2	3
CO5	2	-	2	-

* Legend: L – Low (1), M – Medium (2), H – High (3).

SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Proficiency in designing hydraulic and pneumatic systems enables the creation of innovative and efficient circuits and systems, thereby fostering sustainable industrial development.