ACADEMIC REGULATIONS
AND
SYLLABUS

M.Tech
in
CAD/CAM
(VR 19)

Department of Mechanical Engineering
VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE

(An Autonomous, ISO 9001:2008 Certified Institution)
(Approved by AICTE, Accredited by NAAC with 'A' Grade, Affiliated to JNTUK, Kakinada)
(Sponsored by Siddhartha Academy of General & Technical Education)
Kanuru, Vijayawada
Andhra Pradesh - 520007, INDIA.
www.vrsiddhartha.ac.in

PROGRAMME OUTCOMES

a) Accomplish a comprehensive conceptual knowledge of modeling and analysis of mechanical components and systems using CAD tools.

b) Acquire the technological knowledge of advanced materials and manufacturing methods for improving quality and productivity.

c) Apply the principle of Robotics and other automation technologies in manufacturing.

d) Independently carry out research /investigation and development work to solve practical problems in CAD/CAM.

e) Write and present a substantial technical report/document.

f) Learn independently and engage in lifelong learning with understanding of professional, social and ethical responsibilities for the need of sustainable development.

VELAGAPUDI RAMAKRISHNA

SIDDHARTHA ENGINEERING COLLEGE

(Autonomous)
Kanuru, Vijayawada – 520 007
(Approved by AICTE, Accredited by NAAC, and ISO 9001: 2015 Certified)
(Affiliated to Jawaharlal Nehru Technological University, Kakinada)

Academic Regulations for M. Tech (MTECH-19) w. e. f: 2019-2020

(Common to all branches)

1. INTRODUCTION

Academic Programs of the College are governed by rules and regulations as approved by the Academic Council, which is the highest Academic Body of the Institute. These academic rules and regulations are effective from the academic year 2019-20, for students admitted into two year PG program offered by the college leading to Master of Technology (M. Tech).

The regulations listed under this head are common for postgraduate programs, leading to award of M. Tech degree, offered by the college with effect from the academic year 2019-20 and they are called as "M. TECH-19" regulations.

The regulations hereunder are subjected to amendments as may be made by the Academic Council of the college from time to time, keeping the recommendations of the Board of Studies in view. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the program, as may be decided by the Academic Council.

2. DEFINITIONS

a) "Commission" means University Grants Commission (UGC)

b) "Council" means All India Council for Technical Education (AICTE)

c) “University” means Jawaharlal Nehru Technological University Kakinada, Kakinada (JNTUK)

d) “College” means Velagapudi Ramakrishna Siddhartha Engineering College (VRSEC)

e) “Program” means any combination of courses and/or requirements leading to the award of a degree

f) “Course” means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.

g) “Degree” means an academic degree conferred by the university upon those who complete the postgraduate curriculum.

3. PROGRAMS OFFERED

The nomenclature and its abbreviation given below shall continue to be used for the degree programs under the University, as required by the Council and Commission.

Master of Technology (M. Tech) besides, the name of the program shall be indicated in brackets after the abbreviation. For example, PG engineering degree in Computer Science and Engineering is abbreviated as M. Tech (Computer Science and Engineering).

Presently, the college is offering Post Graduate program in Engineering with the following programs:

Table 1: List of Programs offered by college leading to M. Tech Degree

S. No	Program	Department
1	Structural Engineering	Civil Engineering
2	Geotechnical Engineering	
3	Computer Science and Engineering	Computer Science and Engineering
4	Power Systems Engineering.	Electrical and Electronics Engineering
5	Communication Engineering and Signal	Electronics and Communication Engineering
6	VLSI Design and Embedded Systems	
7	Data Science	Information Technology
8	CAD CAM	Mechanical Engineering
9	Thermal Engineering	

These Regulations shall be applicable to any new postgraduate program (M. Tech) that may be introduced from time to time.

4. DURATION OF THE PROGRAM

- The duration of the program is two academic years consisting of four semesters.
- A student is permitted to complete the program within a maximum duration of 4 years.

5. MINIMUM INSTRUCTION DAYS

- Each semester shall consist of a minimum of 90 instruction days with about 25 to 35 contact periods per week.

6. ELIGIBILITY CRITERIA FOR ADMISSION

- The eligibility criteria for admission into M.Tech program are as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

6.1 CATEGORY – A Seats:

- These seats will be filled by the Convener, PGECET Admissions.

6.2 CATEGORY – B Seats :

- These seats will be filled by the College as per the guidelines of Andhra Pradesh State Council of Higher Education (APSCHE).

7. PROGRAM STRUCTURE

The program structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their post-graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories to cover the depth and breadth required for the program and for the attainment of program outcomes of the corresponding program.

7.1 Program Core:

The core consists of set of courses considered necessary for the students of the specific. The courses under this category should satisfy the program specific criteria prescribed by the

appropriate professional societies. The credits for program core courses is 18.

7.2 Program Electives:

The electives are set of courses offered in which covers depth and breadth to further strengthen their knowledge. The students may register for appropriate electives offered in the based on their area of interest. The credits for the program electives are 12.

7.3 Self-Learning Course (Program Elective V):

The courses under this category shall carry three credits and must have a minimum duration of 8 weeks/12 weeks. The department will recommend the self-learning courses from the available open courseware. The self- learning courses shall be taken from the list of approved MOOCs providers (SWAYAM / NPTEL/ EDX / Others). They must be approved/ratified in the respective Board of Studies.

In case a student fails to complete the MOOCs course offered by MOOCs providers, he/she may be allowed to register again in the subsequent semester for the same or alternative course from the list provided by the department with any of the providers. Students can register and complete the opted course in approved MOOCs platform on or before the last instruction day of III semester. Students can also complete program

elective V in semester I or II by satisfying the prerequisites. They have to submit the pass certificate before the last instruction day of that semester.

7.4 Mandatory learning Course (Research Methodology and IPR):

The students shall undergo this mandatory learning course and achieve satisfactory performance.

7.5 Audit Course (Technical Report Writing):

The students shall enroll in technical report writing course as audit course for the purpose of self-enrichment and academic exploration.

7.6 Term Paper:

There shall be seminar presentations during I year II semester. For seminar, a student shall collect the literature on the advanced topic in relevant fields and critically review the literature and submit it to the department in a form of report and shall make an oral presentation before the Academic Committee consisting of program coordinator, guide and two other senior faculty members of the department.

7.7 Internship:

The students shall undergo Internship for a period of six weeks in Industry/Research organizations/ institute of higher learning approved by the Head of the Department during any

time after the second semester and shall earn a minimum of two credits.

7.8 Project:

The Project shall be offered in 2nd year of the program. The project shall be carried out by the students, as individual project, for a minimum period of one academic year. The project shall be carried out in the major areas pertaining to the program approved by Project Review Committee and may address the societal problems/issues related to the program. The project shall consist of Part-A and Part-B carrying 10 and 16 credits, respectively spreading over for one semester each. The project part B shall be the extension of project Part A.

- If the candidate wishes to change his/her topic of the project, he/she can do so with approval of the project review committee within one week from the completion of 1st review.

PROJECT WORK IN COLLABORATION WITH INDUSTRY:

- A student may, with the approval of the Head of the Department/Centre, visit an industry or a Research Laboratory for data collection, discussion of the project, experimental work, survey, field studies, etc. during the project period. Projects sponsored by the industry or Research Laboratories will be encouraged and a close liaison with such organizations will be maintained.

- A student may, with the approval of Project Review Committee, do the project work in collaboration with an industry, a Research and Development Organization. The student shall acknowledge the involvement and / or contribution of an industry, R&D organization in completing the project in his/her thesis and a certificate to this effect, issued by the supervisor from the industrial organization, will be included in the thesis.

7.9 Course Code and Course Numbering Scheme

Course Code consists of ten characters in which the first two are numerals, next four are alphabets and the rest are numerals. The first two digits '19' indicates year of regulation. The third and fourth character represents the name of the department offering PG program as described in Table 2.

Table 2: Third - and Fourth-Character description

Characters	Name of the Department
CE	Civil Engineering Department
CS	Computer Science and Engineering Department
EC	Electronics & Communication Engineering Department
EE	Electrical & Electronics Engineering Department
IT	Information Technology Department
ME	Mechanical Engineering Department

The fifth and sixth character represents specialization offering as mentioned in Table No.3.

Table 3: Fifth- and Sixth-Character description

Next Two	Name of the Specialization
SE	Structural Engineering
GT	Geotechnical Engineering
CS	Computer Science and Engineering
SP	Communication Engineering and Signal Processing
VE	VLSI Design and Embedded Systems
PS	Power Systems Engineering
DS	Data Science
CC	CAD CAM
TE	Thermal Engineering

For all the Seventh and Eighth characters represent semester number and syllabus version number of the course offered. Ninth character represents course type, as per Table No. 4

Table 4: Course type description

Ninth Character	Description
0	Program Core
1	Program Elective
2	Mandatory Course
3	Audit Course
4	Open Elective
5	Internship/ Laboratory
6	Term Paper/Project

For example, in **19CESE 1051** course, the first two digits indicate year of regulation as the course is offered by Civil Engineering Department (**CE**) in Structural Engineering specialization (**SE**) offered in the first semester (**1**), the course

syllabus version number (**0**), the course is of laboratory type (**5**) and the course number is (**1**), as given in figure.1 below.

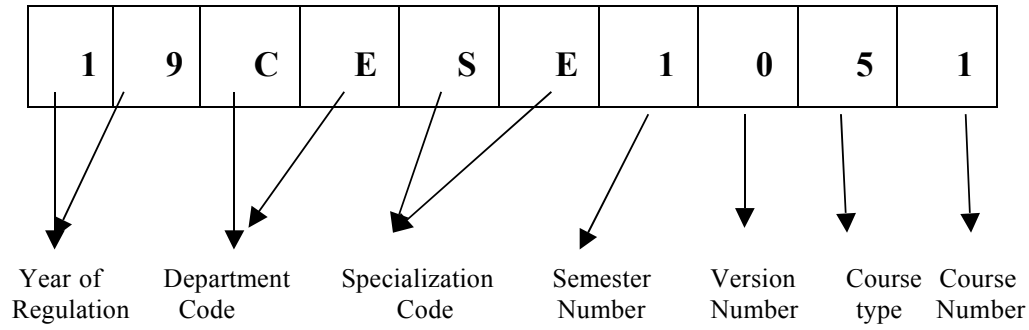

Figure 1: Course Code Description

7.10 Scheme of Instruction for 1st and 2nd Years

- The scheme of instruction and syllabus of all postgraduate programs are given separately.

7.11 Contact Hours and Credits

Credit means quantifying and recognizing learning. Credit is measured in terms of contact hours per week in a semester. The Course Credits are broadly fixed based on the following norms:

- Lectures – One Lecture period per week is assigned one credit.
- Tutorials - One tutorial period per week is assigned one credit.
- Practical – 3 periods per week is assigned one and half credit
- Mandatory learning and audit course do not carry any credit
- Term paper shall have 01 credit.
- Internship shall have 02 credits.
- Project (Part A) shall have 10 credits.
- Project (Part B) shall have 16 credits.

7.12 Theory / Tutorial Classes

Each course is prescribed with fixed number of lecture periods per week. During lecture periods, the course instructor shall deal with the concepts of the course. For certain courses, tutorial periods are prescribed, to give exercises to the students and to closely monitor their learning ability.

7.13 Laboratory Courses

A minimum prescribed number of experiments have to be performed by the students, who shall complete these in all respects and get each experiment evaluated by teacher concerned and certified by the Head of the Department concerned at the end of the semester.

7.14 Program Credits

Each specialization of M.Tech program is designed to have a total of 68 credits, and the student shall have to earn all the credits for the award of degree.

8. MEDIUM OF INSTRUCTION

The medium of instruction and examination is English.

9. SYLLABUS

As approved by the concerned BOS and the Academic Council.

10. ELIGIBILITY REQUIREMENT FOR APPEARING SEMESTER END EXAMINATION AND CONDONATION

- A regular course of study means a minimum average attendance of 75% in the semester computed by totaling the number of periods of lectures, tutorials, practical courses and project as the case may be, held in every course as the denominator and the total number of periods attended by the student in all the courses put together as the numerator.
- Condonation of shortage in attendance may be recommended by the respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student. Students, having shortage of attendance, shall have to pay the requisite fee towards condonation**.**
- Minimum of 50% aggregate marks must be secured by the candidates in the continuous evaluations conducted in that semester for courses such as theory, laboratory courses and project to be eligible to write semester end examinations. However, if the student is eligible for promotion based on the attendance, in case necessary, a shortage of internal marks up to a maximum of 10% may be condoned by the Principal based on the recommendations

of the Heads of the Departments.

- Students having shortage of internal marks up to a maximum of 10% shall have to pay requisite fee towards condonation**.**
- A student, who does not satisfy the attendance and/or internal marks requirement, shall have to repeat that semester.
- Eligible candidates who failed to register for all courses for the semester-end examinations shall not be permitted to continue the subsequent semester and has to repeat the semester for which he/she has not registered for semester end examinations.

11. EXAMINATIONS AND SCHEME OF EVALUATION

11.1 Continuous Evaluation:

11.1.1 Theory Courses

Each course is evaluated for **40** marks (a+b)

a) The internal evaluation shall be made based on the two midterm examinations each of 2**5** marks will be conducted in every theory course in a semester. The midterm marks shall be awarded giving a weightage of 2/3rd in the examination in which the student scores more marks and 1/3rd for the examination in which the student scores less marks. Each midterm examination shall be conducted for duration of 90 minutes without any choice**.**

b) There shall be project based assessment /assignments/ seminars decided by the course handling faculty for 15 marks. A project-based assessment will apply multifaceted skills to be encompassed into a cumulative project. This can be a singular project at the end of a semester or it can be done at designated intervals throughout the semester. The intent is to design the project-based assessment to encompass the lesson plans, teacher worksheets and any additional teacher resources which will ultimately provide a physical example of what has been learned and what can be applied by the student. It shall measure the knowledge of the students in apply and above levels, in cognitive learning domain as per the revised Bloom's taxonomy. The 15 marks shall be awarded as per the rubric prepared by the course handling faculty and shall be informed to the students well in advance before the evaluation.

11.1.2 Laboratory Courses: 40 marks

- For Laboratory courses there shall be continuous evaluation during the semester for 40 internal marks. The distribution of internal marks is given below:

Table 5: Distribution of Marks

Sl. No.	Criteria	Marks
1	Day to Day work	10
2	Record	10
3	Internal examination	20

11.1.3 Term Paper: 40 marks

The distribution of internal marks for the term paper is given below.

Table 6: Distribution of Marks

Sl. No.	Criteria	Marks
1	Presentation	15
2	Viva-voce	10
3	Report	15

11.1.4 Project: (40 marks)

The continuous evaluation (Project Part A and Project Part B) for 40 marks shall be on the basis of two seminars by each student on the topic of his/her project work and evaluated by a review committee and the day to day assessment by the supervisor in respective semester. The review committee consists of HOD, Program Coordinator, respective internal guide and two senior faculty members of the department with expertise in the specialization nominated by HOD. The distribution of marks is as follows in Table 7.

Table 7: Continuous internal assessment in each semester

Sl. No.	Criteria	Marks
1	Two reviews	15+15
2	Day to day assessment	10

Rubrics shall be prepared by review committee using appropriate performance indicators for each review separately and informed

to the students well in advance.

11.1.5 Self-Learning Courses: Nil

No continuous evaluation for self-learning courses offered as program elective-V.

11.1.6 Mandatory Learning Course: 40 marks

No credit. One internal examination for 40 Marks will be conducted for **60 minutes** duration at institutional level. The question paper shall be given in the following pattern: Part A: Contains '10' questions of one mark each. Part B: Contains '05' questions of ten Marks each out of which student shall answer three questions. The marks earned/attendance will not be considered for internal detention.

11.1.7 Audit Course: Nil

No credit. However, ***student*** must maintain more than 75% attendance to get satisfactory grade in that particular audit course.

11.2 SEMESTER END EXAMINATIONS

11.2.1 Theory Courses: 60 marks

The Semester end examinations shall be conducted for 3 hours duration at the end of the semester. The question paper shall be given in the following pattern: There shall be two questions from each unit with internal choice. Each question carries 15 marks. Each course shall consist of four units of the syllabus.

11.2.2 Laboratory Courses: 60 marks

40 marks are allotted for experiments/job works & **20** marks are allotted for viva-voce examination.

11.2.3 Term Paper: 60 marks

There shall be a seminar presentation. For Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department, Program coordinator, supervisor and one to two other senior faculty members of the department. For Seminar, the evaluation is done for 60 marks internally based on rubric prepared by committee. A candidate has to secure a minimum of 50% to be declared successful.

11.2.4 Self-Learning Courses:

No evaluation for self-learning courses (offered as program elective -V).

11.2.5 Project: 60 marks

Publication of paper in Scopus indexed (or higher) journal or conference based on project work is mandatory for submission of final thesis. Plagiarism check is mandatory with a maximum 35% plagiarism index before submission of

thesis. The project (Project Part A and Part B) shall be evaluated for 60 marks in respective semesters. The semester end examination for project part – A shall be evaluated by Project Review Committee (PRC) as per 11.1.4 and project part – B shall be evaluated by a project evaluation committee consisting of the Head of the Department, project internal guide and an external examiner nominated by the Principal. The rubrics for evaluation of semester end examination shall be defined by the Project review committee.

11.2.6 Mandatory Learning Course: 60 marks

Mandatory Learning Course does not carry any credit. Semester End Examination will be conducted for 60 Marks internally. The question paper pattern shall be same as other theory courses.

Grades will be awarded as per table 8 of 12.2.

The grades earned by the students from Mandatory Learning Courses will not be considered for the calculation of CGPA.

11.2.7 Audit Course:

No credit. No semester end evaluation.

11.2.8: Internship/Summer Training in Research Organizations/ Institutions of Higher Learning:

The candidate shall submit the comprehensive report to the department. The review committee consisting of head of the department, program coordinator and industry institute interaction coordinator will evaluate the report for 100 marks. No continuous

evaluation.

12. CONDITIONS FOR PASS AND AWARD OF CREDITS FOR A COURSE

12.1 Conditions for Pass and award of Grades & Credits:

a) A candidate shall be declared to have passed in individual Theory course if he/she secures a minimum of 50% aggregate marks (Internal & semester end examination marks put together), subject to a minimum of 40% marks in the semester end examination.

b) A candidate shall be declared to have passed in individual laboratory course if he/she secures a minimum of 50% aggregate marks (Internal & semester end examination marks put together), subject to a minimum of 50% marks in the semester end examination.

c) If a candidate secures minimum of 40% marks in Theory Courses in the semester end examination and 40% - 49% of the total marks in the semester end examination and internal evaluation taken together in some theory courses and secures an overall aggregate of 50% in all theory courses in that semester he/she declared to be passed in the theory courses of that semester in regular Examinations. This provision is applicable for Regular candidates only during Regular Semester – end Examinations.

d) The student has to pass the failed course by appearing the

examination when offered next, as per the requirement for the award of degree.

e) A candidate shall be declared to have passed the project part A/project part B, if he/she secures minimum of 50 % aggregate marks (continuous evaluation and semester end examination put together), subjected to a minimum of 50 % of marks in semester end examinations.

f) If any candidate does not fulfill the pass requirement as per 12.1.(e) in semester end examination of Project Part – A, he / she will be given two months additional time to re appear at the semester end examination after paying the requisite examination fee. If the candidate does not fulfill the pass requirement again in Project Part – A as per 12.1(e), he/she has to repeat the semester in next academic year.

g) In a special case, if any student does not submit his / her thesis of Project Part – B, due to ill health or any other reason, he / she will be given another chance to attend for Project, Viva – Voce examination conducted separately at a later date i.e. within two months from the completion of Project Part – B semester end examination of that particular academic year after paying the requisite examination fee, if the expenditure for conducting Project Part – B is completely borne by the candidate.

h) On passing a course of a program, the student shall earn assigned credits in that Course.

12.2 Method of Awarding Letter Grades and Grade Points for a Course.

A letter grade and grade points will be awarded to a student in each course based on his/her performance as per the grading system given below.

Table 8: Grading System for individual subjects/labs

Theory	Lab/	Grade Points	Letter Grade
>= 90%	>= 90%	10	Ex
80-89%	80-89%	9	A+
70-79%	70-79%	8	A
60-69%	60-69%	7	B
50-59%	55-59%	6	C
45-49%	50-54%	5	D
40-44%	-	4	E
< 40%	< 50%	0	F (Fail)
ABSENT	ABSENT	0	AB

12.3 Calculation of Semester Grade Points Average (SGPA)* and award of division for the program.

The performance of each student at the end of each semester is indicated in terms of SGPA. The SGPA is calculated as below:

$$SGPA = \frac{\sum(CR \times GP)}{\sum CR}$$

(For all courses passed in semester)

Where CR= Credits of a course

GP = Grade points awarded for a course

*SGPA is calculated for the candidates who passed all the

courses in that semester.

12.4 Calculation of Cumulative Grade Point Average (CGPA) for Entire Program.

The CGPA is calculated as below:

$$CGPA = \frac{\sum(CR \times GP)}{\sum CR}$$

(For entire program)

Where CR= Credits of a course

GP = Grade points awarded for a course

Table 9: Award of Divisions

CGP	DIVISIO
≥7.7	First Class with
≥6.5 -	First
≥5.5 -	Second Class
≥4 -	Pass
<4	Fail

For the purpose of awarding first class with distinction, the candidate should complete the program with in 2 years and should get required CGPA.

Detained, Break in study candidates, and the candidates who availed themselves of the opportunity of extension of project part A/ part – B for a further period of two months are not eligible for the award of first class with distinction.

For the purpose of awarding first/ second/ pass class, CGPA obtained in the examinations appeared within the maximum period allowed for the completion of course including extensions

in project, if any shall be considered.

12.5 Transitory Regulations

A candidate, who is detained or discontinued in the semester, on readmission shall be required to pass all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently and the academic regulations be applicable to him/her which have in force at the time of his/her admission. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) and additional subjects are to be studied as approved by Board of Studies and ratified by Academic Council.

12.6 Consolidated Grade Card

A consolidated grade card containing credits & grades obtained by the candidates will be issued after completion of the two years M. Tech Program.

13. READMISSION CRITERIA

A candidate, who is detained in a semester due to lack of attendance/marks, has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling all the required norms stipulated by the college in addition to paying an administrative fee of Rs. 1,000/-

Rules for calculation of attendance for readmitted students.

a) No. of classes conducted will be counted from the day 1 of the semester concerned, irrespective of the date of payment of tuition fee.

b) They should submit a written request to the principal of the college, along with a challan paid towards tuition and other fee. for re – admission before the commencement of class work.

c) Student should come to know about the date of commencement of class – work of the semester in to which he / she wishes to get re – admission. The information regarding date of commencement of class – work for each semester is available in the college notice boards / website.

14. BREAK IN STUDY

Student, who discontinues the studies for whatsoever may be the reason, can get readmission into an appropriate semester of M. Tech program after a break-in study only with the prior permission of the Principal of the College provided such candidate shall follow the transitory regulations applicable to such batch in which he/she joins. An administrative fee of Rs. 2000/- per each year of break in study in addition to the prescribed tuition and special fee has to be paid by the candidate to condone his/her break in study.

15. ELIGIBILITY FOR AWARD OF M.TECH. DEGREE

The M. Tech., Degree shall be conferred on a candidate who satisfies the following requirement. A student should register himself for 68 Credits, and should obtain all the 68 credits in order to become eligible for the award of M.Tech Degree.

16. CONDUCT AND DISCIPLINE

- Students shall conduct themselves within and outside the premises of the Institute in a manner befitting the students of our Institute.
- As per the order of the Honorable Supreme Court of India, ragging in any form is considered a criminal offense and is banned. Any form of ragging will be severely dealt with.
- The following acts of omission and/or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

i. Lack of courtesy and decorum; indecent behavior anywhere within or outside the campus.

ii. Willful damage or distribution of alcoholic drinks or any kind of narcotics to fellow students /citizens.

The following activities are not allowed within the campus

- Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.
- Mutilation or unauthorized possession of library books.
- Noisy and unseemly behavior, disturbing studies of fellow students.
- Hacking computer systems (such as entering into other person's areas without prior permission, manipulation and/or damage of computer hardware and software or any other cyber crime etc.
- Use cell phones in the campus.
- Plagiarism of any nature.
- Any other act of gross indiscipline as decided by the college from time to time.
- Commensurate with the gravity of an offense, the punishment may be reprimanded, fine, expulsion from the institute / hostel, debarment from a examination, disallowing the use of certain facilities of the Institute, rustication for a specified period or even outright expulsion from the Institute, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.
- For an offense committed in (i) a hostel (ii) a department or in a classroom and (iii) elsewhere, the

Chief Warden, the Head of the Department and the Principal, respectively, shall have the authority to reprimand or impose fine.

- Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Principal for taking appropriate action.
- Unauthorized collection of money in any form is strictly prohibited.
- Detained and Break-in-Study candidates are allowed into the campus for academic purposes only with permission from the authorities.
- Misconduct committed by a student outside the college campus, but having the effect of damaging, undermining & tarnishing the image & reputation of the institution will make the student concerned liable for disciplinary action commensurate with the nature & gravity of such misconduct.
- The Disciplinary Action Committee constituted by the Principal, shall be the authority to investigate the details of the offense, and recommend disciplinary action based on the nature and extent of the offense committed.
- “Grievance appeal Committee” (General) constituted by the

Principal shall deal with all grievances pertaining to the academic / administrative /disciplinary matters.

- All the students must abide by the code and conduct rules of the college.

17. MALPRACTICES

- The Principal shall refer the cases of malpractices in internal assessment tests and Semester-End Examinations, to a Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the erring students based on the recommendations of the committee.
- Any action on the part of the candidate at an examination trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing examination papers and preparing/keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or

misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

18. OTHER MATTERS

18.1 The physically challenged candidates who have availed additional examination time and a scribe during their B. Tech/PGECET/GATE examinations will be given similar concessions on production of relevant proof/documents.

18.2 Students who are suffering from contagious diseases are not allowed to appear either internal or semester end examinations.

18.3 The students who participated in coaching/ tournaments held at the state / National /International levels through University / Indian Olympic Association during the end semester external examination period will be promoted to subsequent semesters till the entire course is completed as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated 18-08-1994.

18.4 The Principal shall deal with any academic problem, which is not covered under these rules and regulations, in

consultation with the Heads of the Departments in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved in the Heads of the Departments Meetings, shall be reported to the academic council for ratification.

19. AMENDMENTS TO REGULATIONS

The Academic Council may, from time to time, revise, amend, or change the regulations, Schemes of examination and/or syllabi.

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
SCHEME OF INSTRUCTION FOR TWO YEAR PG PROGRAMME [M.TECH 19]
CAD/CAM

SEMESTER I **Contact Hours: 23**

S.No	Course Type	Course Code	Title of the Course	L	T	P	Credits	CE	SE	Total
1.	Programme Core - I	19MECC1001	Computer Aided Modelling	3	0	0	3	40	60	100
2.	Programme Core - II	19MECC1002	Computer Numerical Control and Part Programming	3	0	0	3	40	60	100
3.	Programme Core - III	19MECC1003	Design for Manufacturing and Assembly	3	0	0	3	40	60	100
4.	Programme Elective - I	19MECC1014	A. Computer Graphics B. Vision System and Image Processing C. Artificial Intelligence	3	0	0	3	40	60	100
5.	Programme Elective - II	19MECC1015	A. Optimization Techniques B. Mechanical Vibrations C. Material Selection in Mechanical Design	3	0	0	3	40	60	100
6.	Mandatory Learning Course	19MTMC1026	Research Methodology and IPR	2	0	0	0	40	60	100
7.	Laboratory - I	19MECC1051	CAD Laboratory	0	0	3	1.5	40	60	100
8.	Laboratory - II	19MECC1052	CAM Laboratory	0	0	3	1.5	40	60	100
			Total	**17**	**0**	**6**	**18**	**320**	**480**	**800**

SEMESTER II **Contact Hours: 25**

S.No	Course Type	Course Code	Title of the Course	L	T	P	Credits	CE	SE	Total
1.	Programme Core – IV	19MECC2001	Computer Integrated Manufacturing	3	0	0	3	40	60	100
2.	Programme Core – V	19MECC2002	Finite Element Analysis	3	0	0	3	40	60	100
3.	Programme Core – VI	19MECC2003	Robotics and Automation	3	0	0	3	40	60	100
4.	Programme Elective – III	19MECC2014	A. Mechatronics B. Signal Processing And Condition Monitoring C. Fluid Power and Control Systems	3	0	0	3	40	60	100
5.	Programme Elective – IV	19MECC2015	A. Additive Manufacturing B. Computer Aided Inspection and Testing C. Mechanics and Manufacturing Methods of Composites	3	0	0	3	40	60	100
6.	Audit Course	19MTAC2036	Technical Report Writing	2	0	0	-	0	0	0
7.	Laboratory - I	19MECC2051	FEA Laboratory	0	0	3	1.5	40	60	100
8.	Laboratory - II	19MECC2052	Robotics and AutomationLaboratory	0	0	3	1.5	40	60	100
9.	Term Paper	19MECC2063	Term Paper*	0	0	2	1	40	60	100
			Total	**17**	**0**	**8**	**19**	**320**	**480**	**800**

% **Students should conduct the Literature Survey for the proposed research topic and they need to develop a proto type or simulation based (must be outcome oriented) – the same to be presented in any conference (national or international)**

Semester III **Contact Hours: 24**

S.No	Course Type	Course Code	Title of the Course	L	T	P	Credits	CE	SE	Total
1.	Programme Elective - V	19MECC3011	Choice for students to complete course in any MOOCS Platform@	0	0	0	3	-	100	100
2.	Project	19MECC3061	Project – Part A **#**	0	0	20	10	40	60	100
3.	Internship	19MECC3052	Internship*	0	0	4	2	-	100	100
			Total	**0**	**0**	**24**	**15**	**40**	**260**	**300**

@ Program Elective V may be completed in semester I or II

@Evaluation done by MOOCs providers will be considered

 # To be continued in the IV Semester

***Students to be encouraged to go industrial training for at least Six weeks during semester break**

Semester IV **Contact Hours: 32**

S.No	Course Type	Course Code	Title of the Course	L	T	P	Credits	CE	SE	Total
1.	Project	19MECC4061	Project – Part B	0	0	32	16	40	60	100
			Total	**0**	**0**	**32**	**16**	**40**	**60**	**100**

L – Lecture, T – Tutorial, P – Practical, C – Credits
CE – Continuous Evaluation SE – Semester End Evaluation
Total Credits: 68

Course Type

Programme Core - 0
Programme Elective - 1
Mandatory Course - 2
Audit Course - 3
Open Elective - 4
Internship/ Laboratory - 5
Term Paper/Project- - 6

Semester	Credits
1	18
2	19
3	15
4	16
Total	68

Program Core	**6**
Program Ele	**5 (V is moocs)**
Program lab	**4**
MLC	**1**
Audit Course	**1**
Term Paper/Mini Project/Project	**3**

19MECC1001 COMPUTER AIDED MODELLING

Course Category:	Programme Core	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Engineering Graphics, Machine-Drawing	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Understand the features of computer aided design over the traditional design approaches.

CO2: Implement algorithms and parametric equations to generate complex graphic entities.

CO3: Apply different techniques to improve the visual realism of part models & surfaces.

CO4: Optimize the assembly process through various assembly sequences.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	H			L	M	L
CO2	H			H	M	H
CO3	H		M	H	M	H
CO4	H		M	M	M	H

(L – Low, M - Medium, H – High)

Course Content

UNITI

Introduction to CAD: Fundamentals of CAD, Applications of computer for design, benefits of CAD, design work station, graphics terminal, product cycle revised with CAD/CAM, Transformations-(translation, rotation, scaling & mirror). Homogeneous representation of transformations, Concatenation of transformations.

UNITII

Geometric Modeling: Generation of Parametric equations of line, circle, ellipse, cubic spline, Bezier curve, B-Spline curve.

Parametric equations of Surfaces: Bezier surface, B-spline surface, surfaces of revolutions, ruledsurface, tabulated cylinder.

UNITIII

Visual Realism: Introduction, Hidden line removal algorithm - the priority algorithm, advantages & applications.

Hidden surface algorithm: z-buffer algorithm, advantages & applications, shading techniques: Gourant shading & Phong shading, applications, Coloring techniques.

UNITIV

Assembly of Parts: Introduction, assembly modelling: part modelling representation, Hierarchical relationship, mating conditions; Generation of assembly sequences.

Precedence diagram: assembly tree, representation in Precedence diagram and Liaison sequence analysis: Liaison diagram, Liaison graph generation for various case studies like: a) Electric motor clutch assembly b) House hold fan assembly c) Screw jack assembly d) Electric bell assembly

Text Books:

1. CAD/CAM – Theory & Practice, Ibrahim Zied, Mc Graw Hill, International edition, 2017.
2. CAD/CAM, Mikel P Groover & W Zimmers Jr, Pearson Education, India, 5thimpression 2015
3. CAD/CAM concepts & applications, Chennakesava R. Alavala,(PHI), 2009

Reference Books:

1. CAD/CAM, P.N.Rao, Tata McGraw Hill, 6th reprint, 2006
2. Procedural elements for Computer Graphics by Rogers, Tata McGraw Hill, 2005
3. Principles of Interactive Graphics by Newman and Sproull, Tata McGraw Hill, 2009.

Web Resources:

1. http://itc.fgg.uni-lj.si/bled96/papers/fridqvis.pdf
2. http://www.autodesk.com/solutions/cad-software
3. http://math.harvard.edu/~ytzeng/worksheet/0926_sol.pdf
4. http://wwwme.nchu.edu.tw/~CIM/courses/

19MECC1002 COMPUTER NUMERICAL CONTROL AND PART PROGRAMMING

Course Category:	Programme Core	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:		Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes:

At the End of the course the student will be able to:

CO1: Understand NC, CNC & DNC machines, Design features of NC, CNC & DNC and Machine control unit.

CO2: Develop manual part programme for machining components.

CO3: Understand the principles of APT programming, adaptive control machining system and solve simple problems using APT

CO4: Understand the concepts of Group Technology and Computer Aided Process Planning

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1		H				
CO2		H		L		
CO3		H		L		
CO4		M	L			

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Introduction: Fundamentals of numerical control, advantages of NC systems, classification of NC systems, point to point and contouring NC systems, incremental and absolute systems.

Machine control unit: Functions of MCU, MCU organization

CNCand DNC: Introduction, problems with conventional NC, principles ofoperation of CNC, features of CNC, advantages of CNC,

Direct numerical control, types and functions of DNC, advantages of DNC.

UNIT II

NC Part Programming: Introduction, NC coordinate system, Manual part programming, Codes
and concepts, types of tape formats, Tool Length and radius compensation, point to point and contour programming examples.

NC Part Programming (Contd.): Canned cycles, Subroutines, MACROS, simple problems ofDrilling, Turning and two-dimensional Milling.

UNIT III

Computer Aided Part Programming: NC language: APT. Preprocessor, Post processor, advantages of computer aided programming, APT programming, Geometric statements, motion statements, additional APT statements, simple problems of APT programming**.**

Adaptive Control: Adaptive Control machining systems, types, benefits of Adaptive control systems.

UNIT IV

Group Technology: Introduction, Part Families, Parts Classification and Coding, Different parts classification and coding systems, Cellular Manufacturing, Composite Part Concept, Benefits of Group Technology.

Computer Aided Process Planning: Types of Computer Aided Process Planning, Retrieval type of Process Planning Systems, Generative Process Planning Systems, Benefits of CAPP.

Text Books:

1. CAD/CAM – M.P.Groover & E.W.Zimmers, Pearson, Eleventh impression,2012
2. Computer Control of Manufacturing Systems - Y. Koren, Tata McGraw Hill, Eight reprint, 2012

Reference Books:

1. Automation, Production Systems and CIM – M.P.Groover , Pearson, Fourth Edition, Second impression, 2017.
2. "CAD / CAM "– PN Rao (PHI)3rd Edition, 2010.
3. Numerical Control & Computer Aided Manufacturing – T.K.Kundra, P.N.Rao & N.K.Tewari, Tata McGraw-Hill
4. Computer Aided Manufacturing – T.K.Kundra, P.N.Rao & N.K. Tiwari, Mc Graw Hill, Ist edition, 22 reprint, 2014.

Web resources:

1. http://www.technologystudent.com/cam/cncman4.htm
2. http://www.cnccookbook.com/CCCNCMachine.htm
3. https://www.cncci.com/resources/articles/what%20is%20cnc.htm

19MECC1003 DESIGN FOR MANUFACTURING AND ASSEMBLY

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Manufacturing Processes Engineering Design	Continuous Evaluation: Semester End Evaluation: Total Marks:	40 60 100

Course Outcomes

At the End of the course the student will be able to:

CO1: Understand the basic concept of DFMA for economical production and select the materials.

CO2: Apply the knowledge in the field of metal casting.

CO3: Select the machining and forming considerations in Design for Manufacturing.

CO4: Apply the design considerations in joining and integrate the knowledge of compliance analysis and interference analysis for assembly.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1		H				H
CO2	M	H		M		H
CO3	M	H	M	M		H
CO4	M	H	M	M		H

(L – Low, M - Medium, H – High)

Course Content:

UNIT I

Introduction to DFMA: History of DFMA, Steps for applying DFMA during product design, Advantages of applying DFMA during product design, Reasons for not implementing DFMA,

Introduction to Manufacturing Process: Classification of manufacturing process, Basic manufacturing processes, Mechanical properties of material: Tensile properties, engineering stress-strain, True stress strain, Compression properties, Shear properties,

Introduction to materials and material selection: Classification of engineering materials, Material selection for product design

UNIT II

DFM methodology for Sand casting: Typical characteristics of sand cast part, Design recommEndation for sand casting, Die casting:Suitable material consideration, General design consideration, Specific design recommEndation. Powder metal processing:Typical characteristics,Design recommEndations.

UNIT III

DFM methodology for Machining: RecommEnded materials for machinability, Design recommEndations, Turning operation: Suitable materials, Design recommEndations,

DFM methodology for Forging: Forging processes, Forging nomenclature, Suitable materials for forging, Design recommEndations, Extrusion: Process, Suitable material for extrusion, Design recommEndation for metal extrusion. Rolled Section: Process, Design recommEndations of rolled section,

UNIT IV

DFM methodology for Welding: Review of welding Processes,design recommEndation for welding process, Solder and brazed assembly: Process, Typical characteristics, Suitable materials, Design detail recommEndations, Adhesively bonded assemblies: Typical characteristics, Suitable materials, Design recommEndations for adhesive joint

Assembly: Compliance analysis and interference analysis for the design of assembly –design and development of features for automatic assembly –liaison diagrams. Environment: Motivations for

environment, principles of environment-eco-efficiency, product life cycle perspective, environment tools and processes, environment design guidelines.

Text Books:

1. L. C. Schmidt, G. Dieter, Engineering Design, 4thedition, McGraw Hill Education India Private Limited.
2. James G. Bralla, Hand Book of Product Design for Manufacturing, McGraw Hill Co., 2nd edition1986.
3. Robert Matousek., Engineering Design - A Systematic Approach, Blackie & Sons Ltd, 1963.
4. P.Dewhurst, W.Knight, G.Boothroyd, Product Design for Manufacture and Assembly, CRC Press.

References:

1. A K Chitale and R C Gupta, “Product Design and Manufacturing”, PHI, New Delhi,
2. J. Lesko, Industrial Design, Materials and Manufacture Guide, John Willy and Sons, Inc
3. O. Molloy, S. Tilley and E.A. Warman Design for Manufacturing and assembly, Chapman &Hall, London, UK.
4. D. E. Whitney, Mechanical Assemblies: Their Design, Manufacture, and Role in Product Development, Oxford University Press, New York

Web Resources:

1. http://www.npd-solutions.com
2. http://www.slideshare.net
3. http://poeth.com
4. http://hubpages.com
5. www.sciencedirect.com
6. http://soa.asee.org

19MECC1014A COMPUTER GRAPHICS

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Engineering Graphics, Matrices, Geometry	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes
At the End of the course the student will be able to:

CO1: Understand fundamentals of the computer graphics devices.
CO2: Analyze the mathematical methods for Line generation in computer graphics
CO3: Develop various Polygons and Data Structure related to Computer Graphics
CO4: Apply the concepts of animation, windowing and clipping operation in computer graphics

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	**M**			**M**		
CO2	**H**					
CO3	**H**					**M**
CO4	**H**			**M**		**M**

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Introduction: Role of Computer Graphics in CAD/CAM, configuration of graphic workstations, menu design and Graphical User Interfaces (GUI), customization and parametric programming.
Introduction to computer graphics: Color CRT raster scan monitors, plasma display & liquid crystal display monitors, computer input devices, Hard Copy Output Devices**.**

UNIT II

Geometry and Line Generation: Introduction, Lines, Line segments, PerpEndicular Lines, Distance between a point and a Line, Vectors, Pixels and Frame Buffers.

Graphic Primitives: Introduction, Display devices, Primitive Operations, The Display-File Interpreter, Normalized Device Coordinates, Display-File structures

UNIT III

Polygons: Introduction to Polygons, Polygon representation, Polygon Interfacing Algorithms, Filling Polygons, Filling with a pattern, Initializing, Anti-aliasing**.**

Data Structure in Computer Graphics: Introduction to product data standards and data structures, data-base integration for CIM.

UNIT IV

Windowing: Introduction, The Viewing Transformation, Viewing transformation implementation

Clipping: Clipping, the Cohen-Sutherland Algorithm, Clipping of Polygons,Sutherland-Hodgman algorithm.

Computer animation: Design of animation sequence, general computer animation functions, raster animation, key frame systems, motion specifications

Text Books:

1. Computer graphics by Steven Harrington McGraw Hill Education (India) Private Limited. Second Edition, 2014
2. IbrahimZeid "CAD/CAM – Theory and Practice" – McGraw Hill, International Edition, 1998.

Reference Books:

1. Procedural elements for Computer Graphics by Rogers, Tata McGraw Hill, 2005
2. Schaum's Outline of Theory and Problems of Computer Graphics by Roy A. Plastock and Gordon Kalley, McGraw-Hill Companies, Inc., 1986.
3. Donald Hearn and M.Pauline Baker “Computer Graphics”, Prentice Hall, Inc., 1992.
4. David.F.Rogers, J.Alan Adams, “Mathematical elements for computer graphics” (second edition), Tata McGraw Hill edition, 1990.
5. William,M.Newman, Robert,F.Sproull, “Principles of interactive computer graphics” (second edition), Tata mcgraw Hill edition, 1997.
6. Foley, Wan Dam, Feiner and Hughes – Computer graphics principles & practices, Pearson Education – 2003.

Web resources:

1. http://en.wikipedia.org/wiki/Computer_graphics
2. http://nptel.ac.in/courses/106106090/
3. http:// www.youtube.com/watch?v=fwzYuhduME4

19MECC1014B VISION SYSTEM & IMAGE PROCESSING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Engineering Mathematics	**Continuous Evaluation:**	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Apply the fundamentals of image acquisition and processing .
CO2: Analyze image enhancement and restoration techniques
CO3: Apply image compression and segmentation techniques.
CO4: Understand object recognition concepts.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	M	M	L			
CO2	M	M	L			
CO3	M	M	L			
CO4	M	M	L			

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Machine vision, Vision sensors, Visual perception, Low level vision, introduction to stereopsis, Image sensing and acquisition, Image sampling and Quantization, Gray level to binary image conversion, basic relationship between pixels, Linear and Non-linear Operations.

UNIT II

Image enhancement, Spatial domain techniques, Histogram Processing; Spatial Filtering.

Frequency domain operations, Fast Fourier transform (FFT), Hough transform, Image Restoration, Image smoothing and sharpening, homo-morphic filtering

UNIT III

Image Compression, Fidelity criteria, Source encoder and decoder, Error free and Lossy compression

Image segmentation, Edge detection, detection of discontinuities, Thresholding, region based segmentation, Region Growing

UNIT IV

Image compression, Edge detection, Thresholding, Spatial smoothing, Boundary and Region representation, Shape features, Scene matching and detection, Image classification

Text Books:

1. R C Gonzalez and R E Woods, “Digital Image Processing”, Pearson Education, 3rd edition, 2007.
2. Kenneth R Castleman “Digital Image Processing, Prentice Hall Press, 1996.

Reference Books:

1. S Jayaraman, T Veerakumar and S Esakkirajan, “Digital Image Processing”, Academic Press, 2009
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Prentice Hall, 1989
3. Chanda & Mazumdar “Digital Image Processing & Analysis”, PHI, 2011
4. R C Gonzalez, R E Woods, Steven L Eddins, “Digital Image Processing using MATLAB”, 2nd Edition, 2009
5. Justin Solomon, “Numerical Algorithms: Methods for Computer Vision, Machine Learning and Graphics”, CRC Press, 2015

Web Resaources:

1. https://nptel.ac.in/courses/117105079
2. https://www.coursera.org/learn/image-processing

19MECC2014C ARTIFICIAL INTELLIGENCE

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Probability and statistics	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course outcomes:
At the End of the course the student will be able to:

CO1: Analyze basic search techniques.
CO2: Learn the basics and applications of Knowledge Representation.
CO3: Learn and design intelligent systems with Uncertain.
CO4: Acquire knowledge about the architecture of an expert system .

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	M			M		
CO2	M		L	M		
CO3	H		M	M		
CO4	H		M	M		

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents.
Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

UNIT II

Knowledge Representation and Reasoning: ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

Planning: planning as search, partial order planning, construction and use of planning graphs

UNIT III

Representing and Reasoning with Uncertain Knowledge: probability, connection to logic, indepEndence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

UNIT IV

Machine Learning and Knowledge Acquisition: learning from memorization, examples, explanation, and exploration. Learning nearest neighbour, naive Bayes, and decision tree classifiers, Q-learning for learning action policies, applications.

Expert Systems: Architecture of an expert system, existing expert systems like MYCIN, RI, Expert system shells.

Text Books:

1. Rich E., Artificial Intelligence, Tata McGraw Hills .
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education Asia .

Reference Books:

1. Patterson D.W, Introduction to AI and Expert Systems, McGrawHill.
2. Shivani Goel, Express Learning- Artificial Intelligence, Pearson Education India.

Web Recourses

- https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Artificial%20Intelligence/Notes%20from%20the%20frontier%20Modeling%20the%20impact%20of%20AI%20on%20the%20world%20economy/MGI-Notes-from-the-AI-frontier-Modeling-the-impact-of-AI-on-the-world-economy-September-2018.ashx

- https://arstechnica.com/gadgets/2018/06/google-duplex-is-calling-we-talk-to-the-revolutionary-but-limited-phone-ai/

19MECC1015A OPTIMIZATION TECHNIQUES

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Operation research, Algorithms	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Understand different classical and numerical Optimization algorithms.
CO2: Acquire the knowledge in principles of ANN and training of networks.
CO3: Understand principles of Genetic Algorithms.
CO4:Solve and understand different Optimization problems and fuzzy systems.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1		H		M		
CO2		M		M		
CO3		M		M		
CO4		M	M	M		

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Classical Optimization Techniques: Single variable optimization with and with out constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions.

Numerical Methods for Optimization: Interval halving method, Fibonacci method,Quadratic interpolation method, Newton method, Quasi Newton method, Secant method.

UNIT II

Introduction to Neural networks: History ofneural Network,Basic Concepts of Neural Networks, Human Brain, Model of an Artificial Neuron, Neural Network Architectures – Single layer feed forward Network; Multilayer feed forward Network, Recurrent Networks. Characteristics of Neural Networks, Neural Network Architecture – Rosenblatt's perceptron, ADALINE, MADLINE

Back Propagation Networks: Architecture of a Back propagation – the Perceptron Model –solving XOR AND and OR. Back propagation Learning: Input layer computation, Hidden layer computation, Output layer Computation, calculation of error, Training of Neural Network, Network – objective, supervise training, unsupervised training, Method of Steepest Descent , Effect of learning Rate , adding a momentum term, Applications

UNIT III

Fundamentals of Genetic Algorithms: History , Biological Background, Creation of Offsprings Working Principle, Encoding – Binary encoding, Octal Encoding, Hexadecimal Encoding, Permutation Encoding, Value Encoding, Tree encoding, Fitness function, Reproduction – Roulette wheel Selection, Boltzman selection Tournament Selection, Rank Selection, Steady state selection Differences and similarities between conventional andevolutionary algorithms,

Genetic Modeling: Inheritance Operators, Cross over-Single site, Two point, Multi point, Uniform, Matrix Crossover, Gross Cross over. Inversion and Deletion, Mutation Operator - Mutation, Mutation Rate

Genetic Programming (GP): The Primitives of Genetic Programmes: The Terminal Set, The Function Set The Basic GP

Algorithm- Generational GP Algorithm, Steady – state GP Algorithm, Differences between GA & GP.

UNIT IV

Fuzzy Set Theory: Fuzzy Versus Crisp, Crisp sets- operations, properties Partition and covering. Fuzzy sets- Membership Function, Basic Fuzzy Set Operations properties of Fuzzy sets. Crisp Relations – Cartesian product, Other Crisp Relations, Operations on Relations, Fuzzy Relations –Fuzzy Cartesian Product, Operations on Fuzzy Relations

Applications of Optimization in Design And Manufacturing Systems: Sometypical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs, general optimization model of a machining process, optimization of arc welding parameters.

Text Books:

1. Engineering Optimization – Singiresu S. Rao, New Age Publishers,3rd edition,2010 .
2. Neural Networks,Fuzzy Logic, and Genetic Algorithms – Synthesis and Applications –S. Rajasekaram G A VijayalakshmiPai PHI.

Reference Books :

1. Genetic Programming – An Introduction - Wolfgang Banzhaf, Peter Nordin Robert E .Keller Frank D. Francone.
2. Optimization for Engineering Design: Algorithms and examples – Kalyanmoy Deb, PHI Publishers,2012.
3. Multi objective Optimization using Evolutionary Algorithms - Kalyanmoy Deb, PHI Publishers,2010
4. Introduction to Optimum Design- Jasbir S. Arora, McGraw Hill (International) Publishers 1989.

Web Resources:

http://www.nptel.ac.in/courses/105108127/pdf/Module_1/M1L4slides.pdf
https://en.wikipedia.org/wiki/Artificial_neural_network
http://www.geneticprogramming.com/Tutorial/
https://archive.org/stream/

19MECC1015B MECHANICAL VIBRATIONS

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Engineering Mechanics Machine Dynamics	**Continuous Evaluation:**	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes:

At the End of the course the student will be able to:

CO1: ComprehEnd the concepts of damping and the response of damped free and forced vibrations of single degree of freedom systems.
CO2: Solve two-degree and multi-degree of freedom systems to obtain natural frequencies and mode shapes using exact methods.
CO3: Analyze the behavior of transient vibrations and critical speeds of shafts.
CO4: Understand the vibrations of continuous systems and reasons for non-linear vibrations.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	H			M		L
CO2	H			M		L
CO3	H			M		L
CO4	H			M		L

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Damped Free Vibrations of Single Degree of FreedomSystems: Different types of damping, Free vibrations with viscous damping, Logarithmic decrement, Viscous dampers, Dry friction or Coulomb damping, Solid or structural damping, Slip or interfacial damping.

Forced Vibrations of Single Degree of FreedomSystems: Forced vibrations with constant harmonic excitation, Forced vibrations with rotating and reciprocating unbalance, Forced vibrations due to excitation of the support, Energy dissipated by damping, Forced vibrations with Coulomb damping, Forced vibrations with structural damping, Determination of equivalent viscous damping from frequency response curve and Vibration isolation and transmissibility.

UNIT II

Two Degrees of Freedom Systems: Principal modes of vibration, Semi-definite system, Combined rectilinear and angular modes, Undamped forced vibrations with harmonic excitation, Vibration absorbers and Vibration isolation.

Multi-Degree of Freedom Systems-Exact Analysis: Free vibrations-equations of motion, Influence coefficients, Generalized coordinates and coordinate coupling, Natural frequencies and mode shapes (Eigen values and Eigen vectors), Orthogonal properties of the normal modes, Modal analysis (undamped free vibrations).

UNIT III

Transient Vibrations: Introduction, Response to an impulsive input, Response to a step input, Response to a pulse input: rectangular pulse and half sinusoidal pulse, Phase-plane method and Shock spectrum.

Critical Speeds of Shafts: Critical speed of a light shaft having a single disc without damping, Critical speed of a light shaft having a single disc with damping, Critical speed of a light shaft having two discs without damping.

UNIT IV

Continuous Systems: Vibrations of strings, Longitudinal vibrations of bars, Torsional vibrations of circular shafts, Lateral vibrations of beams.

Nonlinear Vibrations: Introduction: difference between linear and nonlinear vibrations, Examples of nonlinear systems: abrupt non-linearity (vibrating mass connected to string), hard and soft springs, Phase Plane, Undamped free vibration with nonlinear spring forces. Phase plane plot of hard and soft springs.

Text Books:

1. Mechanical Vibrations by G. K. Grover, Nem Chand & Bros, Roorkee, Uttarakhand, India, 8th edition, 2009.

Reference Books:

1. Mechanical Vibrations by R. Venkatachalam, PHI Learning Private Limited, 2014.
2. Mechanical Vibrations by V. P. Singh, Dhanpat Rai & Co. (P) Ltd, Delhi, 4th edition, 2015.

Web Resources:

1. https://ocw.mit.edu/courses/mechanical-engineering/2-003sc-engineering- dynamics-fall-2011/mechanical-vibration/
2. https://nptel.ac.in/courses/112/103/112103111/
3. https://nptel.ac.in/courses/112/103/112103112/
4. https://freevideolectures.com/Course/2684/Mechanical-Vibrations

19MECC1015C MATERIAL SELECTION IN MECHANICAL DESIGN

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Engineering Metallurgy	**Continuous Evaluation:**	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes
At the End of the course the student will be able to:

Course Outcomes
Upon successful completion of the course, the student will be able to:
CO1: Study themechanical, electrical, thermal and eco properties of materials.
CO2: Analyzeseveral of material property parameters using charts.
CO3: Identify the material selection strategies for different applications.
CO4: Apply the suitable materials for specific mechanical applications.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1		H		M		
CO2		H		M		
CO3		H		M		M
CO4		H		M		M

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Material Properties: General properties:Introduction, Density, price, Mechanical properties: Elastic moduli,Yield strength,Tensile strength, Compressive strength, Failure strength, hardness, Elongation, Fatigue Endurance limit, Fracture toughness,Toughness,Thermal Properties:Melting point, Glass temperature, Maximum service temperature, Minimum service temperature,Thermal conductivity, Specific heat,Thermal expansion coefficient and Thermal shock resistance, Electricalproperties: Electrical resistivity, Dielectric

constant, Breakdown potential andPower factor,Eco-properties: Embodied energy, Carbon footprint

UNIT II

Material Property Charts:Introduction,Exploring Material Properties,the modulus–density chart, the strength–density chart,The modulus–strength chart,The specific stiffness–specific strength chart,The fracture toughness–modulus chart,The fracture toughness–strength chart,The loss coefficient–modulus chart,The thermal conductivity–electrical resistivity chart,The thermal conductivity–thermal diffusivity chart,The thermal expansion–thermal conductivity chart, The thermal expansion–modulus chart,The maximum service temperature chart,Friction and wear,Cost bar charts,the modulus–relative cost chart andthe strength–relative cost chart.

UNIT III

Materials Selection:Introduction, The Selection Strategy: Material attributes,Selection strategies, Translation, Screening, Ranking, Documentation andLocal conditions.Material Indices,the Selection Procedure,Computer-Aided Selection,the Structural Index,Selection of material and shape:Shape Factors, Limits to Shape Efficiency Exploring Material-shape Combinations, Material Indices That Include Shape and Graphical Co-selecting Using Indices Architecture Materials: Microscopic Shape.

UNIT IV

Case Studies: Materials Selection:Introduction, Materials for Oars, Materials for Table Legs, Materials for Flywheels, Materials for Springs, Elastic Hinges and Couplings, Materials for Seals, Materials for Passive Solar Heating, Materials to Minimize Thermal Distortion in Precision Devices, Materials for Heat Exchangers, Heat Sinks for

Hot Microchips, Materials for Radomes andCost: Structural Materials for Buildings.

Text Books:

1. Michael F. Ashby., “Materials Selection in Mechanical Design”, Elsevier, 2011.
2. Charles, J.A., Crane, F.A.A and Furness, J.A.G., “Selection and use of engineering Materials”, (3 rd Edition, Butterworth – Heiremann, 1977.
3. Courtney, T.H.,” Mechanical Behavior of Materials” ,(2nd edition), McGraw Hill,2000

Reference Books:

1. James, K.W., Wiley, Intersam, John, “The Hand book of Advance Materials”, Publishers., 2004.
2. Flinn,R.A.and Trojan ,P.K.., “Engineering Materials and their Applications” (4thEdition), Jaico, 1999.
3. Failure Analysis and Prevention -Metals hand book, vol. 10,10th edition, 1994.E-resources and other digital material:

Web Resources:

1. https://www.youtube.com/watch?v=oHeGT75rbDA
2. https://www.youtube.com/watch?v=QW1cHSZy-qs
3. https://www.youtube.com/watch?v=my63D9zG7bc

19MTMC1026 RESEARCH METHODOLOGY AND IPR

Course Category: Mandatory Learning Course **Credits**: 0
Course Type : Theory **Lecture/Tutorial/ Practice**: 2-0-0
Prerequisites: **Continuous Evaluation**: 40
Semester End Evaluation: 60
Total Marks: 100

Course Outcomes:

At the End of the course the student will be able to:

CO1: Acquire an overview of the research methodology and techniques to define research problem

CO2: Review the literature and identify the problem.

CO3: Analyze the optimum sampling techniques for collected data.

CO4: Apply various forms of the intellectual properties for research work.

PO	a	b	c	d	e	f
CO1				M		H
CO2				L		H
CO3						H
CO4						H

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Research Approaches, Significance of Research, Research and Scientific Methods, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Research Problem: Defining theResearch Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, an Illustration.

UNIT II

Reviewing the literature: Place of the literature review in research, improving research methodology, broadening knowledge base in research area, enabling contextual findings.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Basic Principles of experimental Designs, Important Experimental Designs.

UNIT III

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, sources of error in measurement tools.

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method **Testing of Hypotheses:** Hypothesis, Basic Concepts, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing.

UNIT IV

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, and Significance of Report Writing

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act, 1957, Trade Secrets, Utility Models WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks,

Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement.

Text Books:

1. Research methodology: Methods and Techniques, **C.R. Kothari, GauravGarg,** New Age International, 4th Edition, 2018.
2. Research Methodology a step-by-step guide for beginners. **Ranjit Kumar, SAGE Publications** Ltd.,3rd Edition, 2011
3. Study Material, Professional Programme Intellectual Property Rights, Law and Practice, **The Institute of Company Secretaries of India**, Statutory Body under an Act of Parliament, September 2013.

References:

1. An introduction to Research Methodology, Garg B.L et al ,RBSA Publishers 2002
2. An Introduction to Multivariate Statistical Analysis Anderson T.W, Wiley 3rd Edition,
3. Research Methodology, Sinha, S.C, Dhiman, EssEss Publications2002
4. Research Methods: the concise knowledge base ,Trochim ,Atomic Dog Publishing ,2005
5. How to Write and Publish a Scientific Paper, Day R.A, Cambridge University Press 1992
6. Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009
7. Proposal Writing, Coley S.M. Scheinberg, C.A, Sage Publications, 1990
8. Intellectual Property Rights in the Global Economy, Keith Eugene Maskus, Institute for International Economics.

19MECC1051 CAD LABORATORY.

Course Category:	Programme Core	Credits:	1.5
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-3
Prerequisites:	Engineering Graphics, Machine-Drawing, 2D drafting lab.	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Develop drawing algorithms for various graphic entities using Matlab software.

CO2: Generate geometrical part models and assemblies of machine components.

CO3: Apply theData exchange formats for CAD files.

CO4: Develop 2D views with bill of materials.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	H	L		L	L	L
CO2	H	L		M	H	M
CO3	H	L		M	M	M
CO4	H	L		M	M	M

(L – Low, M - Medium, H – High)

Course Content

1. Development of 2D drawing algorithms using matlab software.
2. Part modelling with simple & moderate features.
3. Part & surface modelling with advance features.
4. Assembly of solid model parts & verification for interface tolerances.
5. Exporting and importing of solid models for various applications.
6. 2D views with Bill of materials.

Text Books:

1. Pro/ENGINEER Wildfire 4.0 for Engineers and Designers - Prof. Sham Tickoo, Publications: CADCIM Technologies, 2017.
2. CATIA V5R20 for Designers - Sham Tickoo, Publications - Purdue University Calumet and CADCIM Technologies, USA Published by CADCIM Technologies, USA - ISBN: 978-1-932709-94-0.

Reference Book:

1. CAD/CAM: Theory & Practice (Theory and Practice), Zeid Ibrahim, Tata Mc-Graw hill publication.

Web Resources:

- https://www.youtube.com/watch?v=srnm--lKtl4
- https://**catia**tutor.com/
- https://www.youtube.com/watch?v=BDHdcSzKhxk
- https://www.youtube.com/results?search_query=project+2d+sketches+with+bill+of+materials

19MECC1052 CAM LABORATORY

Course Category:	Programme Core	Credits:	1.5
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-3
Prerequisites:	Machining processes Modeling, Part programming	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes:

At the End of the course the student will be able to:

CO1: Understand and prepare Part Programs for Turning, milling and drilling using FANUC (OT & OM) Simulation Software and operation of CNC lathe

CO2: Understand and Perform Pick and Place Operations and moving the Robot arm along a defined path using SCORBOT ER 4u Robot.

CO3: Perform 2D, 3 D Models and carryout turning & milling operations using Master CAM

CO4: Develop fasteners andsectional model using additive manufacturing.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1		H				
CO2			M			
CO3	M	M				
CO4		H				

(L – Low, M - Medium, H – High)

Course Content

Manual Part Programming

- Step & Taper Turning
- Linear & Circular interpolation
- Mirror Imaging

Computer Assisted Part Programming:

- Facing, Step and Taper Turning
- Thread Cutting & Chamfering, Filleting

Material Handling

- Pick and Place Programming with Robot

Manufacturing

- Demonstration of making any two parts on CNC Lathe

Additive Manufacturing

- Making a Bolt and Nut
- Making a Sectional Model

Reference Books:

1. CAM/CAM - PN Rao, PHI, 2004
2. Computer Control of Manufacturing Systems – Y Koren, McGraw Hill, 1983

Web Resources:

- http://www.mfg.mtu.edu/cyberman/machtool/auto/nc/index.html
- http://www.instruction.greenriver.edu/manufacturing/08Spr/NC%20PGM.pdf
- http://elabz.com/wp-content/uploads/2010/04/ER4u_User_Manual.pdf
- http://cncmanual.com/?s=mastercam+manual
- http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/
- Computer%20Aided%20Design%20&%20ManufacturingII/Module%20F/ Module%20F(1)/p1.htm
- http://www.mfg.mtu.edu/cyberman/machtool/auto/nc/method.html

19MECC2001 COMPUTER INTEGRATED MANUFACTURING

Course Category:	Programme Core	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	CAD, CNC machines, Science of measurement	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Learn fundamental concepts of manufacturing, automation, CAD/CAM and CIM.

CO2: Understand the basic concepts of Group technology, Machine cell design and Robotics.

CO3: Learn the building blocks of FMS and automated material handling systems such as AGVS.

CO4: Understand various types of Automated Storage and Retrieval Systems, automated contact and non- contact inspection techniques.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	H	H	M	M		H
CO2	L	H	H	H		H
CO3	H	H	H	H		H
CO4	L	H	H	H		H

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Introduction: Definition of Automation, Need for Automation, Types of Automation, Advantages and Disadvantages of Automation, Types of Production, Functions in manufacturing, Automation Strategies, Introduction to CAD, Applications of Computers in Design, Introduction to CAM, Manufacturing Planning and control, Fundamentals of computer Integrated Manufacturing.

UNIT II

Group Technology: Introduction, Part families, Parts classification and coding (OPITZ & MULTI CLASS), Production flow analysis, Machine cell design, Types of cell design, Benefits of Group Technology.

Robotics: Robot anatomy, Robot Configuration, Basic Robot motions, Types of drivers, End effectors.

UNIT III

Flexible Manufacturing Systems: What is FMS, FMS Workstations, Materials Handling and storage system, Computer Control System, Planning the FMS, Applications and benefits.

Automated Material Handling: Introduction, Types of material handling equipment, automated guided vehicle system (AGVS), Applications, Vehicle guidance and routing, Traffic control and safety, System management.

UNIT IV

Automated Storage Systems (AS): Storage systems performance, Automated storage / Retrieval systems (AS / RS), Basic components of AS /RS, AS / RS controls, Special features, applications.

Automated Inspection & Testing: Automated inspection principles and methods, sensor technologies for automated inspection, Co-ordinate measuring machines (CMM), construction, operation & programming, CMM benefits and trEnds. Introduction to machine vision & non-contact inspection methods.

Text Books:

1. Automation, Production Systems, and Computer Integrated Manufacturing–M.P.Groover Pearson New International Edition, 2013.

Reference Books:

1. CAD/CAM - Mikell P.Groover, and Emory W.Zimmers.Jr. PHI Publishers,1984
2. Computer Aided Design and Manufacturing, K.Lalit Narayan, K.Mallikarjuna Rao, MMM Sarcar, PHI Publishers,2008
3. CAD/CAM/CIM, Radhakrishnan and Subramanian, New Age Publishers

Web resources:

- http://www.enotes.com/computer-integrated-manufacturing
- http://www.britannica.com/EBchecked/topic/computer-integrated–manufacturing
- http://en.wikipedia.org/wiki/computer-integrated-manufacturing#overview

19MECC2002 FINITE ELEMENT ANALYSIS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Strength of materials, Dynamic analysis	**Continuous Evaluation:**	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Apply 1-D FEM for truss, beam and frame problems.

CO2: Apply 2-D FEM for plane and axisymmetric solids.

CO3: Understand the formulations for 3-D and Numerical Integration.

CO4: Apply the FEM for dynamic systems.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	H			M		M
CO2	H			M		M
CO3	H			M		M
CO4	H			M		M

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Analysis of Trusses, Beams and Frames: Introduction, two-node Planar and Space truss elements, two-node Beam element, two-node Planar Frame element. Numerical problems with maximum three unknowns.

UNIT II

Analysis of Plane Stress and Plane Strain Problems: Finite Element modeling using CST and LST elements, element matrices

for plane stress and plane strain, Stress calculations, Problem modeling and boundary conditions.

Axisymmetric Solids Subjected to Axisymmetric Loading: Axisymmetric formulation, Finite element modeling using linear triangular element, element matrices, Stress calculations, Problem modeling and boundary conditions.

UNIT III

Analysis of Three-Dimensional Problems: Introduction, Finite Element formulation using linear tetrahedron element, element matrices, stress calculations.

Numerical Integration: Gauss quadrature formula, One-dimensional Integration with one-point formula, two point formula, three-point formula, Two-dimensional numerical integration with two-point formula for linear triangular and linear quadrilateral regions.

UNIT IV

Dynamic Analysis: Dynamic equations of motion, consistent and lumped mass matrices, mass matrices of linear plane truss, space truss, planar frame, beam, and tetrahedron elements. Free longitudinal vibrations of a stepped bar, dynamic response using FEM.

Text Books:

1. Introduction to Finite Elements in Engineering by T.R. Chandrupatla and A. D. Belegundu, PHI Learning Private Limited, 3rd edition, 2011.

Reference Books:

1. The Finite Element Method in Engineering – S. S. RAO, Butterworth-Heinemann publications, 5th edition, 2011
2. Applied Finite Element Analysis – Larry J. Segerlind, John Wiley and Sons, Second Edition, 1984

Web resources:

- http://ocw.mit.edu/courses/mechanical-engineering/2-092-finite-element-analysis-of-solids-and-fluids-i-fall-2009/
- http://www.infocobuild.com/education/audio-video-courses/mechanical-engineering/linear-finite-element-analysis-mitocw.html

19MECC2003 ROBOTICS AND AUTOMATION

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Vector Algebra, Matrix properties, Basic Electronics	**Continuous Evaluation:**	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Understand the role of robotics in manufacturing automation and integration issues.
CO2: Analyze manipulator composition, selection of microcontroller/ PLCs.
CO3: Understand the dynamics and control of robotic manipulators.
CO4: Apply robot programming language methods with reference to work cells and automation.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1		M	H	L		
CO2		M	H	L		
CO3	H		M	L		
CO4	H		M	L		

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Automation and robotics, evolution, robotic applications in automated processing, assembly and inspection, automated guided vehicles, multiple robots and machine interference, considerations in work-cell design, interlocks, economic justification.

UNIT II

Robot Anatomy, Degree of freedom, Manipulator classification, performance specifications: resolution, precision and accuracy, End-effector types, selection/ design considerations.

Programmable Logic controllers in factory automation, Comparison of Microcontroller and PLC structure, ladder programming, and programming issues related to automation. P, PI, PID controllers.

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UNIT III

Orthogonal coordinate systems, Transformation matrices, Denavit-Hartenberg algorithm for forward kinematics, Inverse Kinematics and singularities, Manipulator Dynamics, Motion and Force control of manipulators

UNIT IV

Programming languages: VAL, RAIL, AML, structure of the language, programming methods, motion interpolation, wait, signal and delay commands, branching, capabilities and limitations of lead-through programming.

Importance of Vision and Image processing in robotics, Role of AI in robotic systems. Case studies on Robotics and automated manufacturing.

Text Books:

1. M. P. Groover, M. Weiss, R. N. Nagel and N. G. Odrey, “Industrial Robotics-Technology, Programming and Applications”, McGraw-Hill Book and Company (1987).
2. I. J. Nagrath and R. K. Mittal, “Robotics and Control”, TMH publishing Company Ltd., 2003 edition.

Reference Books:

1. John J. Craig, “Introduction to Robotics: Mechanics and Control”, Addison-Wesley Publishing Company, 3rd Edition, 2003.
2. M. Spong, M. Vidyasagar, S. Hutchinson, “Robot Modeling and Control”, Wiley & Sons, 2005.
3. Pires, “Industrial Robot Programming–Building Application for the Factories of the Future”, Springer (2007).
4. K. S. Fu, R. C. Gonzalez and C.S.G. Lee, “ROBOTICS: Control, Sensing, Vision and Intelligence”, McGraw-Hill (1987).
5. Francis X Govers, “Artificial Intelligence for Robotics”, 1st edition (Kindle edition), Packt Publishing Limited (2018).

Web resources:

- https://www.edx.org/course/robotics-dynamics-control-pennx-robo3x
- https://www.coursera.org/learn/motion-and-kinetics
- https://www.edx.org/course/robotics-vision-intelligence-machine-pennx-robo2x
- https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/
- https://see.stanford.edu/Course/CS223A

19MECC2014A MECHATRONICS

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Basics of Electronics Engineering	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Acquire knowledge about microprocessors and its need.
CO2: Understand the internal architecture of 8086 microprocessor and micro controllers.
CO3: Know the working of actuators.
CO4: Design the mechatronics system.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1			H	M		
CO2			H	M		
CO3			H	M		
CO4			M	M		

(L – Low, M - Medium, H – High)

Course Content

UNIT - I

Introduction: Introduction to Mechatronics - Systems - Mechatronics in Products - Measurement Systems - Control Systems - Traditional design and Mechatronics Design.

Microprocessor and micro controllers: General definitions of microprocessors and micro controllers, Similarities and Dissimilarities of Microprocessors and microcontrollers. interfacing of microprocessors with RAMs, ROMs. Introduction to peripheralinterfacing.

UNIT II

INTEL 8086 Microprocessor: Pin Functions, Architecture, Characteristics and Basic Features of Family.

Microcontroller: Introduction to Microcontrollers, Evolution, Basic structure, input/output processing, Mnemonics, Timers, Internal relays and counters. Data handling.- Analog input/ output, D/A Converters and A/D Converters, Selection of PLC.

UNIT III

Actuators: Selection of actuators based on principle of operation, performance characteristics, maximum loading conditions, safety etc. Classification of Actuators: Linear actuators, Rotary actuators, Actuators to operate flow control valves

Principle and selection of mechano-electrical actuators: DC motors, Stepper Motors, Solenoid Actuators, Servo Motors.

UNIT IV

Sensors and Transducers: Introduction-Performance terminology-static and dynamic characteristics, Displacement position and proximity- strain gauged element, capacitive element, Differential transformers, Optical encoders, Proximity switches. Velocity and Motion- Tachogenerator, pyroelectric sensors. Temperature sensors – RTDs, Thermisters, thermocouples. Light sensors, Selection of sensors.

Mechatronics Design: Designing, Possible design solutions- wiper mechanism, Pick and place robot, Car park barrier, Automatic camera.Traffic light controller and Tank level control system

Text books:

Mechatronics – Electronics Control Systems in Mechanical and Electrical Engineering, Bolton. W, Pearson Education, 5th Edition.

Gaonkar, Ramesh, Microprocessor Architecture, Programming and Applications with the 8086, Penram International Publishing India Pvt, Ltd.

References:

Mechatronics by HMT,1st Edition.
Mechatronics by Mahalik,1st Edition,TMH.
Introduction to Mechatronics –David and Alcaitore Michael B.Histand TMH,

Web Resources:

1.http://www.engr.sjsu.edu/sjlee/vEndors.html
2.www.engr.colostate.edu/~dga/mechatronics/resources.html
3.www.NI.com
4.www.cambridgemechatronics.com/contact/terms
5.www.pdf-free-download.com/mechatronics-labs.pdf6.mechatronics.me.wisc.edu

19MECC2014B SIGNAL PROCESSING AND CONDITION MONITORING

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Mathematics, Mechanical Vibrations	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO 1: Understand the maintenance scheme and their scope.

CO 2: Analyze signals for machine condition monitoring .

CO 3: Develop an appreciation for the need of modern technological approach for condition Monitoring

CO 4: Understand various condition monitoring techniques.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1			M			
CO2	M		H	M		
CO3				M		
CO4	M		H	M		

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Maintenance – Introduction - objectives –types –concepts and economic benefits, Preventive maintenance –time based & condition based, Condition Monitoring & Performance monitoring, **Vibration Monitoring** –causes and effects of vibration. Review of Fundamentals of Vibrations, Vibration Measuring Equipment - Sensors, Signal conditioners, recording elements, Sensors –Factors affecting the choice of sensors, Contact type sensors –Non contact type sensors.

UNIT II

Signal Conditioning –Display/Recording elements, Vibration meters and analyser, Overall Level Measurement, Vibration limits &

Standards, Signal Analysis -Frequency Analysis, Measurement of overall vibrations levels, Vibration limits and standards,

UNIT III

Special Vibration Measuring Techniques- Shock Pulse Method, Kurtosis, Cepstrum Analysis, Critical speed analysis, Orbit, vibration control, Wear behavior monitoring and Contaminants Monitoring Technique, Filters, chip detectors, Ferrography, Oil Analysis –oil degradation analysis, Abrasive Particle in oil, counters, Particle classification and counter, spectrometric oil analysis,

UNIT IV

Performance TrEnd Monitoring –Primary and secondary parameters, Performance trEnd analysis, Performance trEnd monitoring systems, Temperature Monitoring –Various techniques – thermometer, thermocouple, Thermography, infrared pyrometers etc, Corrosion Monitoring –different techniques, Selection of condition motoring techniques,

Non-Destructive Techniques –important features, Types of defects detected by NDT –Visual, Dye Penetration, Acoustic Emission and its applications, X-ray, Radiographic, Magnetic Flux test etc, Application of NDT Techniques,

Text Book:

1. Rao, J S., Vibration Condition Monitoring, Narosa Publishing House.

Reference Book:

1. R. Mohanty Machinery Condition Monitoring: Principles and Practices, CRC Press.

Web Resources:

- *http://freevideo*lectures.com/Course/2684/Mechanical-Vibrations.
- http://freevideolectures.com/Course/3137/Soil-Dynamics/12
- http://freevideolectures.com/Course/2684/Mechanical-Vibrations/36
- http://www.cosmolearning.com/courses/mechanical-vibrations-537/video-lectures/
- http://www.cosmolearning.com/video-lectures/vibration-testing-equipments-signal-analysis-11570/

19MECC2014C FLUID POWER AND CONTROL SYSTEMS

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:		Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Differentiate various types and working of different hydraulic Pumps, Actuators.

CO2: Understand the working of various valves.

CO3: Design various Hydraulic and Pneumatic circuits.

CO4: Design various Pneumatic Logic Circuits.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1			H			L
CO2			M			L
CO3			H			L
CO4			H			L

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Oil Hydraulic Systems: Introduction, Hydraulic Power Generators-Selection of Pumps.

Hydraulic Actuators: Linear and Rotary Actuators

UNIT II

Control and Regulation Elements: Pressure, Direction and Flow Control Valves, Servo and Proportional Valves

UNIT III

Industrial Hydraulic Circuits: Reciprocation, Quick Return Circuit, Sequencing and Synchronizing Circuits, Accumulator Circuits, Intensifier Press Circuit, Hydraulic Operation of a Milling Machine Circuit.

Safety Circuits: Two Hand Safety Control Circuit, Fail Safe Control Circuit Using Emergency Cut off Valve.

Pneumatics: Basic Pneumatic system, Pneumatic Valves

Pneumatic circuits: Basic Pneumatic Circuit, Speed Control Circuit, Quick Exhaust

Circuit, Two Step Feed Control Circuit, Time Delay Circuit, automatic cylinder reciprocating circuit.

UNIT IV

Pneumatic Logic Controls: Position and Pressure Sensors.

Design of pneumatic logic circuits: Classic method, Cascade method, Step Counter Method.

Maintenance: Fault Finding-Hydro Pneumatic Circuits and Trouble shooting of pneumatic systems, possible causes and remedies.

Low cost automation: Concepts of Low Cost Automation. Technologies used for Low Cost Automation.

Textbooks:

1. Fluid power with Applications by Antony Espossito, Pearson Education India, 6th Edition, 2003
2. Hydraulic and Pneumatic Controls by R Srinivasan, Mc Graw Hill Education (India) Private Limited, 2nd Edition, 2008

References:

1. Basic Fluid Power by Dudley A. Pease and John J. Pippenger, Prentice Hall, 2nd Edition, 1987

2. Hydraulics and Pneumatics by Andrew Parr, (HB), Jaico Publishing House, 2nd Edition, 1999
3. Pneumatic and Hydraulic Systems by Bolton. W, Butterworth – Heinemann Ltd., 1997

Web resources:

http:// www.pneumatics.com
http:// www.fluidpower.com.tw

19MECC2015A ADDITIVE MANUFACTURING

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Computer Aided Modelling, CAD Lab.	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes
At the End of the course the student will be able to:

CO1: Understand the importance and applications of AM system in engineering design.
CO2: Develop various layered models through different AM processes.
CO3: Analyse the parameters to improve the part accuracy and rapid tooling.
CO4: Apply the concepts of AM in rapid manufacturing and related processes.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	M	M	H	L		L
CO2	H	H	H	H		H
CO3	H	H	H	H		H
CO4	H	H	H	H		H

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Introduction: Introduction to AM, History of AM system, Survey of applications, Growth of AM industry and classification of AM system.
Stereo Lithography System: Principle, Process parameter, Process details, Data preparation, Data files and machine details & Applications.
Selective Laser Sintering (SLS): Principle, Process details, machine details & Applications.

UNIT II

Laminated Object Manufacturing: Principle of Operation, LOM materials, Process details & Applications.

Solid ground curing: Principle of operation, Machine details & Applications.

Fusion Deposition Modelling: Principle, process parameter, Path generation &Applications.

UNIT III

Laser Engineering Net Shaping (LENS): Principle, process parameter, Path generation & Applications

Rapid Tooling: Indirect Rapid tooling- Silicon rubber tooling- Aluminum filled epoxy tooling, Spray metal tooling, Cast kriksite, 3D keltool.

Software for AM: STL files, importance of various softwares: Magics, Imics.

UNIT IV

Rapid Manufacturing Process Optimization: Factors influencing accuracy, Data preparation error, Part building error, Error in finishing, Influence of build orientation.

Reverse Engineering: Introduction to Reverse engineering, Surface digitization and Surface generation from point cloud, Surface modification. **CMMmachine**: machine details, process & operation.

Text Books:

1. Chua, Rapid prototyping 3e, Principles & Application, Cambridge University press, 2010
2. Paul F.Jacobs – “stereo lithography and other RP & M Technologies”, SME, NY 1996

Reference Book:

1. Flham D.T & Din joy S.S “Rapid Manufacturing” Verlog London 2001

Web Resources:

- http://www.additive3d.com/rp_int.htm
- https://www.rolanddga.com/applications/rapid-prototyping
- http://www.emeraldinsight.com/journal/rpj
- http://additivemanufacturing.com/
- http://www.eos.info/additive_manufacturing/for_technology_interested

19MECC2015B COMPUTER AIDED INSPECTION AND TESTING

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Computer Aided Modelling, CAD Lab.	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Understand the importance and applications of computer aided testing & inspection **.**

CO2: Develop image processing methods for machine vision technique **.**

CO3: Analyse the influencing parameters for surface roughness measurement.

CO4: Apply the concepts proximity sensing for object recognition**.**

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	M		M			
CO2	H		M	M		M
CO3	M	M	M	M		M
CO4	M		M	M		M

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Introduction: Computer aided testing (CAT) and computer aided inspection (CAI), computer aided quality control (CAQC), on-line inspection and quality control, technology of automation Gauging, automatic inspection machines, in-process gauging,

Co-Ordinate Measuring Machines: Basic Types of Measuring Machines, probe types, operating modes, programming software's, accessories, measurement and inspection capabilities, flexible inspection systems, inspection problems.

UNIT II

Machine Vision: Functions of machine vision system, evaluating the performance of machine Vision system, Applications of machine vision.

Image Formation: Motion Vision: identification of obstacles in mobile robot, Shape from Shading, Binary Image Processing and Object Representation Alignment

UNIT III

Scanning Laser Beam Devices: Laser interferometer, laser, alignment devices, X-ray optics, CCD (Charge-coupled Devices) Array, ultrasonic system.

Machine Tool Sensing: Part measurement, Tool wear, Axial, motion, Sequence of functions, tool Identification. Computer aided surface roughness measuring systems, High accuracy profile measuring systems.

UNIT IV

Proximity Sensing: Photoelectric Transducers, Image processing for vision sensor, 3 dimensional object recognition. Proximity and distance measuring sensors.

Text Books:

1. Machine Vision-Nello Zueh and Richard K.Miller prentice hall,2015
2. Roborts Sensor -Pugh, IFS Publication, 2013
3. Computer Control of Manufacturing Systems -Koren, McGraw Hill, 1983

Reference:

1. Transducers and Interfacing -Bannister and Whitehead~ Von Nostrand. 1986

Web resources:

- https://www.assemblymag.com/ext/resources/White_Papers/Sep16/Introduction-to-Machine-Vision.pdf
- http://www.ignou.ac.in/upload/Unit-8-62.pdf
- https://www.diva-portal.org/smash/get/diva2:319488/FULLTEXT02.pdf

19MECC2015C MECHANICS AND MANUFACTURING METHODS OF COMPOSITES

Course Category:	Programme Elective	Credits:	3
Course Type:	Theory	Lecture-Tutorial-Practice:	3-0-0
Prerequisites:	Engineering Graphics, Machine-Drawing	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes:

At the End of the course the student will be able to:

CO1: Understand the benefits limitations and application of composites.

CO2: Understand common fabrication techniques of Composites.

CO3: Derive constitutive relations and determine stresses and strains in composites.

CO4: Analyze failure mechanisms of composites.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1		H		M		
CO2	M	H	M	M		
CO3	H	H		H		
CO4	H	H		H		

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Basic Concepts and Characteristics: Geometric and Physical definitions, Classification and characteristics of composite materials, Mechanical behaviour of composite materials, Advantages and limitations of composite materials, Current and potential usage of composite materials.

UNIT II

Reinforcements And Fabrication Of Composites: Different reinforcing fibers, Matrix materials, fabrication of thermosetting resin matrix composites, fabrication of thermoplastic resin matrix composites, fabrication of metal matrix composites, fabrication of ceramic matrix composites.

UNIT III

Elastic Behaviour of Composite Lamina: Stress strain relation for a general anisotropic material, specially orthotropic material, Transversely Isotropic material, Orthotropic material under plane stress, Isotropic material, Stress strain and strain stress relations in terms of Engineering constants, stress strain and strain stress relations for a thin lamina in terms of Engineering constants, Transformation of stress strain for two dimensional lamina, Relationship between transformed reduced stiffnesses as a function of principal lamina stiffnesses, Relationship between transformed reduced compliances as a function of principal lamina compliances, transformation of stress strain relation in terms of engineering constants for two dimensional lamina.

UNIT IV

Strength of Unidirectional Lamina: Micro mechanics of failure, Failure mechanisms, Strength of an orthotropic lamina, Strength of a lamina under tension and shear maximum stress and strain criteria

Text Books:

1. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 2006.
2. B. D. Agarwal and L. J. Broutman,K Chandra shekhara Analysis and performance of fibre Composites, Third Edition John wiley & Sons, Inc. New jersey, 2006

Reference books:

1. R. M. Jones, Mechanics of Composite Materials, Second Edition, Taylor& Francis Inc.Philadelphia,1999.

2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York.

Web Resources:

- http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Composite Materials.

19MTAC2036 TECHNICAL REPORT WRITING

Course Category:	Audit Course	Credits:	0
Course Type:	Theory	Lecture-Tutorial-Practice:	2-0-0
Prerequisites:		Continuous Evaluation:	00
		Semester End Evaluation:	00
		Total Marks:	00

Course Outcomes:

At the End of the course the student will be able to:

CO1: Understand the significance of Technical Report writing.
CO2: Develop Proficiency in writing technical reports.
CO3: Apply the basic principles to prepare documentation using LATEX.
CO4:Understanding the need of Bibliography and references for quality report writing

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1						
CO2						
CO3						
CO4						

(L – Low, M - Medium, H – High)

Course Content

UNIT I

Writing scientific and engineering papers-Title, Abstract, Introduction, Materials And Methods, Result, Discussion, Conclusion, References, Acknowledgements, AppEndices, Hedging and Criticizing, Paraphrasing and Plagiarism.

UNIT II

Effective use of charts, graphs and tables-Bar Chart, Line Chart, Pie Chart, Area Chart, Cylindrical Chart, Column Bars, Bubble Chart, Flow Diagram, Screen Capture, Tables

Writing Technical Reports-Objectives Of Technical Report, Types Of Reports, Steps In Writing A Technical Report, Guidelines For Writing A Technical Report.

UNIT III

LATEX- Introduction, Document Structure- Creating a Title, Sections, Labeling, Table of Contents

Typesetting Text- Font Effects, Colored Text, Font Sizes, Lists, Comments & Spacing, Special Characters

UNIT IV

Tables, Figures, Equations- Inserting Equations, Mathematical Symbols, Practical.

Inserting References- Introduction, The BibTeX file, Inserting the bibliography, Citing references, Styles, Practical.

Text Book(s):

1. Barun K Mitra, Effective Technical Communication-A Guide for Scientists and Engineers,Oxford University Press,2006, ISBN:978019568291.
2. LATEX for Beginners, Workbook Edition 5, March 2014 Document Reference: 3722-2014.

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books) Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

19MECC2051 FEA LABORATORY

Course Category:	Programme Core	**Credits:**	1.5
Course Type:	Laboratory	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:		**Continuous Evaluation:**	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes

At the End of the course the student will be able to:

CO1: Simulate static, dynamic and buckling analysis of engineering problems using FEA software.

CO2: Simulate static analysis of composite structures using FEA software.

CO3: Achieveconvergence by mesh refinement.

CO4: Report and interpret the results.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1	H			H	M	M
CO2	H			H	M	M
CO3	H			H	M	M
CO4	H			H	M	M

(L – Low, M - Medium, H – High)

Course Content

Finite Element Analysis using analysis packages for different structures that can be described with 1-D, 2-D & 3-D elements to perform the following analysis:

1. Static Analysis.
2. Dynamic Analysis.
3. Buckling Analysis.
4. Analysis of Composite Structures.

Reference:

1. Finite Element Analysis using ANSYS 11.0 - Paleti Srinivas, published by PHI Learning Private Limited, New Delhi, 2013.

Web Resources:

- www.engr.uvic.ca/~mech410/**proe**_tutorials.../Getting_Started_**ProE**.pdf
- https://**catia**tutor.com/
- www.mece.ualberta.ca/tutorials/ansys/
- nccastaff.bournemouth.ac.uk/jmacey/.../www/opengl_programming.html

19MECC2052 ROBOTICS AND AUTOMATION LABORATORY

Course Category:	Programme Core	Credits:	1.5
Course Type:	Laboratory	Lecture-Tutorial-Practice:	0-0-3
Prerequisites:	Mechatronics, Industrial Robotics Fluidics & Control Systems	Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes
At the End of the course the student will be able to:

CO1: Interface the robot End effectors for material handling process
CO2: Analyse the welding process parameters in Arc & spot welding robot.
CO3: Develop ladder diagrams for different logic gates like NOT, AND, OR, NAND, XOR etc.
CO4: Apply the logic to reciprocate pneumatic cylinders like single acting, double acting and sequencing of cylinders.

Contribution of Course outcomes towards achievement of Program Outcomes

PO	a	b	c	d	e	f
CO1		M	H	H		H
CO2		H	H	H		H
CO3		L	H	H		H
CO4		L	H	H		H

(L – Low, M - Medium, H – High)

Course Content

1. Robotics lab. in SIEMENS CoE:

1) Material Handling
2) Arc Welding Robot
3) Spot Welding Robot

2. Simulation software in Mechatronics lab.

1) Robot simulator
2) H-simulator
3) P-simulator
4) PLC simulator

2. Logic gates using LSM controller package

1) NOT
2) AND
3) OR
4) NAND
5) NOR
6) XOR
7) General Latching
8) Motor Latching
9) Traffic lights signal
10) On-off cyclic timer
11) Delay of timer
12) Cascade timers
13) Single acting cylinder using pneumatic system
14) Double acting cylinder using pneumatic system
15) Sequencing of cylinder using pneumatic system

Reference Books :

1. Industrial Robotics by Mikell P.Groover, TMH
2. Robotic Engineering by Richard D.Klafter, Prentice Hall, Tata Mc Graw-Hill, 1995. 3rd Edition.
3. Mechatronics (Electronic Control Systems in Mechanical and Control Engineering) by W.Bolton, 3rd edition, Pearson, 2010

Web references:

- http://engineering.nyu.edu/gk12/amps-cbri/pdf/Intro%20to%20Mechatronics.pdf
- http://runplc.com/wp-content/uploads/Books/plcprogramming.pdf
- http://www.mechatronic.me/files/ebooks/Mechatronic_Systems_Applications.pdf
- https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=10&cad=rja&uact=8&ved=0CE4QFjAJahUKEwje16HAzLLHAhXPA44KHbiQBLU&url=http%3A%2F%2Fwww.cengagebrain.co.nz%2Fcontent%2F9781285210223.pdf&ei=UyDTVZ7iN8-HuAS4oZKoCw&usg=AFQjCNG9xiziocBF0Acjh8EplOCoNiziw&sig2=yAWziE4zbmQ4VKWCSrtAHg

Video references:

- https://www.youtube.com/watch?v=7h2PlDXlo4Y&list=PL4iJohn8M7SSrxhhqpr03qYKN2TIyipWp
- https://www.youtube.com/watch?v=BKCTqHCaKn0

19MECC2067 TERM PAPER

Course Category:	Term Paper	Credits:	1
Course Type:	Term Paper	Lecture-Tutorial-Practice:	2-0-2
		Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes:

At the End of the course the student will be able to:

CO1: Identify simple theoretical and practical problems related to the area of CAD/CAM.

CO2: Analyse / Solve theoretical / practical problems for arriving at feasible solutions.

CO3: Prepare an organized report employing elements of technical writing and critical thinking.

CO4: Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO a	PO b	PO c	PO d	PO e	PO f
CO1	M			H		M
CO2	M			H		M
CO3				H	H	M
CO4				H	H	M

19MECC3011 MOOCS

Course Category:	Programme Elective - V	Credits:	3
Course Type:	MOOCS Platform	Lecture-Tutorial-Practice:	0-0-0
Prerequisites:		Continuous Evaluation:	0
		Semester End Evaluation:	100
		Total Marks:	100

The following courses are offered Under MOOCS Platform

1. Design practice
2. Fundamentals of surface engineering
3. Mathematical modeling of manufacturing processes
4. Work system design

19MECC3061 PROJECT – PART A

Course Category:	Project	Credits:	10
Course Type:	Project	Lecture-Tutorial-Practice:	0-0-20
		Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes:

At the End of the course the student will be able to:

CO1: Identify a topic in relevant areas of CAD/CAM.

CO2: Review literature to identify gaps and define objectives & scope of the work.

CO3: Understand the methods and processes from literature and apply appropriate research methodologies.

CO4: Develop a model / experimental set-up / computational techniques and prepare a report and develop competence in presenting.

Contribution of Course outcomes towards achievement of Program Outcomes

	PO a	PO b	PO c	PO d	PO e	PO f
CO1	M	M		M		M
CO2	M	M		M	M	M
CO3	M	M		M	M	M
CO4		M		M	H	M

(L – Low, M - Medium, H – High)

19MECC3052 INTERNSHIP

Course Category:	Internship	Credits:	2
Course Type:	Summer Training	Lecture-Tutorial-Practice:	0-0-4
		Continuous Evaluation:	00
		Semester End Evaluation:	100
		Total Marks:	100

The students shall undergo Internship for a period of six weeks in Industry/Research organizations/ institute of higher learning approved by the Head of the Department during any time after the second semester and shall earn a minimum of two credits.

19MECC4061 PROJECT - PART B

Course Category:	Project	Credits:	16
Course Type:	Project	Lecture-Tutorial-Practice:	0-0-32
		Continuous Evaluation:	40
		Semester End Evaluation:	60
		Total Marks:	100

Course Outcomes:

At the End of the course the student will be able to:

CO1: Identify methods and resources to carry out analysis and experiments.

CO2: Reorganize the procedures with a concern for society, environment and ethics.

CO3: Analyze and discuss the results to draw valid conclusions.

CO4: Prepare a report and defEnd the work and explore the possibility of publishing the work.

Contribution of Course outcomes towards achievement of Program Outcomes

	PO a	PO b	PO c	PO d	PO e	PO f
CO1	M	H	H	H		M
CO2	M	M	M	H	M	M
CO3	H	M	M	H	H	M
CO4	M	M	M	H	H	M

(L – Low, M - Medium, H – High)