ACADEMIC REGULATIONS (R-25)
COURSE STRUCTURE
AND
DETAILED SYLLABI

M. Tech Regular (Full Time) Two Year Post Graduate Degree Programme

(For the Batches Admitted from the Academic Year 2025-2026)

CAD/CAM

Department of Mechanical Engineering

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

Accredited by NBA, New Delhi, Accredited by NAAC, Bengaluru|Affiliated to JNTUA, Ananthapuramu, Recognized by UGC under 12(B) & 2(F) | Approved by AICTE, New Delhi)

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FOREWORD

The autonomy is conferred on Sri Venkateswara College of Engineering & Technology by JNT University, Anantapur based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

Sri Venkateswara College of Engineering & Technology is proud to win the confidence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTUA, Anantapur to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

Principal

VISION

To be recognized as a center for quality education in Mechanical Engineering and allied areas and to train young students to solve the problems of tomorrow.

MISSION

M1: Provide excellent foundation through Teaching-Learning and train the students based on research to help them progress for Higher education.

M2: Fostering student development with special focus on domain and soft skills for a prospective career placement.

M3: Developing students with skills in entrepreneurship contributing to job creation and societal development.

M4: Creating an ecosystem for continuous development of faculty and students by providing relevant infrastructure and resources.

QUALITY POLICY

Sri Venkateswara College of Engineering and Technology strides towards excellence by adopting a system of qualitative policies and processes with continued improvements to enhance students' skills and talents for their exemplary contribution to the society, the nation and the world.

SRI VENKATESWARA COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
(AFFILIATED TO JNTUA, ANANTAPUR)

ACADEMIC REGULATIONS – R25

MASTER OF TECHNOLOGY (M. TECH)

REGULAR (Full-Time) TWO YEAR POST GRADUATE DEGREE PROGRAMME

(Effective for the students admitted into I year from the Academic Year 2025-26 and onwards)

Sri Venkateswara College of Engineering and Technology (Autonomous), offers **Two** Years (Four Semesters) full-time Master of Technology (M. Tech.) Degree programme, under Choice Based Credit System (CBCS) in different branches of Engineering and Technology with different specializations.

The Jawaharlal Nehru Technological University Anantapur, Ananthapuramu shall confer M. Tech Post Graduate degree to candidates who are admitted to the Master of Technology Program and fulfill all the requirements for the award of the degree.

1. **Applicability**:
   All the rules specified herein, approved by the Academic Council, shall be in the force and applicable to the students admitted from the Academic Year 2025-2026 onwards. Any reference to "College" in these rules and regulations stands for SVCET.

2. **Extent**: All the rules and regulations, specified hereinafter shall be read as a whole for the purpose of interpretation. As and when a doubt arises, the interpretation of the Chairman, Academic Council shall be final and ratified by the Academic Council in the forthcoming meeting. As per the requirements of statutory bodies, Principal, Sri Venkateswara College of Engineering College shall be the Chairman, Academic Council.

3. **Award of the M. Tech. Degree**
   A student will be declared eligible for the award of the M. Tech. degree if he/ she fulfils the following:
   - **3.1** Pursues a course of study for not less than two academic years and not more than four academic years.
   - **3.2** Registers for 75 credits and secures all 75 credits.

4 Students, who fail to fulfil all the academic requirements for the award of the degree within four academic years from the year of their admission, shall forfeit their seat in M. Tech. course and their admission stands cancelled.

5 **Programme of Study:**
The following M. Tech. Specializations are offered at present in different branches of Engineering and Technology in the institution:

Sl. No.	Discipline	Name of the Specialization	Code
01	Civil Engineering	Structural Engineering	20
02	Electrical and	Power Electronics & Electrical	54

	Electronics Engineering	Drives	
03	Mechanical Engineering	CAD / CAM	04
04	Electronics and Communication Engineering	VLSI Design	57
05	Computer Science and Engineering	Computer Science & Engineering	58
06		Data Science	32

and any other specializations as approved by AICTE/University from time to time.

6 Eligibility for Admissions:

6.1 Admission to the M. Tech Program shall be made subject to the eligibility, qualification and specialization prescribed by the A.P. State Government/University from time to time.

6.2 Admissions shall be made either on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination/ the merit rank obtained by the qualified student in an entrance test conducted by A.P. State Government (APPGECET) for M. Tech. programmes/an entrance test conducted by University/on the basis of any other exams approved by the University, subject to reservations as laid down by the Govt. from time to time.

7 Programme related terms:

7.1 ***Credit:*** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit

7.2 Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year.

7.3 Choice Based Credit System (CBCS): The CBCS provides choice for students to select from the prescribed courses.

8 Programme Pattern:

8.1 Total duration of the of M. Tech. programme is two academic years

8.2 Each academic year of study is divided into two semesters.

8.3 Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per semester.

8.4 The student shall not take more than four academic years to fulfill all the academic requirements for the award of M. Tech. degree from the date of commencement of first year first semester, failing which the student shall forfeit the seat in M. Tech. programme.

8.5 The medium of instruction of the programme (including examinations and

project reports) will be in English only.

8.6 All subjects/courses offered for the M. Tech. degree programme are broadly classified as follows:

S. No.	Broad Course Classification	Course Category	Description
1.	Core Courses	Foundational & Professional Core Courses (PC)	Includes subjects related to the parent discipline / department / branch of Engineering
2.	Elective Courses	Professional Elective Courses (PE)	Includes elective subjects related to the parent discipline/ department/ branch of Engineering
		Open Elective Courses (OE)	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline which are of importance in the context of special skill development
3.	Research	Research methodology & IPR	To understand importance and process of creation of patents through research
		Technical Seminar	Ensures preparedness of students to undertake major projects / Dissertation, based on core contents related to specialization
		Cocurricular Activities	Attending conferences, scientific presentations and other scholarly activities
		Dissertation	M. Tech. Project or Major Project
4.	Audit Courses	Mandatory noncredit courses	Covering subjects of developing desired attitude among the learners is on the line of initiatives such as Unnat Bharat Abhiyan, Yoga, Value education etc.

8.7 The college shall take measures to implement Virtual Labs (https://www.vlab.co.in) which provide remote access to labs in various disciplines of Engineering and will help student in learning basic and advanced concept through remote experimentation. Student shall be made to work on virtual lab experiments during the regular labs.

8.8 A faculty advisor/mentor shall be assigned to each specialization to advise students on the programme, its Course Structure and Curriculum, Choice of Courses, based on his competence, progress, pre-requisites and interest.

8.9 Preferably 25% course work for the theory courses in every semester shall be conducted in the blended mode of learning.

9 Attendance Requirements:

9.1 A student shall be eligible to appear for the external examinations if he/she acquires i) a minimum of 50% attendance in each course and ii) 75% of attendance in aggregate of all the courses.

9.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

9.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence

9.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class.

9.5 A stipulated fee shall be payable towards condonation of shortage of attendance.

9.6 A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek re-admission into that semester when offered next.

9.7 If any candidate fulfils the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

9.8 If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

10 Evaluation – Distribution and Weightage of Marks:

The performance of a student in each semester shall be evaluated subject - wise (irrespective of credits assigned), for a maximum of 100 marks for theory and 100 marks forpractical, based on Internal Evaluation and End Semester Examination.

10.1 There shall be five units in each of the theory subjects. For the theory subjects 60 marks will be for the End Examination and 40 marks will be for Internal Evaluation.

10.2 Two Internal Examinations shall be conducted for 30 marks each, one in the middle of the Semester and the other immediately after the completion of instruction. First mid examination shall be conducted for I & II units of the syllabus and second mid examination for III, IV & V units. Each mid exam shall be conducted for a total duration of 120 minutes with 3 questions (without choice) each question for 10 marks. Final Internal marks for a total of 30 marks shall be arrived at by considering the marks secured by the student in both the internal examinations with 80% weightage to the better internal exam and 20% to the other. There shall be an online examination (TWO) conducted during the respective mid examinations by the college for the remaining 10 marks with 20 objective questions.

10.3 The following pattern shall be followed in the End Examination:

- **10.3.1** Five questions shall be set from each of the five units with either/or type for 12 marks each.
- **10.3.2** All the questions have to be answered compulsorily.
- **10.3.3** Each question may consist of one, two or more bits.

10.4 For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day-to-day performance.
The internal evaluation based on the day-to-day work-10 marks, record-10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with a breakup mark of Procedure-10, Experimentation-25, Results-10, Viva- voce-15.

10.5 There shall be a Comprehensive Viva-Voce in I year – II sem for 2 credits. The Comprehensive Viva-Voce will be conducted by the committee consisting of Head of the Department and two senior faculty members of the department nominated by the Principal as recommended by the chairman, BOS. The Comprehensive Viva – Voce is aimed to assess the students understanding in various subjects he studies during the M. Tech I year course of study. The Comprehensive Viva – Voce shall be evaluated for 100 marks by the committee. There are no internal marks for the Comprehensive Viva – Voce. A student shall acquire 2 credits assigned to the Comprehensive Viva – Voce only when he secures 40% or more marks. In case, if a student fails in Comprehensive Viva – voce, he shall reappear as and when I/II supplementary examinations are conducted.

10.6 There shall be Mandatory **Audit courses** in I & II semesters for zero credits. There is no external examination for audit courses. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 50% or more in the internal examinations. In case, the student fails, a re- examination shall be conducted for failed candidates for 40 marks every six months/semester satisfying the conditions mentioned in item 1 & 2 of the regulations.

10.7 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

10.8 In case the candidate does not secure the minimum academic requirement in any of the subjects he/she has to reappear for the Semester Examination either supplementary or regular in that subject or repeat the course when next offered or do any other specified subject as may be required.

10.9 The laboratory records and mid semester test papers shall be preserved for a minimum of 3 years in the respective institutions as per the University norms and shall be produced to the Committees of the University as and when the same are asked for.

10.10 Industry internship with a minimum of eight weeks duration, done at the end of second semester. The internship can be done by the students at local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs. Evaluation of the industry internship shall be through the departmental committee. A student will be required to submit industry internship report to the concerned department and appear for an oral presentation before the departmental committee. The report and the oral presentation shall carry

40% and 60% weightages respectively. A student shall acquire 2 credits assigned to the industry internship only when he secures 40% or more marks. In case, if a student fails in industry internship, he shall reappear as and when II/III supplementary examinations are conducted.

11 Credit Transfer Policy

As per University Grants Commission (Credit Framework for Online Learning Courses through SWAYAM) Regulation, 2016, the Institution shall allow up to a maximum of 40% of the total courses being offered in a particular Programme in a semester through the Online Learning courses through SWAYAM.

11.1 The Institution shall offer credit mobility for MOOCs and give the equivalent credit weightage to the students for the credits earned through online learning courses through SWAYAM platform.

11.2 The online learning courses available on the SWAYAM platform will be considered for credit transfer. SWAYAM course credits are as specified in the platform

11.3 Student registration for the MOOCs shall be only through the institution, it is mandatory for the student to share necessary information with the institution

11.4 The institution shall select the courses to be permitted for credit transfer through SWAYAM. However, while selecting courses in the online platform institution would essentially avoid the courses offered through the curriculum in the offline mode.

11.5 The institution shall notify at the beginning of semester the list of the online learning courses eligible for credit transfer in the forthcoming Semester.

11.6 The institution shall also ensure that the student has to complete the course and produce the course completion certificate as per the academic schedule given for the regular courses in that semester

11.7 The institution shall designate a faculty member as a Mentor for each course to guide the students from registration till completion of the credit course.

11.8 The Institution shall ensure no overlap of SWAYAM MOOC exams with that of the Internal / External examination schedule. In case of delay in SWAYAM results, the Institution will re-issue the marks sheet for such students.

11.9 Student pursuing courses under MOOCs shall acquire the required credits only after successful completion of the course and submitting a certificate issued by the competent authority along with the percentage of marks and grades.

11.10 The departments shall submit the following to the examination section of the Institution:

a) List of students who have passed MOOC courses in the current semester along with the certificates of completion.
b) Undertaking form filled by the students for credit transfer.

11.11 The Institution shall resolve any issues that may arise in the implementation of this policy from time to time and shall review its credit transfer policy in the light of periodic changes brought by UGC, SWAYAM,

NPTEL and state government.

Note: Students shall also be permitted to register for MOOCs offered through online platforms other than SWAYAM NPTEL. In such cases, credit transfer shall be permitted only after seeking approval of the Head of the Institution at least three months prior to the commencement of the semester.

12 Re-registration for Improvement of Internal Evaluation Marks:

A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and has failed in the end examination

12.1 The candidate should have completed the course work and obtained examinations results for **I, II and III** semesters.

12.2 The candidate should have passed all the subjects for which the Internal Evaluation marks secured are more than 50%.

12.3 Out of the subjects the candidate has failed in the examination due to Internal Evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.

12.4 The candidate has to re-register for the chosen subjects and fulfill the academic requirements.

12.5 For reregistration the candidates have to submit the applications to the Head of the Institution through the Head of the Department by paying the requisite fees (For each course, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D./ Challan in favour of the Principal, Sri Venkateswara College of Engineering & Technology) and get approval from the Head of the Institution before the start of the semester in which re-registration is required.

12.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

13 Evaluation of Project/Dissertation Work:

The Project work shall be initiated at the beginning of the III Semester and the duration of the Project is of two semesters. Evaluation of Project work is for 300 marks with 200 marks for internal evaluation and 100 marks for external evaluation. Internal evaluation of the Project Work – I & Project work – II in III & IV semesters respectively shall be for 100 marks each. External evaluation of final Project work viva voce in IV semester shall be for 100 marks.

A Project Review Committee (PRC) shall be constituted with the Head of the Department as Chairperson, Project Supervisor and one faculty member of the department offering the M.Tech. programme.

13.1 A candidate is permitted to register for the Project Work in III Semester after satisfying the attendance requirement in all the subjects, both theory and laboratory (in I & II semesters).

13.2 A candidate is permitted to submit Project dissertation with the approval of PRC. The candidate has to pass all the theory, practical and other courses before submission of the Thesis.

13.3 Project work shall be carried out under the supervision of teacher in the parent department concerned.

13.4 A candidate shall be permitted to work on the project in an industry/research organization on the recommendation of the Head of the Department. In such cases, one of the teachers from the department concerned would be the internal guide and an expert from the industry/ research organization concerned shall act as co-supervisor/ external guide. It is mandatory for the candidate to make full disclosure of all data/results on which they wish to base their dissertation. They cannot claim confidentiality simply because it would come into conflict with the Industry's or R&D laboratory's own interests. A certificate from the external supervisor is to be included in the dissertation.

13.5 Continuous assessment of Project Work - I and Project Work – II in III & IV semesters respectively will be monitored by the PRC.

13.6 The candidate shall submit status report by giving seminars in three different phases (two in III semester and one in IV semester) during the project work period. These seminar reports must be approved by the PRC before submission of the Project Thesis.

13.7 After registration, a candidate must present in Project Work Review - I, in consultation with his Project Supervisor, the title, objective and plan of action of his Project work to the PRC for approval within four weeks from the commencement of III Semester. Only after obtaining the approval of the PRC can the student initiate the project work.

13.8 The Project Work Review - II in III semester carries internal marks of 100. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate the work for the other 50 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the Project Work.

13.9 A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review - II. Only after successful completion of Project Work Review – II, candidate shall be permitted for Project Work Review – III in IV Semester. The unsuccessful students in Project Work Review - II shall reappear for it as and when supplementary examinations are conducted.

13.10 The Project Work Review - III in IV semester carries 100 internal marks. Evaluation should be done by the PRC for 50 marks and the Supervisor will evaluate it for the other 50 marks. The PRC will examine the overall progress of the Project Work and decide whether or not eligible for final submission. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review - III. If he fails to obtain the required minimum marks, he has to reappear for Project Work Review - III after a month.

13.11 For the approval of PRC the candidate shall submit the draft copy of dissertation to the Head of the Department and make an oral presentation before the PRC.

13.12 After approval from the PRC, the students are required to submit a report

showing that the plagiarism is within 30%. The dissertation report will be accepted only when the plagiarism is within 30%, which shall be submitted along with the dissertation report.

13.13 Research paper related to the Project Work shall be published in conference proceedings/UGC recognized journal. A copy of the published research paper shall be attached to the dissertation.

13.14 After successful plagiarism check and publication of research paper, three copies of the dissertation certified by the supervisor and HOD shall be submitted to the College.

13.15 The dissertation shall be adjudicated by an external examiner selected by the Head of the Institution. For this, the supervisor concerned and department head for each student shall submit a panel of three examiners to the Principal. However, the dissertation will be adjudicated by one examiner nominated by the Head of the Institution.

13.16 If the report of the examiner is not satisfactory, the candidate shall revise and resubmit the dissertation, in the time frame as decided by the PRC. If report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to reregister for the project and complete the project within the stipulated time after taking the approval from the Head of the Institution

13.17 If the report of the examiner is satisfactory, the Head of the Department shall coordinate and make arrangements for the conduct of Project Viva voce exam.

13.18 The Project Viva voce examinations shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who has adjudicated the dissertation. For Dissertation Evaluation (Viva voce) in IV Sem. there are external marks of 100 and it is evaluated by external examiner. The candidate has to secure a minimum of 50% marks in Viva voce exam.

13.19 If he fails to fulfill the requirements as specified, he will reappear for the Project Viva voce examination only after three months. In the reappeared examination also, if he fails to fulfill the requirements, he will not be eligible for the award of the degree.

14 Credits for Co-curricular Activities

The credits assigned for co-curricular activities shall be given by the Head of the Department and the same shall be submitted to the Examination section through Head of the Institution.

A Student shall earn 01 credit under the head of co-curricular activities, viz., attending Conference, Scientific Presentations and Other Scholarly Activities.

Following are the guidelines for awarding Credits for Co-curricular Activities

Name of the Activity	Maximum Credits / Activity
Participation in National Level Seminar/ Conference / Workshop /Training programs (related to the specialization of the student)	1

Participation in International Level Seminar / Conference / workshop/Training programs held outside India (related to the specialization of the student)	1
Academic Award/Research Award from State Level/National Agencies	1
Academic Award/Research Award from International Agencies	1
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	1
Research / Review Publication in International Journals with Editorial board outside India (Indexed in Scopus / Web of Science)	1

Note:

i) Credit shall be awarded only for the first author. Certificate of attendance and participation in a Conference/Seminar is to be submitted for awarding credit.

ii) Certificate of attendance and participation in workshops and training programs (Internal or External) is to be submitted for awarding credit. The total duration should be at least one week.

iii) Participation in any activity shall be permitted only once for acquiring required credits under cocurricular activities

15. Results Committee

Results Committee comprising of Principal, Controller of Examinations, Additional Controller of Examinations, One Senior Professor nominated by the Principal, and the University Nominee will oversee the details of marks, grades, and pass percentages of all the subjects and branch-wise pass percentages.

Office of the Controller of Examinations will generate student-wise result sheets and the same will be published through the college website.

Student-wise Grade Sheets are generated and issued to the students.

16 Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned

≥ 90	S (Superior)	10
≥ 80 < 90	A (Excellent)	9
≥ 70 < 80	B (Very Good)	8
≥ 60 < 70	C (Good)	7
≥ 50 < 60	D (Pass)	6
< 50	F (Fail)	0
Absent	Ab (Absent)	0

i) A student obtaining Grade 'F' or Grade 'Ab' in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.
ii) For noncredit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$$

where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

i) The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \Sigma (C_i \times S_i)/ \Sigma C_i$$

where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester.
ii) Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
iii) While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters S, A, B, C, D and F.

17. Personal Verification / Revaluation / Final Valuation

17.1 Personal Verification of Answer Scripts:

Candidates appear in a particular semester end examinations may appeal for verification of their answer script(s) for arithmetic correction in totaling of marks and any omission / deletion in evaluation within 7 days from the date of declaration of results at the office of the Controller of Examinations on the prescribed proforma and by paying the prescribed fee per answer script.

It is clarified that personal verification of answer script shall not tantamount to revaluation of answer script. This is only a process of reverification by the candidate. Any mistake / deficiency with regard to arithmetic correction in totaling of marks and any omission / deletion in evaluation if found, the institution will correct the same.

17.2 Recounting / Revaluation:
Students shall be permitted for request for recounting/revaluation of the Semester-End examination answer scripts within a stipulated period after payment of prescribed fee. After recounting or revaluation, records are updated with changes if any and the student will be issued a revised grade sheet. If there are no changes, the same will be intimated to the students.

17.3 Final Valuation:
Students shall be permitted for request for final valuation of the Semester–End Examination answer scripts within a stipulated period after the publication of the revaluation results by paying the necessary fee. The final valuation shall be carried out by an expert not less than Associate Professor as per the scheme of valuation supplied by the examination branch in the presence of the student, Controller of Examinations and Principal. However students are not permitted to discuss / argue with the examiner. If the increase in marks after final valuation is equal to or more than 15% of the previous valuation marks, the marks obtained after final valuation shall be treated as final. If the variation of marks after final valuation is less than 15% of the previous valuation marks, then the earlier valuation marks shall be treated as the final marks.

17.4 Supplementary Examinations: In addition to the regular semester-end examinations conducted, the College may also schedule and conduct supplementary examinations for all the courses of other semesters when feasible for the benefit of students. Such of the candidates writing supplementary examinations may have to write more than one examination per day.

18. Award of Class:
After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following three classes:

Class Awarded	Cumulative Grade Point Average
First Class with Distinction	≥7.75
First Class	≥6.75 and<7.75
Second Class	≥6.0 and <6.75

19. Exit Policy: The student shall be permitted to exit with a PG Diploma based on his/her request to the Head of the Institution through the respective Head of the Department at the end of first year subject to passing all the courses in first year.

The Head of the Institution shall resolve any issues that may arise in the implementation of this policy from time to time and shall review the policy in the light of periodic changes brought by UGC, AICTE, Affiliating University and State government.

20. Withholding of Results:

If the candidate has any case of in-discipline pending against him, the result of the candidate shall be withheld, and he will not be allowed/promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

20. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfilment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

21. Medium of Instruction:

The Medium of Instruction is English for all courses, laboratories, Internal and External examinations, Seminar Presentation and Project Reports.

22. Mode of Learning:

Preferably 50% course work for the theory courses in every semester shall be conducted in the blended mode of learning. If the blended learning is carried out in online mode, then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

23. General Instructions:

23.1 The academic regulations should be read as a whole for purpose of any interpretation.

23.2 Disciplinary action for Malpractice/improper conduct in examinations is appended.

23.3 There shall be no places transfer within the constituent colleges and affiliated colleges of Jawaharlal Nehru Technological University Anantapur.

23.4 Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

23.5 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

23.6 The University / Institution may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University / Institution.

23.7 The above rules and regulations are to be approved / ratified by the College Academic Council as and when any modification is to be done.

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Identification of Courses

M. Tech

Each course shall be uniquely identified by an alphanumeric code of width 7 characters as given below.

No. of Digits	Description
First two digits	Year of regulations Ex:25
Next one letter	Type of program: A: B. Tech B: M. Tech C: M.B.A D: M.C.A E: BBA F: BCA
Next two letters	Code of program: ST: Structural Engineering, P.E: Power Electronics & Electric Drives, CM: CAD/CAM, VL: VLSI, CS: Computer Science and Engineering, DS: Data Science
Last two digits	Indicate serial numbers: ≥ 01

Ex:
25BST01
25BPE01
25BCM01
25BVL01
25BCS01
25BDS01
25BMB01
25BHS01

SRI VENKATESWARA COLLEGE OF ENGINEERING AND TECHNOLOGY
(AUTONOMOUS)
(AFFILIATED TO JNTUA, ANANTHAPURAMU)
RULES FOR DISCIPLINARY ACTION FOR MALPRACTICE / IMPROPER CONDUCT IN EXAMINATIONS

Sl.No.	Nature of Malpractices / Improper conduct If the candidate	Punishment
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination).	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester / year. The Hall Ticket of the candidate is to be cancelled.
3.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and

		project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester / year.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
6.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The candidate is also debarred and forfeits of seat.
7.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and

		forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he will be handed over to the police and a case is registered against him.
8.	Refuses to obey the orders of the Chief Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in-charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction or property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate (s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester / year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Examination committee for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.

Note:

Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfil all the norms required for the award of Degree.

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SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

R.V.S. NAGAR, CHITTOOR - 517127, A.P.

COURSE STRUCTURE AND SCHEME OF EXAMINATION FOR

M. TECH-CAD/CAM I-SEMESTER

S.NO	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	SCHEME OF EXAMINATION (MAXIMUM MARKS)		
			L	T	P		CIE	SEE	TOTAL
1	25BHS02	Computational Methods	3	0	0	3	40	60	100
2	25BCM01	Advanced Finite Element Methods	3	0	0	3	40	60	100
Program Elective Course - I									
3	25BCM02	Computer Integrated Manufacturing	3	0	0	3	40	60	100
	25BCM03	Design for Cellular Manufacturing System							
	25BCM04	Design of Hydraulic & Pneumatic System							
Program Elective Course – II									
4	25BCM05	Advances in Manufacturing Technology	3	0	0	3	40	60	100
	25BCM06	Quality Engineering and Manufacturing							
	25BCM07	Computer Aided Process Planning							
5	25BCM08	Geometric Modeling Laboratory	0	0	4	2	40	60	100
6	25BCM09	Finite Element Analysis Laboratory	0	0	4	2	40	60	100
7	25BMB01	Research Methodology and IPR	2	0	0	2	40	60	100
8	25BDS10	Artificial Intelligence and Machine Learning	0	1	2	2	40	60	100
Audit Course – I									
9	25BHS04	English for Research paper writing	2	0	0	-	-	-	-
	25BST11	Disaster Management							
	25BHS05	Essence of Indian Traditional Knowledge							
TOTAL			**16**	**1**	**10**	**20**	**320**	**480**	**800**

M.TECH, II-SEMESTER

S.NO	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	SCHEME OF EXAMINATION (MAXIMUM MARKS)		
			L	T	P		CIE	SEE	TOTAL
1	25BCM10	Advanced Optimization Techniques	3	0	0	3	40	60	100
2	25BCM11	Industrial Robotics and Expert Systems	3	0	0	3	40	60	100
Program Elective Course – III									
3	25BCM12	CNC Technology & Programming	3	0	0	3	40	60	100
	25BCM13	Computer Graphics							
	25BCM14	Global Integrated Manufacturing							
Program Elective Course – IV									
4	25BCM15	Mechatronics Applications in Manufacturing	3	0	0	3	40	60	100
	25BCM16	Rapid Prototyping							
	25BCM17	Artificial Intelligence & Expert Systems							
5	25BCM18	Process Automation Laboratory	0	0	4	2	40	60	100
6	25BCM19	CAM Laboratory	0	0	4	2	40	60	100
7	25BCS22	Quantum Technologies and Applications	2	0	0	2	40	60	100
8	25BCM20	Comprehensive Viva-voce	0	0	0	2	0	100	100
Audit Course – II									
9	25BMB02	Pedagogy Studies	2	0	0	-	-	-	-
	25BHS06	Yoga for Stress Management							
	25BHS07	Personality Development through Life Enlightenment Skills							
TOTAL			**16**	**0**	**8**	**20**	**280**	**520**	**800**

M.TECH, III-SEMESTERS

S.NO	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	SCHEME OF EXAMINATION (MAXIMUM MARKS)		
			L	T	P		CIE	SEE	TOTAL
Program Elective Course – V									
1	25BCM21	Advanced Tool Design	3	0	0	3	40	60	100
	25BCM22	Design for Manufacturing							
	25BCM23	Computer Aided Tools for Manufacturing							
Open Elective									
2	25BCS01	Advanced Data Structure & Algorithms	3	0	0	3	40	60	100
	25BCS04	Enterprise Cloud Concepts							
	25BCM24	Mechatronics							
3	25BCM25	Dissertation Phase-I	-	-	20	10	40	60	100
4	25BCM26	Industry Internship	0	0	0	2	0	100	100
5	25BCM27	Co-curricular Activities	0	0	0	1	0	100	100
TOTAL			**6**	**0**	**20**	**19**	**120**	**380**	**500**

M.TECH, IV-SEMESTERS

S.NO	SUBJECT CODE	SUBJECT	PERIODS			CREDITS	SCHEME OF EXAMINATION (MAXIMUM MARKS)		
			L	T	P		CIE	SEE	TOTAL
1	25BCM30	Dissertation Phase-II	-	-	32	16	120	180	300
TOTAL						**16**	**120**	**180**	**300**

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

M. Tech - I Sem (CAD/CAM)

L	T	P	C
3	0	0	3

25BHS02: COMPUTATIONAL METHODS

Course Outcomes (CO): After completion of the course, the student will be able
CO1: Apply numerical techniques to solve linear and non-linear systems of equations using matrix operations, iterative and relaxation methods.
CO2: Demonstrate the application of numerical integration methods including Newton-Cotes, Simpson's rules, and Gaussian quadrature in engineering problems.
CO3: Solve engineering optimization problems using various techniques for constrained and unconstrained conditions in one or multiple dimensions.
CO4: Implement numerical and finite element methods to solve boundary value problems and partial differential equations including parabolic, hyperbolic, and elliptic types.
CO5: Perform curve fitting, regression analysis, and function approximation for modeling and interpreting engineering data using least squares and other techniques.

UNIT – I
Introduction to numerical methods applied to engineering problems: Examples, solving sets of equations – Matrix notation – Determinants and inversion – Iterative methods – Relaxation methods – System of non-linear equations – computer programs
Numerical integration: Newton-Cotes integration formulas – Simpson's rules, Gaussian quadrature. Adaptive integration.

UNIT – II
Optimization: One dimensional unconstrained optimization, multidimensional unconstrained optimization –direct methods and gradient search methods, constrained optimization
Boundary value problems and characteristic value problems: Shooting method – Solution through a set of equations – Derivative boundary conditions – Rayleigh – Ritz method – Characteristic value problems.

UNIT – III
Numerical solutions of partial differential equations: Laplace's equations – Representations as a difference equation – Iterative methods for Laplace's equations – poisson equation – Examples – Derivative boundary conditions – Irregular and non – rectangular grids – Matrix patterns, sparseness – ADI method – Finite element method.

UNIT – IV
Parabolic partial differential equations: Explicit method – Crank-Nickelson method – Derivative boundary condition – Stability and convergence criteria – Finite element for heat flow – computer programs.
Hyperbolic partial differential equations: Solving wave equation by finite differences- stability of numerical method –method of characteristics-wave equation in two space dimensions-computer programs.

UNIT – V
Curve fitting and approximation of functions: Least square approximation fitting of non-linear curves by least squares –regression analysis- multiple linear regression, nonlinear regression - computer programs.

Text Books:

1. "Numerical Methods for Engineers", Steven C. Chapra, Raymond P. Canale Tata Mc-Graw hill
2. "Applied numerical analysis", Curtis F.Gerald, partick.O.WheatlyAddison-wesley,1989
3. "Numerical methods", Douglas J. Faires, Riched Burden Brooks/ Cole publishing company, 1998. Second edition.

References:

1. "Numerical mathematics and computing", Ward Cheney &David Kincaid Brooks/Cole publishing company1999, fourth edition.
2. "Mathematical methods for physics andengineering" Riley K.F.M.P. Hobson. & Bence S.J. Cambridge university press,1999.

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

M.Tech - I Sem (CAD/CAM)

L	T	P	C
3	0	0	3

25BCM01: ADVANCED FINITE ELEMENT METHODS

Course Outcomes (CO): After completion of the course the student will be able to
CO1: Formulate engineering problems using variational methods such as Galerkin and Rayleigh-Ritz, and apply boundary conditions using calculus of variations.
CO2: Develop and assemble global stiffness matrices for one-dimensional bar and heat transfer elements and solve for displacements, stresses, and temperature effects.
CO3: Analyze structural behavior of trusses, beams, and frames using finite element formulation to determine displacements, reactions, and stresses.
CO4: Solve two-dimensional and axisymmetric problems using CST, LST, and isoparametric elements with appropriate interpolation functions and numerical integration techniques.
CO5: Apply FEM to structural dynamics problems and assess convergence through h- and p-refinement methods and interpolation completeness.

UNIT – I
Formulation Techniques: Methodology, Engineering problems and governing differential equations, finite elements., Variational methods-potential energy method, Raleigh Ritz method, strong and weak forms, Galerkin and weighted residual methods, calculus of variations, Essential and natural boundary conditions**.**

UNIT – II
One-dimensional finite element methods: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element, Heat transfer problems: One-dimensional, conduction and convection problems. Examples: - one dimensional fin.

UNIT – III
Trusses: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, temperature effects.
Beams and Frames: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses.

UNIT – IV
Two dimensional problems: CST, LST, four noded and eight nodded rectangular elements, Lagrange basis for triangles and rectangles, serendipity interpolation functions. Axisymmetric Problems: Axisymmetric formulations, Element matrices, boundary conditions. Heat Transfer problems: Conduction and convection, examples: - two-dimensional fin.
Isoparametric formulation: Concepts, sub parametric, super parametric elements, numerical integration.

UNIT – V
Finite elements in Structural Dynamics: Dynamic equations, eigen value problems, and their solution methods, simple problems.
Convergence: Requirements for convergence, h-refinement and p-refinement, complete and incomplete interpolation functions, pascal's triangle.

Text Books:

1. Introduction to Finite element methods by Chandraputla & Ashok D. Belagondu by Pearson 2012.
2. Concepts and Applications of Finite Element Analysis by Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt.

References:

1. Finite element method in Heat transfer and fluid dynamics, J.N. Reddy, CRC press,1994.
2. Finite Element Method, Zienckiwicz O.C. & R. L. Taylor, McGraw-Hill,1983.
3. Finite Element of Nonlinear continua, J. N. Oden, McGraw-Hill, New York, 1971.
4. Finite element procedures, K. J. Bathe, Prentice-Hall, 1996.

Online Learning Resources:

- https://nptel.ac.in/courses/112/104/112104193/
- https://nptel.ac.in/courses/112/104/112104205/
- https://nptel.ac.in/courses/105/105/105105041/
- https://nptel.ac.in/courses/112/106/112106130/
- https://nptel.ac.in/courses/112/103/112103295/

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

M.Tech - I Sem (CAD/CAM)

L	T	P	C
3	0	0	3

25BCM02: COMPUTER INTEGRATED MANUFACTURING
Program Elective Course - I

Course Outcomes: After completion of the course the student will be able to
CO1: Explain fundamental concepts of manufacturing automation, CAD/CAM integration, automation strategies, and analyze the economics of automation and numerical control.
CO2: Develop NC part programs using manual programming techniques and understand tape coding formats and manual data input for NC machines.
CO3: Describe the structure and functions of CNC and DNC systems, and apply Group Technology (GT) principles for part classification, machine cell design, and production flow analysis.
CO4: Illustrate the configuration and components of Flexible Manufacturing Systems (FMS) and apply Computer Aided Process Planning (CAPP) and Material Requirement Planning (MRP) methods.
CO5: Apply adaptive control concepts and computer process monitoring to machining operations and describe the hierarchical structure of computers in Computer Integrated Manufacturing.

UNIT - I
Introduction: Fundamental concepts in Manufacturing and Automation, Automation Strategies, Economic analysis in production, fundamentals of CAD / CAM, product cycle and CAD/CAM, Automation and CAD/CAM, Scope of CIM, Automated flow lines, Transfer mechanisms, methods of Line balancing.
Numerical control machines: Introduction- basic components of an NC system-the NC procedure- NC coordinate system, NC motion control system- application of numerical control-Economics of Numerical control.

UNIT - II
NC part programming: Introduction - The Bunch tape in NC - Tape code format - manual part programming. NC programming with manual data input.

UNIT - III
Computer controls in NC: NC controllers' technology - Computer Numerical Control (CNC), Direct Numerical control (DNC).
Group Technology: Part families, parts classification and coding, production flow analysis, Composite part concept, Machine cell design, benefits of GT.

UNIT - IV
Flexible Manufacturing Systems: Components of FMS, FMS Work stations, Material Handling Systems, and Computer Control system, FMS layout configurations and benefits of FMS.
Computer aided planning systems: Approaches to Computer aided Process Planning (CAPP) - Generative and Retrieval CAPP systems, benefits of CAPP, Material Requirement Planning (MRP), mechanism of MRP, benefits, and Capacity Planning.

UNIT - V
Computer integrated manufacturing: Adaptive control machining systems. adaptive control optimization system, adaptive control constraint system, applications to machining processes, computer process monitoring, hierarchical structure of computers in manufacturing, and computer process control.

Text Books:

1. Automation, Production systems and Computer Integrated Manufacturing Systems – Mikel P. Groover, PHI Publishers.

References:

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

Online Learning Resources:

- https://en.wikipedia.org/wiki/Computer-integrated_manufacturing
- https://www.techopedia.com/definition/30965/computer-integrated-manufacturing-cim
- https://www.youtube.com/watch?v=_OaBMsUgqgQ
- https://www.youtube.com/watch?v=edplvB_Xvso
- https://nptel.ac.in/courses/112/104/112104289/
- https://www.youtube.com/watch?v=9fqygvj-O2s.

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

M.Tech – I Sem (CAD/CAM)

L	T	P	C
3	0	0	3

25BCM03: DESIGN FOR CELLULAR MANUFACTURING SYSTEM (PE-I)

Course Outcomes (CO): After completion of the course, the students will be able to understand

CO1: Explain the fundamental concepts, limitations of traditional systems, and benefits and issues involved in implementing Group Technology (GT).

CO2: Design Cellular Manufacturing Systems (CMS) using traditional and advanced approaches such as Genetic Algorithms, Simulated Annealing, and Neural Networks.

CO3: Develop implementation strategies for GT/CMS including intra/inter-cell layout, batch sizing, team-based structures, and life cycle considerations.

CO4: Evaluate CMS performance using parametric analysis and control tools, and integrate GT with Material Requirements Planning (MRP).

CO5: Analyze the economic and human aspects of GT/CMS and compare traditional and group-based computer modeling approaches through case studies.

UNIT – I INTRODUCTION

Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

UNIT – II CMS PLANNING AND DESIGN

Problems in GT/CMS - Design of CMS - Models, traditional approaches and non-traditional approaches - Genetic Algorithms, Simulated Annealing, Neural networks.

UNIT – III IMPLEMENTATION OF GT/CMS

Inter and Intra cell layout, cost and non-cost-based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

UNIT – IV PERFORMANCE MEASUREMENT AND CONTROL

Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

UNIT – V ECONOMICS OF GT/CMS

Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS – cases.

Text Books:

1. Askin, R.G. and Vakharia, A.J., G.T " Planning and Operation, in the automated factory-Hand Book: Technology and Management ", Cleland.D.I. and Bidananda, B (Eds), TAB Books, NY, 1991.
2. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), " Planning, design and analysis of cellular manufacturing systems ", Elsevier, 1995.

Reference:

1. Burbidge, J.L. Group " Technology in Engineering Industry ", Mechanical Engineering pub.London,1979.
2. Irani, S.A. " Cellular Manufacturing Systems ", Hand Book.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106044/
- https://www.youtube.com/watch?v=toTYb7Sirm0
- https://www.youtube.com/watch?v=Ynhp8Wi2qwM
- https://nptel.ac.in/courses/112/104/112104188/
- https://nptel.ac.in/courses/110/107/110107141/
- https://www.youtube.com/watch?v=voN_297SXD8

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

M.Tech – I Sem (CAD/CAM)

L	T	P	C
3	0	0	3

25BCM04: DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS
(PE-I)

Course Outcomes (CO): After completion of this course, the student will be able to
CO1: Select and specify appropriate hydraulic pumps and actuators based on system requirements and analyze their characteristics for industrial applications.
CO2: Explain the working principles and functions of control and regulation elements such as valves used in hydraulic systems.
CO3: Design and analyze hydraulic circuits for various applications including reciprocation, quick return, sequencing, and industrial machines.
CO4: Develop pneumatic circuits using control elements, logic modules, and sequence design methods such as cascade and step counter techniques.
CO5: Apply knowledge of component selection, fault diagnosis, and circuit integration in hydro-pneumatic and low-cost automated systems using PLCs and microprocessors.

UNIT - I
OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS
Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

UNIT - II
CONTROL AND REGULATION ELEMENTS
Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.

UNIT - III
HYDRAULIC CIRCUITS
Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits - industrial circuits - press circuits - hydraulic milling machine - grinding, planning, copying, - forklift, earth mover circuits- design and selection of components - safety and emergency mandrels.

UNIT - IV
PNEUMATIC SYSTEMS AND CIRCUITS
Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and these integration - sequential circuits - cascade methods - mapping methods - step counter method - compound circuit design - combination circuit design.

UNIT - V
INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS
Pneumatic equipments - selection of components - design calculations – application -fault finding - hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low-cost automation - Robotic circuits.

Text Books:

1. Andrew Parr, “Hydraulic and Pneumatics” (HB), Jaico Publishing House, 1999.
2. Bolton. W., “Pneumatic and Hydraulic Systems “, Butterworth –Heinemann, 1997.

References:

1. Antony Espossito, “Fluid Power with Applications”, Prentice Hall, 1980.
2. Dudleyt, A. Pease and John J. Pippenger, “Basic fluid power”, Prentice Hall, 1987.
3. K. Shanmuga Sundaram, “Hydraulic and Pneumatic Controls: Understanding made Easy" S. Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009).

Online Learning Resources:

- https://nptel.ac.in/courses/112/103/112103249/
- https://nptel.ac.in/courses/112/106/112106175/
- https://nptel.ac.in/content/storage2/courses/112106175/Module%201/Lecture%201.pdf
- https://www.vidyarthiplus.com/vp/attachment.php?aid=18972
- https://snscourseware.org/snscenew/notes.php?cw=CW_5e27ec3b0457a

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

M.Tech - I Sem (CAD/CAM)

L	T	P	C
3	0	0	3

(25BCM05) ADVANCES IN MANUFACTURING TECHNOLOGY
Program Elective Course - II

Course Outcomes (CO): After completion of the course the student will be able to

CO1: Explain various surface processing operations including plating, coating techniques, and thermal/mechanical surface treatments for enhanced material properties.

CO2: Analyze the principles, parameters, applications, and limitations of unconventional machining methods like Abrasive Jet Machining and Ultrasonic Machining.

CO3: Demonstrate the working principles and applications of electro-chemical and Wire EDM processes and assess their influence on accuracy, surface finish, and material removal.

CO4: Understand the mechanisms of electron beam and plasma arc machining, compare thermal and non-thermal processes, and evaluate their effectiveness for precision applications.

CO5: Describe the working principles and methods of Laser Beam Machining and Rapid Prototyping, and analyze their suitability for various industrial applications.

UNIT –I Surface Processing Operations

Plating and Related Processes, Conversion Coatings, Physical Vapor Deposition, Chemical Vapor Deposition, Organic Coatings, Porcelain Enameling and other Ceramic coatings, Thermal and Mechanical Coating Processes.

UNIT –II Un-conventional Machining Methods

Abrasive jet machining - Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent developments. Ultrasonic machining: Elements of the process, machining parameters, effect of parameters on surface finish and metal removal rate, mechanics of metal removal process parameters, economic considerations, applications and limitations.

UNIT-III Electro-Chemical Processes

Electro-Chemical Processes: Fundamentals of electro chemical machining, metal removal rate in ECM, Tool design, Surface finish and accuracy economics aspects of ECM.

Wire EDM Process: General Principle and applications of Wire EDM, Mechanics of metal removal, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy**.**

UNIT-IV Electron Beam Machining

Generation and control of electron beam for machining, theory of electron beam machining, principle, advantages, limitations, comparison of thermal and non-thermal processes.

Plasma Arc Machining: Principle, machining parameters, effect of machining parameters on surface finish and metal removal rate, applications, limitations.

UNIT-V Laser Beam Machining

Principle, effect of machining parameters on surface finish, applications, and limitations.

Rapid Prototyping: Working principle, methods-Stereolithography, Laser sintering, Fused deposition method, applications and limitations.

Text Books:

1. Manufacturing Technology - P. N. Rao, TMH Publishers
2. Fundamentals of Modern Manufacturing, Mikell P. Groover, John Wiley & Sons Publishers

References:

1. Production Technology - HMT
2. Manufacturing Science - Cambel
3. Welding Technology - R.S, Parmar,
4. Introduction to Nanotechnology - Poole and Owens, Wiley (2003). Outcomes.

Online Learning Resources:

- https://nptel.ac.in/courses/112/107/112107078/
- https://youtu.be/t3y_Ys3LgGM
- https://www.youtube.com/watch?v=E4VZ_rFqpG4&t=1s
- https://youtu.be/-tcaR7oSx_w
- https://youtu.be/Uybg6VDLoRQ
- https://youtu.be/Uybg6VDLoRQ
- https://youtu.be/aWQsEX1TrSI

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(25BCM06) QUALITY ENGINEERING AND MANUFACTURING (PE- II)

Course Outcomes (CO): After completion of the course the student will be able to

CO1: Explain the concepts of quality systems and apply quality engineering principles in product and process design.
CO2: Analyse and apply the quadratic loss function to evaluate economic impacts of tolerance variations and classify quality characteristics using N-type, S-type, and L-type models.
CO3: Design optimal tolerances and allocate them across components using functional limits and loss functions, incorporating signal-to-noise ratios and parameter design strategies.
CO4: Apply the principles and steps of Design of Experiments (DOE), including ANOVA, to systematically investigate and optimize design parameters.
CO5: Utilize orthogonal arrays and advanced quality tools such as Six Sigma, ISO 9000, benchmarking, and quality circles to interpret experimental data and improve processes.

UNIT – I Quality value and Engineering

An overall quality system, quality engineering in production design, quality engineering in design production processes

UNIT – II Loss function and quality level

Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances (N-type-, S-type and L-type).

UNIT – III Tolerance Design and Tolerancing

Functional limits, tolerance design for N-type, L-type and S-type characteristics, tolerance allocation for multiple components.

Parameter and tolerance design: Introduction to parameter design, signal to noise ratios, parameter design strategy, Introduction to tolerance design, tolerance design using the loss function, identification of tolerance design factors.

UNIT – IV Design of Experiments

Introduction, Task aids and Responsibilities for DOE process steps, DOE process steps description.

Analysis of variance (ANOVA): no-WAY ANOVA, One-way ANOVA, two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT – V Orthogonal Arrays

Typical test strategies, better test strategies, efficient test strategies, conducting and analyzing an experiment.

Interpolation of experimental results: Interpretation methods, percent contribution, estimating the mean.

ISO-9000 Quality system, BDRE, 6-sigma, bench marking, quality circles-brain storming-fishbone diagram-problem analysis.

Text Books:

1. Taguchi techniques for quality engineering/Philip J. Ross / McGraw Hill Intl. 2nd Edition, 1995.

References:

1. Quality Engineering in Production systems/G.Taguchi, A. Elasayed et al/McGraw Hill Intl. Edition, 1989.
2. Taguchi methods explained: Practical steps to Robust Design/Papan P. Bagchi/Prentice Hall Ind. Pvt. Ltd. New Delhi.

Online Learning Resources:

- https://quality-one.com/quality-engineering/
- https://en.wikipedia.org/wiki/Quality_engineering
- https://youtu.be/5_hng9rgVHE
- https://www.youtube.com/watch?v=oIG_NDb2g3U
- https://nptel.ac.in/courses/110/104/110104080/
- https://nptel.ac.in/courses/110/105/110105088/

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25BCM07: COMPUTER AIDED PROCESS PLANNING
PE – II

Course Outcomes (CO): After completion of the course the student will be able to

1. Generate the structure of automated process planning system and uses the principle of generative and retrieval CAPP systems for automation
2. Select the manufacturing sequence and explains the reduction of total set up cost for a particular sequence
3. Predict the effect of machining parameters on production rate, cost and surface quality and determines the manufacturing tolerances
4. Explain the generation of tool path and solve optimization models of machining processes
5. Create awareness about the implementation techniques for CAPP

UNIT – I Introduction to CAPP

Information requirement for process planning system, Role of process planning, advantages of conventional process planning over CAPP, Structure of Automated process planning system, feature recognition, methods.

Generative CAPP system: Importance, principle of Generative CAPP system, automation of logical decisions, Knowledge based systems, Inference Engine, implementation, benefits.

UNIT – II Retrieval CAPP system

Significance, group technology, structure, relative advantages, implementation, and applications **Selection of manufacturing sequence:** Significance, alternative manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples.

UNIT – III Determination of machining parameters

Reasons for optimal selection of machining parameters, effect of parameters on production rate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

Determination of manufacturing tolerances: design tolerances, manufacturing tolerances, methods of tolerance allocation, sequential approach, integration of design and manufacturing tolerances, advantages of integrated approach over sequential approach

UNIT – IV Generation of tool path

Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods.

UNIT – V Implementation techniques for CAPP

MIPLAN system, Computer programming languages for CAPP, criteria for selecting a CAPP system and benefits of CAPP. Computer integrated planning systems, and Capacity planning system.

Text Books:

1. Automation, Production systems and Computer Integrated Manufacturing System –Mikell P. Groover.
2. Computer Aided Design and Manufacturing – Dr. Sadhu Singh.

References:

1. Computer Aided Engineering – David Bedworth.

Online Learning Resources:

- https://nptel.ac.in/courses/112/104/112104188/
- https://www.youtube.com/watch?v=20_K7c65Swg
- https://www.youtube.com/watch?v=y24meNZbUoU
- https://youtu.be/PRjExZxWsNc
- https://nptel.ac.in/courses/103/103/103103164/

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25BCM08: GEOMETRIC MODELLING LABORATORY

Course Outcomes: After completion of this course, the student will be able to

CO1: Develop and implement C programs for the generation of geometric curves such as Bezier, Spline, and B-Spline curves.

CO2: Construct surface models like Bezier and B-Spline surfaces through C programming for visualization and design tasks.

CO3: Create solid models using C programming by implementing Constructive Solid Geometry (CSG) and Boundary Representation (B-rep) techniques.

CO4: Utilize commercial CAD software (PRO/E, IDEAS, CATIA) to perform surface and solid modeling, and demonstrate competency in drafting and assembly module operations.

CO5: Apply modeling concepts to simulate and visualize complex components and assemblies in real-world engineering design scenarios.

List of experiments:

A – MODELLING

1. Generation of the following curves using "C" language
   i. Bezier curves
   ii. Splines
   iii. B-Splines
2. Generation of the following surfaces using "C" language
   i. Bezier surfaces
   ii. B-Splines surfaces
3. Generation of solids using "C"
   i. Constructive solid geometry
   ii. Boundary representation
4. Typical tasks of Modeling using PRO/E,IDEAS, CATIA solid modeling packages

   Surface modeling
   Solid Modeling
   Drafting and
   Assembly Module

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25BCM09: FINITE ELEMENT ANALYSIS LABORATORY

Course Outcomes: After completion of this course, the student will be able to

1. Select appropriate element for given problem
2. Select suitable meshing and perform convergence test
3. Select appropriate solver for given problem
4. Interpret the result
5. Apply basic aspects of FEA to solve engineering problems & validate FEA solution

List of experiments:

Finite Element Analysis using ANSYS 14.5 Package for different structures the discretization can be done with 1-D, 2-D & 3-D elements to perform the following analysis:

a. Static Analysis
b. Stress analysis of 2D truss.
c. Stress analysis of a plate with a circular hole and L-Bracket – 2D and 3D Stress analysis of beams (cantilever, simply supported & fixed ends)
d. Stress analysis of an axi-symmetric component

Thermal and Fluid flow Analysis

a. Conductive heat transfer analysis of a 2D and 3D components
b. Convective heat transfer analysis of a 2D component
c. Coupled field analysis of a component
d. Determination of velocity of a fluid and volumetric flow rates for 1-D Fluid flow \
e. Determination of velocity of a fluid and volumetric flow rates for 2-D Fluid flow

Modal Analysis

a. mode frequency analysis of a 2D component
b. mode frequency analysis of beams (cantilever, simply supported, fixed ends)

Transient analysis

a. Transient analysis of a cantilever beam

FEM through MAT LAB

a. Introduction to MAT LAB
b. Analysis of 1-dimesional & 2D dimensional truss.

Analysis of 1-dimesional & 2D dimensional beam. d. Analysis of 1-dimesional & 2D dimensional heat conduction.

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25BMB01: RESEARCH METHODOLOGY AND IPR

Course Outcomes (COs): After completion of the course, the student will be able to

CO1: Recall key concepts and terminology related to research design, data collection, and intellectual property rights.

CO2: Explain the importance of research design and data analysis in research studies, and describe the concept of intellectual property rights.

CO3: Design a research study, including data collection and analysis methods, and apply intellectual property rights principles to protect research findings.

CO4: Analyze research studies to identify strengths and limitations, and evaluate the effectiveness of data collection and analysis methods.

CO5: Assess the impact of intellectual property rights on research and innovation, and evaluate the effectiveness of research designs and methods.

CO6: Develop a comprehensive research plan, including a detailed research design, data collection and analysis methods, and a plan for protecting intellectual property.

UNIT – I FUNDAMENTALS OF RESEARCH METHODOLOGY

Overview of research process and design - Types of Research - Approaches to Research (Qualitative vs Quantitative) - Observation studies, Experiments and Surveys - Use of Secondary and exploratory data to answer the research question - Importance of Reasoning in Research and Research ethics - Documentation Styles (APA/IEEE etc.) - Plagiarism and its consequences.

UNIT – II DATA COLLECTION AND SOURCES

Importance of Data Collection - Types of Data - Data Collection Methods - Data Sources - primary, secondary and Big Data sources - Data Quality & Ethics - Tools and Technology for Data Collection.

UNIT – III DATA ANALYSIS AND REPORTING

Overview of Multivariate analysis - Experimental research, cause-effect relationship, and development of hypotheses- Measurement systems analysis, error propagation, and validity of experiments - Guidelines for writing abstracts, introductions, methodologies, results, and discussions - Writing Research Papers & proposals.

UNIT – IV UNDERSTANDING INTELLECTUAL PROPERTY RIGHTS

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT – V PATENTS

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification - Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licenses, Licensing of related patents, patent agents, Registration of patent agents.

Text Books:

1. Stuart Melville and Wayne Goddard, Research Methodology: An introduction for Science & Engineering students, Juta and Company Ltd, 2004

2. Catherine J. Holland, Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets, Entrepreneur Press, 2007.

References:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education 11e (2012).
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
3. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 6th Edition, Cengage 2024.
4. Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, The Craft of Research, 5th Edition, University of Chicago Press, 2024
5. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.
6. Peter Elbow, Writing with Power, Oxford University Press, 1998.

Online Resources (Free & Authentic):

- Coursera / edX – Research Methodology and Data Analysis courses
- Springer Link & ScienceDirect – Latest journals on research design and statistics
- Google Scholar – Free access to research papers
- NCBI Bookshelf – Open-access research methodology resources
- Khan Academy (Statistics & Probability) – For fundamentals of hypothesis testing, regression, and ANOVA.

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25BDS10: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Outcomes (COs): After completion of the course, the student will be able to
CO1: Design intelligent agents, define problems using state-space models, and apply AI techniques.
CO2: Implement and compare different search algorithms (both uniform and heuristic), apply and analyze appropriate strategies for solving AI problems.
CO3: Solve CSPs using local search methods and implement adversarial search algorithms to make optimal decisions in competitive game scenarios.
CO4: Utilize statistical and logical reasoning methods, to represent knowledge and perform forward and backward reasoning in AI applications.
CO5: Understanding and apply various machine learning techniques, along with an introduction to neural networks and deep learning.

UNIT – I

Introduction to Artificial Intelligence and Problem-Solving Agent: Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.

UNIT – II

Search Techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best -first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

UNIT – III

Constraint Satisfaction Problems and Game Theory: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT – IV

Knowledge & Reasoning: Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.

UNIT – V

Introduction to Machine Learning: Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.

Text Books:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015.

2. Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", 1st Edition, Morgan-Kaufmann, 1998.

Reference Books:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence", McGraw Hill, 3rd ed.,2017.
2. Patterson, "Introduction to Artificial Intelligence & Expert Systems", Pearson, 1st ed. 2015.
3. Saroj Kaushik, "Logic & Prolog Programming", New Age International, Ist edition, 2002.
4. Joseph C. Giarratano, Gary D. Riley, "Expert Systems: Principles and Programming", 4th Edition, 2007.

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25BHS04: ENGLISH FOR RESEARCH PAPER WRITING

Course Outcomes (COs): After completion of the course, the student will be able to

CO1: Recall the key language aspects and structural elements of academic writing in research papers.

CO2: Explain the importance of clarity, precision, and objectivity in research writing.

CO3: Apply critical reading strategies and advanced grammar skills to analyze and write research papers.

CO4: Analyze research articles and identify the strengths and limitations of different methodologies.

CO5: Evaluate research papers to check for plagiarism, structure, clarity, and language accuracy.

CO6: Evaluate the effectiveness of different language and technology tools in research writing, including AI-assisted tools and plagiarism detection software.

CO7: Develop a well-structured research paper that effectively communicates complex ideas.

UNIT – I Fundamentals of Academic English

Academic English - MAP (Message-Audience-Purpose) - Language Proficiency for Writing - Key Language Aspects - Clarity and Precision - Objectivity - Formal Tone - Integrating References - Word order - Sentences and Paragraphs - Link Words for Cohesion - Avoiding Redundancy / Repetition - Breaking up long sentences - Structuring Paragraphs - Paraphrasing Skills – Framing Title and Sub-headings.

UNIT – II Reading Skills for Researchers

Reading Academic Texts - Critical Reading Strategies - Skimming and Scanning - Primary Research Article vs. Review Article - Reading an Abstract - Analyzing Research Articles - Identifying Arguments - Classifying Methodologies - Evaluating Findings - Making Notes.

UNIT – III Grammar Refinement for Research Writing

Advanced Punctuation Usage - Grammar for Clarity - Complex Sentence Structures - Active-Passive Voice - Subject-Verb Agreement - Proper Use of Modifiers - Avoiding Ambiguous Pronoun References - Verb Tense Consistency - Conditional Sentences.

UNIT – IV Mastery in Refining Written Content/Editing Skills

Effective Revisions - Restructuring Paragraph - Editing vs Proofreading, Editing for Clarity and Coherence - Rectifying Sentence Structure Issues - Proofreading for Grammatical Precision – Spellings - Tips for Correspondence with Editors - Critical and Creative Phases of Writing.

UNIT – V Technology and Language for Research

Digital Literacy and Critical Evaluation of Online Content - Technology and Role of AI in Research Writing – Assistance in Generating Citations and References - Plagiarism and Ethical Considerations – Tools and Awareness – Fair Practices.

Textbooks:

1. Bailey. S. Academic Writing: A Handbook for International Students. London and New York: Routledge,2015.
2. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

References:

1. Craswell, G. Writing for Academic Success, Sage Publications, 2004.
2. Peter Elbow, Writing with Power, E-book, Oxford University Press, 2007.
3. Oshima, A. & Hogue, A. Writing Academic English, Addison-Wesley, New York, 2005.
4. Swales, J. & C. Feak, Academic Writing for Graduate Students: Essential Skills and Tasks. Michigan University Press, 2012.
5. Goldbort R. Writing for Science, Yale University Press (available on Google Books), 2006.
6. Day R. How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.

Online Learning Resources:

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ge04/
2. https://onlinecourses.swayam2.ac.in/ntr24_ed15/preview
3.. "Writing in the Sciences" – Stanford University (MOOC on Coursera)
https://www.coursera.org/learn/sciwrite
4. Academic Phrasebank – University of Manchester
http://www.phrasebank.manchester.ac.uk
5. OWL (Online Writing Lab) – Purdue University, https://owl.purdue.edu
(Resources on APA/MLA formats, grammar, structure, paraphrasing)
6. Zotero or Mendeley (Reference Management Tools) – Useful for managing citations and sources.

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25BST11: DISASTER MANAGEMENT

Course Outcomes (COs): After completion of the course, the student will be able to

CO1: Define and distinguish between hazards and disasters, and explain their types, nature, and impacts.

CO2: Identify and map disaster-prone areas in India and understand the epidemiological consequences of disasters.

CO3: Assess the economic, social, and ecological repercussions of major natural and man-made disasters.

CO4: Demonstrate knowledge of disaster preparedness tools such as remote sensing, meteorological data, risk evaluation, and community awareness.

CO5: Apply risk assessment methods and propose disaster risk reduction strategies at local, national, and global levels.

CO6: Formulate and evaluate structural and non-structural disaster mitigation strategies, with emphasis on Indian programs and emerging trends.

UNIT – I Introduction

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post- Disaster Diseases and Epidemics.

UNIT – II Repercussions of Disasters and Hazards

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches.

Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT – III Disaster Preparedness and Management

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard;

Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies,

Media Reports: Governmental and Community Preparedness.

UNIT – IV Risk Assessment

Disaster Risk - Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT – V Disaster Mitigation:

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Text books

1. Gupta, H. K. Disaster Management. Universities Press, 2003
2. Singh, R. B. Natural Hazards and Disaster Management. Rawat Publications, 2006.

Reference Books:

1. Coppola, D. P. (2020). Introduction to International Disaster Management (4th ed.). Elsevier.
2. Shaw, R., & Izumi, T. (2022). Science and Technology in Disaster Risk Reduction in Asia. Springer.
3. Wisner, B., Gaillard, J. C., & Kelman, I. (2021). Handbook of Hazards and Disaster Risk Reduction and Management (2nd ed.). Routledge.
4. Saini, V. K. (2021). Disaster Management in India: Policy, Issues and Perspectives. Sage India.
5. Kelman, I. Disaster by Choice: How Our Actions Turn Natural Hazards into Catastrophes, Oxford University Press, 2022
6. Sahni, P. & Dhameja, A. Disaster Mitigation: Experiences and Reflections. Prentice Hall of India, 2004.

Online Resources

- National Disaster Management Authority (NDMA), India: https://ndma.gov.in – official guidelines, reports, and policy frameworks.
- United Nations Office for Disaster Risk Reduction (UNDRR): https://www.undrr.org – Sendai Framework, global risk reduction strategies.
- Global Disaster Alert and Coordination System (GDACS): https://www.gdacs.org – real-time disaster alerts.
- World Health Organization (WHO) – https://www.who.int/emergencies – disaster-related health guidelines.

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25BHS05: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Outcomes (COs): At the end of the course, students will be able to

CO1: Define and explain the concept of traditional knowledge, its nature, characteristics, and scope.

CO2 : Understand the need for protecting traditional knowledge and its significance in the global economy.

CO3: Explain the legal framework and policies related to traditional knowledge protection.

CO4 : Apply traditional knowledge in different sectors, such as engineering, medicine, agriculture, and biotechnology.

CO5 : Analyze the importance of traditional knowledge in various contexts, including its historical impact and social change.

CO6 : Analyze the relationship between traditional knowledge and intellectual property rights, including patents and non-IPR mechanisms.

Unit-I: Introduction to traditional knowledge

Introduction to traditional knowledge - Definition, Nature and characteristics, scope and importance - Kinds of traditional knowledge - Physical and social contexts in which traditional knowledge develop - Historical impact of social change on traditional knowledge systems - Indigenous Knowledge (IK) – Characteristics - traditional knowledge vis-à-vis indigenous knowledge -Traditional knowledge Vs western knowledge, traditional knowledge vis-à-vis formal knowledge.

Unit-II: Protection of traditional knowledge

Protection of traditional knowledge - Need for protecting traditional knowledge - Significance of TK Protection - Value of TK in global economy - Role of Government to harness TK.

Unit-III: Legal frame work and TK

Legal frame work and TK - A) The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 - Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act) – B) The Biological Diversity Act 2002 and Rules 2004 - the protection of traditional knowledge bill, 2016 - Geographical Indicators Act 2003.

Unit-IV: Traditional knowledge and Intellectual property

Traditional knowledge and Intellectual property - Systems of traditional knowledge protection - Legal concepts for the protection of traditional knowledge - Certain non-IPR mechanisms of traditional knowledge protection - Patents and traditional knowledge - Strategies to increase protection of traditional knowledge -Global legal FORA for increasing protection of Indian Traditional Knowledge.

Unit-V: Traditional knowledge in different sectors

Traditional knowledge in different sectors - Traditional knowledge and Engineering - Traditional medicine system - TK and Biotechnology - TK in Agriculture - Traditional societies depend on it for their food and healthcare needs - Importance of conservation and sustainable development of environment - Management of biodiversity, Food security of the country and protection of TK

Text Books

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning Pvt.Ltd. Delhi, 2022.
2.Basanta Kumar Mohanta and Vipin Kumar Singh, Traditional Knowledge System and Technology in India, Pratibha Prakashan 2012.

Reference Books

1. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
2. Kak, S.C. "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), 1987
3. Subbarayappa, B.V. and Sarma, K.V. Indian Astronomy: A Source Book, Nehru Centre, Mumbai, 1985.
4. Bag, A.K. History of Technology in India, Vol. I, Indian National Science Academy, New Delhi, 1997.
5. Acarya, P.K. Indian Architecture, Munshiram Manoharlal Publishers, New Delhi, 1996.
6. Banerjea, P. Public Administration in Ancient India, Macmillan, London, 1961.
7. Kapoor Kapil, Singh Avadhesh,Indian Knowledge Systems Vol – I & II, Indian Institute of Advanced Study, Shimla, H.P., 2022

E-Resources

1.https://www.youtube.com/watch?v=LZP1StpYEPM
2.http://nptel.ac.in/courses/121106003/

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25BCM10: ADVANCED OPTIMIZATION TECHNIQUES

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Apply linear programming techniques such as Two-phase simplex, Big-M method, and Hungarian algorithm to solve optimization problems including assignment and traveling salesman problems.

CO2: Solve single and multi-variable optimization problems using classical methods including Lagrange multipliers and Kuhn-Tucker conditions for constrained optimization.

CO3: Implement numerical optimization techniques such as the Nelder-Mead Simplex method, steepest descent, Newton's method, and penalty methods for constrained optimization.

CO4: Explain and apply genetic algorithms and genetic programming for solving optimization and differential equation problems, including constrained optimization scenarios.

CO5: Analyze and solve multi-objective optimization problems using dominated sorted GA and apply optimization techniques in real-world design and manufacturing applications.

UNIT - I

Linear programming: Two-phase simplex method, Big-M method, duality, interpretation, applications.

Assignment problem: Hungarian's algorithm, Degeneracy, applications, unbalanced problems, traveling salesman problem.

UNIT – II

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

UNIT –III

Numerical methods for optimization: Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT- IV

Genetic algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA,

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

UNIT -V

Dominated sorted GA, convergence criterion, applications of multi-objective problems.

Applications of Optimization in Design and Manufacturing systems: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence

Text Books:

1. Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers
3. Engineering Optimization – S.S.Rao, New Age Publishers.

References:

1. Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers
2. Genetic Programming- Koza
3. Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers.

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

M.Tech - II Sem (CAD/CAM)

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25BCM11: INDUSTRIAL ROBOTICS & EXPERT SYSTEMS

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Explain the basic structure, types, and components of industrial robots and analyze direct and inverse kinematics, trajectories, and dynamics of robotic manipulators.

CO2: Describe robot drive systems including hydraulic, pneumatic, and electric drives, and design suitable end effectors for specific applications.

CO3: Apply the principles of sensing and vision systems in robotics, including image processing techniques and pattern recognition for intelligent robot perception.

CO4: Design and analyze robot work cells, evaluate robot cycle times, and implement safety and coordination strategies in multi-robot environments.

CO5: Demonstrate various robot programming techniques and apply artificial intelligence and expert systems to enhance robotic functionality and decision-making.

UNIT – I INTRODUCTION AND ROBOT KINEMATICS

Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

UNIT – II ROBOT DRIVES AND CONTROL

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

UNIT – III ROBOT SENSORS

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

UNIT – IV ROBOT CELL DESIGN AND APPLICATION

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

UNIT – V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Text Books:

1. K.S. Fu, R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligence”, Mc Graw Hill, 1987.
2. Yoram Koren,” Robotics for Engineers’ Mc Graw-Hill, 1987.

Reference Books:

1. Kozyrey, Yu. “Industrial Robots”, MIR Publishers Moscow, 1985.
2. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984.
3. Deb, S.R.” Robotics Technology and Flexible Automation”, Tata Mc Graw-Hill, 1994.
4. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey,” Industrial Robotics Technology, Programming and Applications”, Mc Graw-Hill, Int. 1986.
5. Timothy Jordanides et al ,”Expert Systems and Robotics “, Springer –Verlag, New York, May 1991.

Online Learning Resources:

- https://freevideolectures.com/course/4560/nptel-mechanism-robot-kinematics
- https://see.stanford.edu/course/cs223a
- https://cosmolearning.org/courses/introduction-to-robotics/video-lectures/
- https://www.youtube.com/watch?v=0yD3uBshJB0
- https://nptel.ac.in/courses/112/105/112105236/
- https://www.youtube.com/watch?v=xrwz9IxpMJg
- https://www.coursehero.com/file/59785981/Lecture-9-Robot-cell-designppt/
- https://www.plantautomation-technology.com/articles/different-types-of-robot-programming-languages

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M.Tech - II Sem (CAD/CAM)

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25BCM12: CNC TECHNOLOGY & PROGRAMMING
Program Elective Course - III

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Explain the evolution, components, and working principles of CNC, DNC, and machining centers, along with the constructional features and accessories of CNC machines.
CO2: Describe various feedback devices used in CNC systems including digital and analog displacement measurement systems, rotary encoders, and laser interferometers.
CO3: Understand and differentiate open and closed-loop CNC control systems, and describe microprocessor-based architecture and hardware/software features of CNC systems.
CO4: Develop part programs using APT language, including geometry and motion commands, subroutines, and post-processor commands for CNC operations.
CO5: Evaluate economic considerations and maintenance practices for CNC machines, including selection factors, cost analysis, preventive maintenance, and training.

UNIT-I Introduction to CNC Machine tools

Evolution of Computerized control in manufacturing, Components, Working principle of CNC, DNC and Machining centers.
Constructional features of CNC machine tools: Introduction, Spindle drives, Transmission belting, axes feed drives, Slide ways, Ball screws.
Accessories: Work tables, Spindles, Spindle heads, Beds and Columns, Tooling – Automatic Tool changer (ATC).

UNIT-II Feedback devices

Introduction, Digital incremental displacement measuring systems, Incremental rotary encoders, Moire fringes, Digital absolute measuring system.
Electro-magnetic analogue position transducers: Principle, advantages, characterstics, Synchros, Synchro- Resolvers, Inductos, Laser interferometer.

UNIT-III Control Systems and interface

Open and closed loop systems, Microprocessor based CNC systems, block diagram of typical CNC system, description of hard ware and soft interpolation systems, Standard and optional features of CNC control systems.

UNIT-IV APT programming

APT language structure, APT geometry, Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to point motion commands, continuous path motion commands, post processor commands, control commands, Macro subroutines, Part programming preparation for typical examples.

UNIT-V Economics and Maintenance of CNC machine tools

Introduction, factors influencing selection of CNC machines, Cost of operation of CNC machines, Maintenance features of CNC machines, Preventive maintenance, Documentation, Spare parts, Training in Maintenance.

Text Books:

1. Computer Numerical Control Machines – Dr. Radha Krishnanan, New Central Book Agency
2. Computer Numerical Control Machines – Hans B. Keif and T. Frederick Waters Macmillan/McGraw Hill.

References:

1. CNC Machines – B.S. Aditahn and Pabla
2. CNC Machining technology – Springer – Verlag
3. Computer Numerical Machine tools - G.E. Thyer, NEWNES.

Online Learning Resources:

- https://nptel.ac.in/courses/112/105/112105211/
- https://academy.titansofcnc.com/files/Fundamentals_of_CNC_Machining.pdf
- http://home.iitk.ac.in/~nsinha/CNC.pdf
- https://www.thomasnet.com/articles/custom-manufacturing-fabricating/understanding-cnc-machining/
- https://www.hubs.com/knowledge-base/cnc-machining-manufacturing-technology-explained/
- https://www.youtube.com/watch?v=P0BvBbQoiok
- https://www.youtube.com/watch?v=bfTQVixviAo
- https://en.wikipedia.org/wiki/APT_(programming_language)

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25BCM13: COMPUTER GRAPHICS
PE - III

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Explain the fundamentals of computer graphics systems including display technologies, input/output devices, and implement basic raster scan algorithms for drawing lines, circles, and polygons.

CO2: Apply polygon and seed fill algorithms and understand techniques such as antialiasing and halftoning to improve graphical output quality.

CO3: Implement line and polygon clipping algorithms for 2D and 3D graphics using techniques like Cohen-Sutherland, Sutherland-Hodgeman, and midpoint subdivision.

CO4: Perform geometric transformations in 2D and 3D using Cartesian and homogeneous coordinate systems including rotation, scaling, shearing, and viewing transformations.

CO5: Understand and implement rendering techniques including hidden surface removal and shading algorithms such as Z-buffer, Phong, and Gouraud shading.

UNIT- I Introduction to computer graphics

Color CRT raster scan monitors, plasma display & liquid crystal display monitors, computer input devices, hard copy devices.

Raster scan graphics: Line drawing algorithms – DDA & Bresenham algorithms, circle generation, general function rasterization, displaying lines, characters and polygons.

UNIT-II Filling algorithms

Polygon filling, edge fill algorithm, seed fill algorithm, fundamentals of antialiasing and half toning.

UNIT-III Line CLIPPING

Simple visibility algorithm, Cohen-Sutherland subdivision line clipping algorithm, mid- point sub division algorithm.

Polygon clipping: polygon clipping, reentrant polygon clipping – Sutherland – Hodgeman algorithm, character clipping, 3D- clipping.

UNIT-IV Transformations

Cartesian and homogeneous coordinate systems two dimensional and three-dimensional transformations – scaling, rotation, Shearing, Zooming, viewing transformation, reflection, rotation about an axis, concatenation.

UNIT-V Rendering

Hidden line removal algorithms, surface removal algorithms, painters, Warnock, Z-buffer algorithm.

Shading algorithms: Constant intensity algorithm, Phong's shading algorithm, gourand shading algorithm, Comparison of shading algorithms.

Text Books:

1. Procedural elements for computer graphics-D.F. Rogers, Tata McGraw-Hill.
2. Computer Graphics-Donald Hearn & M.P. Bakers.

References:

1. Computer graphics-Harrington.

Online Learning Resources:

- https://lecturenotes.in/subject/59/computer-graphics-cg
- https://www.dgp.toronto.edu/~hertzman/418notes.pdf
- http://www2.cs.uidaho.edu/~jeffery/courses/324/lecture.html
- http://personal.ee.surrey.ac.uk/Personal/J.Collomosse/pubs/cm20219.pdf
- http://www.svecw.edu.in/Docs%5CCSECGLNotes2013.pdf
- https://www.youtube.com/watch?v=fwzYuhduME4
- https://nptel.ac.in/courses/106/103/106103224/
- https://nptel.ac.in/courses/106/102/106102065/

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M.Tech - II Sem (CAD/CAM)

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25BCM14: GLOBAL INTEGRATED MANUFACTURING
PE - III

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Explain the evolution, scope, and segments of CIM and understand the role of CAD/CAM and world-class manufacturing in a globalized production environment.

CO2: Analyze global manufacturing enterprise models including reconfigurable systems, strategic sourcing, and IT-based operations to achieve competitive advantage in globalization.

CO3: Describe the functions and economic importance of international logistics, sourcing strategies, and future trends in intermediate logistics including sustainability and technological advancements.

CO4: Apply the principles of CNC, robotics, flexible manufacturing, and material handling systems to design integrated manufacturing systems in a CIM environment.

CO5: Use manufacturing system software tools for planning and control including MRP, SFC, ADC, and explore virtual manufacturing technologies and paperless production models.

UNIT – I INTRODUCTION

Evolution of manufacturing, CAD/CAM and CIM – Globalization - Scope of CIM - Segments of generic CIM, computers and workstations, an overview of CIM software. World class manufacturing and its importance.

UNIT – II GLOBAL MANUFACTURING ENTERPRISE

Global manufacturing revolution – Reconfigurable machine – Reconfigurable manufacturing system - Production design for globalization – Location of manufacturing plants – Global business strategies – Global strategic alliance – IT-based enterprise – Information transfer in manufacturing systems - PRIDE – Competitive advantage: Logistics – Strategic sourcing - Supply chain - The dilemma of globalization – Where manufacturing enterprises heading?

UNIT -III INTERNATIONAL LOGISTICS

Introduction – supply chain background - outbound logistics functions – inbound logistics functions – overall logistics activities – logistics intermediates. Economic importance. Logistics media: ocean ships (cargo types), air transportation, surface transportation. Terms of sale and payment. Documentation and insurance: cargo, hull, air, land transport – settlement of insurance – claims. Famine relief logistics – demand forecasting – sourcing models – packaging – managing inventories - site/route selection – warehousing and storage.
INTERNAL SOURCING: Introduction – why sourcing is global? – design of global sourcing system – global sourcing and procurement – issues in import and export.
FUTURE ISSUES IN INTERMEDIATE LOGISTICS: Overview – increase use of world-class logistics practices – multi-country trade alliances – one stop shopping concept – amodalism – environmental concerns – space transportation and exploration – The internet.

UNIT -IV CNC TECHNOLOGY AND ROBOTIC SYSTEMS

Principles of numerical control, types of CNC machines, features of CNC systems, programming techniques, capabilities of a typical NC, CAM software, integration of CNC machines in CIM environment, DNC – FMS – objectives – components – FMS layout configurations – FMS classification – ERP. Material handling systems – basics and advanced: conveyor analysis, AGV analysis. Warehousing – storage and retrieval systems: AS/RS analysis. Overview of JIT. Robotic systems-types of robots and their performance capabilities, programming of robots, hardware of robots, kinematics of robots, product design for robotized manufacturing, applications of robots in manufacturing and assembly. Process planning, variant and generative process planning methods – manual vs CAPP - AI in process planning.

UNIT- V MANUFACTURING SYSTEM SOFTWARE

CIM architecture - Production management system (PMS) - forecasting, master production schedule, MRP, capacity planning, shop floor control (SFC), factory data collection system (FDS) – Automatic data capture (ADC) method and its techniques – Bar code – types of bar codes – Data acquisition system - inventory management, product routing, job costing, marketing applications – Applications of ADC - Basics of networking concepts, networking devices.

VIRTUAL ORGANISATION: Paperless factory – Mobile office - Introduction of virtual reality and application - Virtual prototyping – Virtual manufacturing - Virtual instrumentation and measurement - Virtual enterprises.

Text Books:

1. Donal F Wood, Anthony P Barone, Paul R Murthy and Daniel L Wardlow, “International logistics”, AMACOM, 2007.
2. Voram Koren, “The Global Manufacturing Revolution: Product – Process – Business Integration and Reconfigurable Systems”, Kindle Edition, 2011.
3. Mikell P Groover, “Automation of Production Systems and Computer Integrated Manufacturing”, Pearson Education, New Delhi, 2001.

Reference Books:

1. Lee Kunwoo, “CAD/CAM/CAE Systems”, Addition, Wesley, USA, 1999.
2. Kant Vajpayee S, “Principles of Computer Integrated Manufacturing”, Prentice Hall, India, New Jersey, 2003.
3. Radha krishnan P, Subramanyan S and Raju V, “CAD/CAM/CIM”, New Age International Pvt. Ltd, New Delhi.

Online Learning Resources:

- https://nptel.ac.in/courses/112/104/112104289/
- https://nptel.ac.in/courses/112/105/112105249/
- https://www.youtube.com/watch?v=lRm9GiGoZKg
- https://osme.co.in/wp-content/uploads/2020/05/6TH-SEM-MECHANICAL-ENGG- Advance- manufacturing-and-CAD-CAM.pdf
- https://www.cet.edu.in/noticefiles/259_Lecturer%20Note%20on%20Mechatronics-ilovepdf- compressed.pdf

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M.Tech - II Sem (CAD/CAM)	**L**	**T**	**P**	**C**
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25BCM15: MECHATRONICS APPLICATIONS IN MANUFACTURING (PE-IV)

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Explain the fundamentals of mechatronic systems and distinguish between traditional and mechatronics design approaches.

CO2: Select and apply appropriate sensors and transducers for measurement of physical quantities and analyze their performance in signal processing and servo systems.

CO3: Describe the architecture and programming of microprocessors (8085) and interface input/output devices for real-time applications like motor and temperature control.

CO4: Develop simple control applications using Programmable Logic Controllers (PLCs), including timers, counters, analog I/O, and data handling techniques.

CO5: Apply mechatronic design principles to solve engineering problems through case studies and propose integrated system solutions.

UNIT – I INTRODUCTION

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

UNIT – II SENSORS AND TRANSDUCERS

Introduction - Performance Terminology - Displacement, Position and Proximity - Velocity and Motion - Fluid pressure - Temperature sensors - Light sensors - Selection of sensors – Signal processing - Servo systems.

UNIT – III MICROPROCESSORS IN MECHATRONICS

Introduction - Architecture - Pin configuration - Instruction set - Programming of Microprocessors using 8085 instructions - Interfacing input and output devices - Interfacing D/A converters and A/D converters – Applications - Temperature control - Stepper motor control - Traffic light controller.

UNIT – IV PROGRAMMABLE LOGIC CONTROLLERS

Introduction - Basic structure - Input / Output processing - Programming -Mnemonics Timers, Internal relays and counters - Data handling - Analog input / output - Selection of PLC.

UNIT – V DESIGN AND MECHATRONICS

Designing - Possible design solutions - Case studies of Mechatronics systems.

Text Books:

1. Michael B. Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 1999.
2. Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ, "Mechatronics ", Chapman and Hall, 1993.
3. Ramesh.S, Gaonkar, "Microprocessor Architecture, Programming and Applications" Wiley Eastern, 1998.

References:

1. Lawrence J. Kamm, " Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics ", Prentice-Hall, 2000.
2. Ghosh, P.K. and Sridhar, P.R., 0000 to 8085, "Introduction to Microprocessors for Engineers and Scientists ", Second Edition, Prentice Hall, 1995.

Online Learning Resources:

- https://www.cet.edu.in/noticefiles/259_Lecturer%20Note%20on%20Mechatronics-ilovepdf- compressed.pdf
- https://lecturenotes.in/subject/137/mechatronics-mech
- http://engineering.nyu.edu/mechatronics/Control_Lab/Criag/Craig_RPI/2001/Mechatronics%20Lecture%20Notes.htm
- https://jcboseust.ac.in/mechanical/images/mtech1stsem/mechatronics_product_design.pdf
- https://www.youtube.com/watch?v=tAkkUNEknGk
- https://nptel.ac.in/courses/112/107/112107298/
- https://www.youtube.com/watch?v=ncSnIkBO-X0

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M.Tech - II Sem (CAD/CAM)

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25BCM16: RAPID PROTOTYPING
PE – IV

Course Outcomes (CO): After completion of the course, the student will be able to
CO1: Describe the need, history, classification, and applications of Rapid Prototyping (RP) systems and explain the principles and operations of Stereo Lithography.
CO2: Explain the working principles, process parameters, and applications of Fusion Deposition Modeling (FDM) and Solid Ground Curing (SGC) technologies.
CO3: Understand the operation and materials used in Laminated Object Manufacturing (LOM) and various concept modelers including 3D printers and thermal jet printers.
CO4: Differentiate between indirect and direct rapid tooling methods and describe the software tools used in RP including STL file handling and collaborative platforms.
CO5: Analyze the factors influencing the accuracy and quality of parts in RP processes and suggest methods to optimize the rapid manufacturing process.

UNIT –I Introduction
Need for the compression in product development, History of RP system, Survey of applications, Growth of RP industry and classification of RP system.
Stereo Lithography System: Principle, Process parameter, Process details, Data preparation, Data files and machine details, Applications.

UNIT –II Fusion Decomposition Modeling
Principle, process parameter, Path generation, Applications.
Solid ground curing: Principle of operation, Machine details, Applications.

UNIT-III Laminated Object Manufacturing
Principle of Operation, LOM materials, Process details, Applications.
Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer, Genisys Xs printer HP system 5, Object Quadra system.

UNIT-IV Laser Engineering Net Shaping (LENS)
Rapid Tooling: Indirect Rapid tooling- Silicon rubber tooling- Aluminum filled epoxy tooling Spray metal tooling, Cast kriksite, 3Q keltool, etc, Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft, Tooling vs. hard tooling.
Software for RP: STL files, Overview of Solid view, magics, imics, magic communication, etc. Internet based software, Collaboration tools.

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

Text Books:

1. "Stereo lithography and other RP & M Technologies", Paul F. Jacobs, SME, NY 1996.
2. "Rapid Manufacturing", Flham D.T & Dinjoy S.S, Verlog London 2001.

References:

1. Rapid automated", Lament wood, Indus Press New York.

Online Learning Resources:

- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4

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M.Tech – II Sem (CAD/CAM)

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25BCM17: ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS
(PE-IV)

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Explain the fundamentals of Artificial Intelligence (AI), formulate AI problems using state-space representation, and apply uninformed and informed search strategies including heuristic methods.

CO2: Describe various knowledge representation techniques, logic programming concepts, and apply predicate logic for reasoning and problem-solving.

CO3: Apply probabilistic reasoning methods including Bayes' theorem, fuzzy logic, and Dempster-Shafer theory to manage uncertainty in AI systems.

CO4: Analyze the architecture and applications of expert systems, and understand pattern recognition, knowledge acquisition, and classification techniques in AI.

CO5: Evaluate typical expert systems like MYCIN and DENDRAL and explore machine learning models including perceptrons, genetic algorithms, and learning automata.

UNIT – I Artificial Intelligence

Introduction, definition, underlying assumption, Important of Al, Al & related fields State space representation, defining a problem, production systems and its characteristic, search and control strategies –Introduction, preliminary concepts, examples of Search , problems. Uniformed or preliminary Concept: Examples of search problems, Uniformed or Blind Search, Informed Search, Or Graphs, Heuristic Search techniques- Generate and Test, Hill climbing, Best first search, Problem reduction, Constraint satisfaction, Means- Ends Analysis.

UNIT – II Knowledge Representation Issues

Representations and Mapping, Approaches, Issues in Kr, Types of knowledge procedural Vs Declarative, Logic programming, Forward Vs Backward reasoning, Matching, Non monotonic reasoning and it logic.

Use of Predicate Logic: Representing simple facts, Instance and is a relationships, Syntax and Semantics for Propositional logic, FOPL, and properties of Wffs, conversion to casual form, Resolution, Natural deduction.

UNIT – III Statistical and Probabilistic Reasoning

Symbolic reasoning under uncertainly, Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster- Shafer Theory, Fuzzy Logic.

UNIT – IV Expert Systems

Introduction, Structure and uses, Representing and using domain knowledge, Expert System Shells. Pattern recognition, introduction, Recognition and classification process, learning classification patterns, recognizing and understanding speech.

Introduction to Knowledge Acquisition: Types of learning, General learning model, and performance measures.

UNIT – V Typical Expert Systems

MYCIN, Variants of MYCIN, PROSPECTOR DENDRAL, PRUFF etc.

Introduction to Machine Learning: Perceptons, Checker Playing examples, Learning, Automata, Genetic Algorithms, Intelligent Editors.

Text Books:

1. "Artificial Intelligence", Elaine Rich & Kevin Knight, M/H 1983
2. "Artificial Intelligence in Business", Wendry B. Ranch, Science & Industry –Vol -II application, Ph 1985.
3. "A Guide to Expert System" Waterman, D.A., Addison, – Wesley inc. 1986.

References:

1. "Building expert system" Hayes, Roth, Waterman, D.A (ed), AW 1983.
2. "Designing Expert System", S.M. and Kulliknowske Weis, London Champion Hull 1984.

Online Learning Resources:

- https://www.youtube.com/watch?v=11nzrNkn9D8
- https://www.youtube.com/watch?v=BXHcPESoaPY
- https://silo.tips/download/module-9-lecture-notes-5-expert-systems
- https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_expert_systems. htm
- https://epub.uni-regensburg.de/13629/1/ubr06078_ocr.pdf
- https://lecturenotes.in/subject/879/artificial-intelligence-and-expert-system
- https://www.vssut.ac.in/lecture_notes/lecture1530018613.pdf
- https://www.cet.edu.in/noticefiles/271_AI%20Lect%20Notes.pdf

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M.Tech-II Sem (CAD/CAM)

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25BCM18: PROCESS AUTOMATION LABORATORY

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Demonstrate the basics of robot programming and perform point-to-point and continuous path programming on a six-axis industrial robot (Aristo XT).

CO2: Simulate and analyze manufacturing and automation systems to evaluate improvements in production rate using online/offline simulation tools.

CO3: Use Automation Studio to design, simulate, and troubleshoot various hydraulic circuits such as meter-in/meter-out, press, clamping, sequencing, and synchronizing systems.

CO4: Design and simulate pneumatic circuits using cascade and step counter methods for sequencing and synchronization using either online or offline tools.

CO5: Explain the working of an additive manufacturing machine and fabricate simple symmetrical and asymmetrical components through design and 3D printing.

LIST OF EXPERIMENTS:

1. Aristo XT Six axis Robot
    a. Introduction to Robot programming
    b. Robot programming exercises (Point-to-Point and continuous path task)
2. Either Online / Offline mode.
    a. Simulation of a manufacturing system for increasing production rate.
    b. Simulation of a simple automation system.
3. Either Online / Offline mode.
    I Hydraulic Circuits
        a. Introduction to Automation studio & its control
        b. Draw & Simulate the Hydraulic circuit for series & parallel cylinders connection
        c. Draw & Simulate Meter-in, Meter-out and hydraulic press and clamping.
        d. Sequencing circuits in hydraulics.
        e. Synchronizing circuits in hydraulics.
    II Pneumatic circuits
        a. Sequencing circuits in Pneumatics.
        b. Synchronizing circuits in Pneumatics.
        c. Design and Simulation of simple pneumatic circuit by using Cascade Method.
        d. Design and Simulation of simple pneumatic circuit by using step counter method
4. Additive manufacturing machine
    a. Introduction to Additive manufacturing Machine.
    b. Design and fabrication of simple symmetrical and unsymmetrical components

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M.Tech-II Sem (CAD/CAM)	**0**	**0**	**4**	**2**

25BCM19: CAM LABORATORY

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Develop manual part programs using G and M codes for CNC lathe operations including linear and circular interpolation, chamfering, grooving, and standard canned cycles.

CO2: Write and execute manual part programs for CNC milling machine operations such as interpolation, contouring, and canned cycles for drilling and boring.

CO3: Apply APT (Automatically Programmed Tools) language to create CNC programs for turning and milling operations.

CO4: Simulate tool paths using CAM simulation software for various machining operations to visualize and verify the programmed part geometry.

CO5: Demonstrate understanding of CNC machining concepts through programming, simulation, and execution of machining operations for real-world applications.

List of Experiments:

1. Manual part programming (using G and M codes) in CNC Lathe Machine
   (a) Part programming for linear interpolation, circular interpolation, chamfering and grooving.
   (b) Part programming by using standard canned cycles for facing, turning, taper turning and thread cutting.
2. Manual part programming (using G and M codes) in CNC Milling Machine
   (a) Part programming for linear interpolation, circular interpolation and contour motions.
   (b) Part programming involving canned cycles for drilling peak drilling and boring.
3. APT (Automatically Programmed Tools) language in CNC Milling and Lathe machine.
4. Cutting tool path generation using any one simulation package for different machining operation.

SRI VENKATESWARA COLLEGE OF ENGINEERING &TECHNOLOGY (AUTONOMOUS)

I M. Tech-II Semester (CSE)

		L	T	P	C
25BCS22	**QUANTUM TECHNOLOGIES AND APPLICATIONS**	**2**	**0**	**0**	**2**

Course Outcomes (CO):

C01: Explain core quantum principles in a non-mathematical manner.
C02: Compare classical and quantum information systems.
CO3: Identify theoretical issues in building quantum computers.
C04: Discuss quantum communication and computing concepts.
CO5: Recognize applications, industry trends, and career paths in quantum technology.

Unit 1: Introduction to Quantum Theory and Technologies

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison,Quantum states and measurement: nature of observation,Overview of quantum systems: electrons, photons, atoms,The concept of quantization: discrete energy levels,Why quantum? Strategic, scientific, and technological significance,A snapshot of quantum technologies: Computing, Communication, and Sensing,National and global quantum missions: India's Quantum Mission, EU, USA, China

Unit 2: Theoretical Structure of Quantum Information Systems

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract,The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences,Philosophical implications: randomness, determinism, and observer role

Unit 3: Building a Quantum Computer – Theoretical Challenges and Requirements

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers:

Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what's working and what remains elusive,The role of quantum software in managing theoretical complexities

Unit 4: Quantum Communication and Computing – Theoretical Perspective

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication,The Idea of the Quantum Internet – Secure Global Networking,Introduction to Quantum Computing,Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: Decoherence and Error Correction,Real-World Importance and Future Potential

Unit 5: Applications, Use Cases, and the Quantum Future

Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum,Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization,Emerging careers in quantum: roles, skillsets, and preparation pathways,Educational and research landscape – India's opportunity in the global quantum race

Textbooks**:**

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
3. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

Reference Books**:**

1. David McMahon, *Quantum Computing Explained*, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing*, Oxford University Press, 2007.
3. Scott Aaronson, *Quantum Computing Since Democritus*, Cambridge University Press, 2013.
4. **Alastair I.M. Rae**, *Quantum Physics: A Beginner's Guide*, Oneworld Publications, Revised Edition, 2005.
5. **Eleanor G. Rieffel, Wolfgang H. Polak**, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
6. **Leonard Susskind, Art Friedman**, *Quantum Mechanics: The Theoretical Minimum*, Basic Books, 2014.
7. **Bruce Rosenblum, Fred Kuttner**, *Quantum Enigma: Physics Encounters Consciousness*, Oxford University Press, 2nd Edition, 2011.
8. **GiulianoBenenti, GiulioCasati, GiulianoStrini**, *Principles of Quantum Computation and Information, Volume I: Basic Concepts*, World Scientific Publishing, 2004.
9. **K.B. Whaley et al.**, *Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document*, Quantum Flagship, European Commission, 2020.
10. **Department of Science & Technology (DST), Government of India**, *National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers*, MeitY/DST Publications, 2020 onward.

Online Learning Resources**:**

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers
- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

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M.Tech – II Sem (CAD/CAM)

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25BCM20: COMPREHENSIVE VIVA-VOCE

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(AUTONOMOUS)

M.Tech – II Sem (CAD/CAM) **L T P C**
2 0 0 0

25BMB02: PEDAGOGY STUDIES

Course Outcomes (CO): After completion of the course, the student will be able to
CO1. Understand the conceptual framework, policy context, and methodological foundations of research in pedagogy and teacher education.
CO2. Analyze pedagogical practices in formal and informal learning environments in developing countries, with emphasis on curriculum and teacher education.
CO3. Evaluate the effectiveness of pedagogical strategies and teacher education programs based on empirical evidence and theoretical models.
CO4. Examine the role of professional development, peer and community support, and classroom alignment in enhancing teaching practices and student learning outcomes.
CO5. Identify research gaps and propose future directions in pedagogy, curriculum, teacher training, and assessment practices to inform educational improvement.

UNIT- I
Introduction and Methodology: Aims and rationale, Policy back ground, Conceptual frame work and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and searching.

UNIT-II
Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III
Evidence on the effectiveness of pedagogical practices, Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and thescho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV
Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class.

UNIT-V
Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

References:

1. Ackers J,Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander R J (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

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M.Tech – II Sem (CAD/CAM) **L T P C**
2 0 0 0

25BHS06: YOGA FOR STRESS MANAGEMENT

Course Outcomes (CO): After completion of the course, the student will be able to
CO1. Explain the eight limbs (Ashtanga) of yoga and their significance in leading a balanced life.
CO2. Describe the principles of Yam and Niyam and their role in ethical living and personal discipline.
CO3. Apply moral values such as ahimsa, satya, and santosh in daily life for self-regulation and personal growth.
CO4. Demonstrate proficiency in basic asanas and pranayama techniques for physical and mental well-being.
CO5. Evaluate the benefits of various yoga poses and breathing techniques, and their impact on mind-body wellness.

UNIT- I
Definitions of Eight parts of yoga. (Ashtanga).

UNIT-II
Yam and Niyam.

UNIT-III
Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigrahaii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

UNIT-IV
Asan and Pranayam.

UNIT-V
i) Various yoga poses and their benefits for mind &body
ii) Regularization of breathing techniques and its effects-Types of pranayam.

References:

1. Yogic Asanas for Group Training-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

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M.Tech – II Sem (CAD/CAM) **L T P C**
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25BHS07: PERSONALITY DEVELOPMENT THROUGHLIFE ENLIGHTENMENTSKILLS

Course Outcomes (CO): After completion of the course, the student will be able to
CO1. Interpret key verses from Neetisatakam that emphasize wisdom, virtue, pride, and heroism for holistic personality development.
CO2. Differentiate between ethical do's and don'ts based on selected Neetisatakam verses to cultivate moral behavior and disciplined living.
CO3. Apply teachings from the Bhagavad Gita to effectively approach daily duties and responsibilities with clarity and dedication.
CO4. Analyze Gita's philosophical insights to understand human behavior, emotional stability, and the characteristics of a role model.
CO5. Evaluate foundational knowledge from selected Gita verses to build mental resilience, ethical judgment, and spiritual insight.

UNIT- I
Neetisatakam- Holistic development of personality
Verses-19,20,21,22(wisdom)
Verses-29,31,32(pride &heroism)
Verses-26,28,63,65(virtue)

UNIT-II
Neetisatakam- Holistic development of personality
Verses-52,53,59(dont's)
Verses-71,73,75,78(do's).

UNIT-III
Approach to day to day work and duties.
Shrimad Bhagwad Geeta: Chapter2-Verses41,47,48,
Chapter3-Verses 13,21,27,35, Chapter6-Verses 5,13,17,23,35,
Chapter18-Verses 45,46,48.

UNIT-IV
Statements of basic knowledge.
Shrimad Bhagwad Geeta: Chapter2-Verses 56,62,68
Chapter12 -Verses13,14,15,16,17,18
Personality of Role model.

UNIT-V
Shrimad Bhagwad Geeta: Chapter2-Verses 17,
Chapter3-Verses36,37,42, Chapter4-Verses18,38,39

Chapter18– Verses37,38,63.

References:

1. Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

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M.Tech - III Sem (CAD/CAM)

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25BCM21: ADVANCED TOOL DESIGN
Program Elective Course - V

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Explain the fundamentals of tool design including classifications, standards, surface finish, tolerances, and the selection of appropriate tooling materials and heat treatment considerations.

CO2: Design various types of cutting tools such as single-point tools, milling cutters, broaching tools, and gear/thread milling cutters based on metal cutting mechanics.

CO3: Design jigs and fixtures by applying principles of location, clamping, and chip formation, and select suitable construction methods for various machining operations.

CO4: Design press tool dies for operations like blanking, piercing, bending, forming, and drawing, and perform force and strip layout calculations.

CO5: Apply tool design principles to CNC machine tools by designing appropriate tooling systems, fixtures, tool holders, and tool changers for automated machining.

UNIT – I INTRODUCTION TO TOOL DESIGN

Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings - Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non-ferrous Tooling Materials- Carbides, Ceramics and Diamond -Non-metallic tool materials-Designing with relation to heat treatment.

UNIT – II DESIGN OF CUTTING TOOLS

Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle - Single- point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form
relieved and profile relieved cutters-Design of gear and thread milling cutters.

UNIT – III DESIGN OF JIGS AND FIXTURES

Introduction – Fixed Gages – Gage Tolerances –selection of material for Gages – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General considerations in the design of drill jigs – Drill bushings – Methods of construction –Thrust and Turning Moments in drilling - Drill jigs and modern manufacturing- Types of Fixtures – Vise Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Modular Fixtures – Cutting Force Calculations.

UNIT – IV DESIGN OF PRESS TOOL DIES

Types of Dies –Method of Die operation–Clearance and cutting force calculations- Blanking and Piercing die design – Pilots – Strippers and pressure pads- Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing dies-Design and drafting.

UNIT – V TOOL DESIGN FOR CNC MACHINE TOOLS

Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools- Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine.

Text Books:

1. Cyrll Donaldson, George H. LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2000.
2. E.G. Hoffman,” Jig and Fixture Design”, Thomson Asia Pvt Ltd, Singapore, 2004.

References:

1. Prakash Hiralal Joshi, “Tooling data”, Wheeler Publishing, 2000
2. Venkataraman K., “Design of Jigs, Fixtures and Presstools”, TMH, 2005.
3. Haslehurst M., “Manufacturing Technology”, The ELBS, 1978.

Online Learning Resources:

- https://www.iare.ac.in/sites/default/files/lecture_notes/TOOL%20DESIGN_Lecture_Notes.pdf
- https://www.cet.edu.in/noticefiles/261_MMP%20Lecture%20Notes-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture-notes.php?url=production-engineering
- https://nptel.ac.in/courses/112/105/112105233/
- https://www.youtube.com/watch?v=7MkX-sW97rI
- https://nptel.ac.in/courses/112/105/112105126/#
- https://youtu.be/7yzvno4AvKw

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25BCM22: DESIGN FOR MANUFACTURING
PE - V

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Understand and apply the principles of design for manufacturability, including steps in the design process, material selection, and process compatibility for economical production.

CO2: Analyze various machining processes and apply general design rules to enhance machining ease, dimensional tolerance, and surface finish.

CO3: Evaluate casting processes and implement design rules and simulation techniques for optimal product design in sand casting and other casting methods.

CO4: Design components for metal joining and forging processes by considering thermal stresses, weld guidelines, and forging design principles.

CO5: Apply design guidelines for extrusion, sheet metal operations, and plastic components considering material behavior and specific manufacturing constraints like injection molding.

UNIT – I

Introduction: Design philosophy-steps in design process-general design rules for manufacturability- basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNIT – II

Machining processes: Overview of various machining processes-general design rules for machining- dimensional tolerance and surface roughness-Design for machining – ease – redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT –III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

UNIT – IV

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

UNIT – V

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

Plastics: Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding.

Text Books:

1. Design for manufacture, John cobert, Adisson Wesley. 1995
2. Design for Manufacture by Boothroyd.

References:

1. ASM Hand book Vol.20.

Online Learning Resources:

- https://nptel.ac.in/courses/112/101/112101005/
- https://www.iare.ac.in/sites/default/files/lecture_notes/DFMA_LECTURE_NOTES.pdf
- https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii-spring- 2004/lecture-notes/
- https://dokumen.tips/documents/design-for-manufacturing-and-assembly-1-lecture-notes-on- design-for-manufacturing.html
- https://www.youtube.com/watch?v=ofmbhbVCUqI
- https://onlinecourses.nptel.ac.in/noc21_me66/preview

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M.Tech - III Sem (CAD/CAM)

L	T	P	C
3	0	0	3

25BCM23: COMPUTER AIDED TOOLS FOR MANUFACTURING
PE - V

Course Outcomes (CO): After completion of the course, the student will be able to
CO1: Explain the fundamentals of manufacturing integration, NC/CNC/DNC systems, and develop NC programs using G-code, M-code, and APT for point-to-point and continuous path machining.
CO2: Analyze the role of Computer Aided Process Planning (CAPP) in CAD/CAM integration and differentiate between variant, generative, and hybrid CAPP approaches.
CO3: Understand the significance of engineering tolerances and apply computer-aided inspection techniques using contact and non-contact methods for quality control.
CO4: Describe the scope and tools of Reverse Engineering (RE) and construct surface and solid models using digitizing techniques and CMM data.
CO5: Evaluate strategies for managing RE data and software tools, and apply methods for detecting reusable components and user interfaces in legacy systems.

UNIT – I COMPUTER AIDED MANUFACTURING
Manufacturing Processes – Removing, Forming, Deforming and joining – Integration Requirements. Integrating CAD, NC and CAM – Machine tools – Point to point and continuous path machining, NC, CNC and DNC – NC Programming – Basics, Languages, G Code, M Code, APT – Tool path generation and verification – CAD/CAM NC Programming – Production Control – Cellular Manufacturing.

UNIT – II COMPUTER AIDED PROCESS PLANNING
Role of process planning in CAD/CAM Integration – Computer Aided Process Planning – Development, Benefits, Model and Architecture – CAPP Approaches – Variant, Generative and Hybrid – Process and Planning systems – CAM-I, D-CLASS and CMPP – Criteria in selecting a CAPP System.

UNIT -III COMPUTER AIDED INSPECTION
Engineering Tolerances – Need for Tolerances – Conventional Tolerances – FITS and LIMITS – Tolerance Accumulation and Surface quality – Geometric Tolerances – Tolerances Practices in design, Drafting and manufacturing – Tolerance Analysis – Tolerance synthesis – Computer Aided Quality control – Contact Inspection Methods – Non-Contact Inspection Methods – Non optical.

UNIT- IV REVERSE ENGINEERING
Scope and tasks of Reverse Engineering – Domain Analysis – Process Duplicating – Tools for RE – Developing Technical data – Digitizing techniques – Construction of surface model – Solid part model – Characteristic evaluation – Software's and its application – CMM and its feature capturing – surface and solid modeling.

UNIT-V DATA MANAGEMENT
Strategies for Reverse Engineering Data management – Software application – Finding renewable software components – Recycling real time embedded software – Design experiments to evaluate a RE tools – Rule based detection for RE user interface – RE of assembly programs.

Text Books:

1. Ibrahim Zeid and R. Sivasubramanian, "CAD/CAM Theory and Practice", Revised First special Indian Edition, Tata Mc Graw Hill Publication, 2007
2. Catherine A. Ingle, "Reverse Engineering", Tata Mc Graw Hill Publication, 1994
3. Ibrahim Zeid, "Mastering CAD/CAM", special Indian Edition, Tata Mc Graw Hill Publication, 2007.

References:

1. David D. Bedworth, Mark R. Henderson, Philp M. Wolfe, "Computer Integrated Design and manufacturing", Mc Graw Hill International series, 1991
2. Linda Wills, "Reverse Engineering" Kluwer Academic Press, 1996
3. Donald R. Honra, "Co-ordinate measurement and reverse Engineering, American Gear Manufacturers Association.

Online Learning Resources:

- https://www.autodesk.com/products/fusion-360/blog/computer-aided-manufacturing-beginners/
- https://www.youtube.com/watch?v=EgKc9L7cbKc
- https://nptel.ac.in/courses/112/105/112105211/
- https://lecturenotes.in/subject/409/computer-aided-design-and-manufacturing-cadm
- https://www.youtube.com/watch?v=9dd3M2a4LKI
- https://www.iare.ac.in/sites/default/files/lecture_notes/CAD_CAM_LECTURE%20NOTES.pdf
- https://learnmech.com/computer-aided-inspection-cim-notes/
- https://canvas.instructure.com/courses/838884/pages/unit-3-lesson-6-reverse-engineering

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25BCS01: ADVANCED DATA STRUCTURES & ALGORITHMS
Open Elective Course - I

Course Outcomes:

After completing this course, students will be able to:

CO1: Implement and manipulate linear data structures like singly/doubly linked lists, circular lists, stacks, and queues using dynamic memory allocation.

CO2: Apply and analyze searching and sorting algorithms including linear, binary search, bubble, selection, insertion, quick, and merge sort.

CO3: Design and implement dictionaries and hashing techniques to efficiently store and retrieve data.

CO4: Construct and operate on trees and priority queues, performing insertion, deletion, and traversal operations.

CO5: Compare and implement balanced search trees (AVL, Red-Black, Splay, B-Trees) for optimized data access and storage

UNIT I: Introduction

Introduction to Data Structures, Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms. Stacks and Queues: Algorithm Implementation using Linked Lists.

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UNIT II: Searching and Sorting:

Linear and Binary Search Methods, Sorting: -Basic sorting techniques, Radix Sort, Bucket Sort, Shell Sort Trees- Binary trees, Properties, Representation and Traversals, Expression Trees (Infix, prefix, postfix). Graphs-Basic Concepts, Storage structures and Traversals.

UNIT III: Dictionaries and Hashing

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT IV: Priority queues

Definition, ADT, Realizing a Priority Queue Using Heaps, Definition, Insertion, Deletion .Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations-Searching, Insertion, Deletion.

UNIT V: Search Trees

AVL Trees, Definition, Height of AVL Tree, Operations-, Insertion, Deletion and Searching, Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees.

Text Books:

1. Data Structures: A Pseudo Code Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon and Cengage
2. Data Structures, Algorithms and Applications in java, 2/e, SartajSahni, University Press

Reference Books:

1. Data Structures and Algorithm Analysis, 2/e, Mark Allen Weiss, Pearson.
2. Data Structures and Algorithms, 3/e, Adam Drozdek, Cengage
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, N.B.Venkateswarulu, E.V.Prasad and S Chand & Co.

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M.Tech - III Sem (CAD/CAM)

L	T	P	C
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25BCS04: ENTERPRISE CLOUD CONCEPTS
Open Elective Course - I

Course Outcomes:
After the completion of the course, student will be able to
CO1: Understand importance of cloud architecture.
CO2: Illustrating the fundamental concepts of cloud security.
CO3: Analyze various cloud computing mechanisms.
CO4: Understanding the architecture and working of cloud computing.

Unit - I
Understanding Cloud Computing: Origins and influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges. Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

Unit - II
Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology CLOUD COMPUTING MECHANISMS: Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication.

Unit - III
Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System, Case Study Example Cloud Computing Architecture.
Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture, Case Study Example.

Unit - IV
Cloud-Enabled Smart Enterprises Introduction, Revisiting the Enterprise Journey, Service-Oriented Enterprises, Cloud Enterprises, Smart Enterprises, The Enabling Mechanisms of Smart Enterprises Cloud-Inspired Enterprise Transformations Introduction, The Cloud Scheme for Enterprise Success, Elucidating the Evolving Cloud Idea, Implications of the Cloud on Enterprise Strategy, Establishing a Cloud-Incorporated Business Strategy.

UNIT-V
Transitioning to Cloud-Centric Enterprises The Tuning Methodology, Contract Management in the Cloud Cloud-Instigated IT Transformations Introduction, Explaining Cloud Infrastructures, A Briefing on Next-Generation Services, Service Infrastructures, Cloud Infrastructures, Cloud Infrastructure Solutions, Clouds for Business Continuity, The Relevance of Private Clouds, The Emergence of Enterprise Clouds.

TEXT BOOKS:

1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, Cloud Computing: Concepts, Technology & Architecture 1st Edition,
2. Pethuru Raj, Cloud Enterprise Architecture, CRC Press.

REFERENCE:

1. James Bond, The Enterprise Cloud, O'Reilly Media, Inc.

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M.Tech - III Sem (CAD/CAM)

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25BCM24: MECHATRONICS
Open Elective Course - I

Course Outcomes (CO): After completion of the course, the student will be able to

CO1: Explain the fundamentals of automation systems, signal conditioning techniques, and control methods used in applications like SPM, CNC, FMS, and CIM.

CO2: Analyze the working and selection criteria of precision mechanical systems including pneumatic, hydraulic, and motorized actuation components.

CO3: Design interface circuits for sensors, actuators, and power electronics, and evaluate drive systems for electromechanical applications.

CO4: Develop and implement embedded system solutions using 8051 microcontroller for interfacing, data conversion, and control tasks.

CO5: Construct and simulate automation control logic using Programmable Logic Controllers (PLCs) and motion controllers for industrial control systems.

UNIT – I

INTRODUCTION: Definition – Trends - Control Methods: Standalone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.

SIGNAL CONDITIONING: Introduction – Hardware - Digital I/O, Analog input – ADC, resolution, speed channels Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass, high pass, notch filtering.

UNIT – II

PRECISION MECHANICAL SYSTEMS: Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

UNIT -III

ELECTRONIC INTERFACE SUBSYSTEMS: TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids, motors Isolation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers, over current sensing, resettable fuses, thermal dissipation - Power Supply - Bipolar transistors / mosfets.

ELECTROMECHANICAL DRIVES: Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives, PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

UNIT- IV

MICROCONTROLLERS OVERVIEW: 8051 Microcontroller, microprocessor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking, Voltage measurement using ADC).

UNIT-V

PROGRAMMABLE LOGIC CONTROLLERS: Basic Structure - Programming: Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

PROGRAMMABLE MOTION CONTROLLERS: Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices: Position, Velocity Sensors - Optical Incremental encoders - Proximity Sensors: Inductive, Capacitive.

Text Books:

1. A text book of Mechatronics by Er.R.K. RAJPUT ., S.CHAND publications
2. A text book of Mechatronics by Nitalgour Premchand Mahalik ., McGraw Hill publications.

References:

1. A text book of Mechatronics by W.Bolton ., Pearson Publications.

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(AUTONOMOUS)

M.Tech – III Sem (CAD/CAM)	**L**	**T**	**P**	**C**
	0	**0**	**20**	**10**

25BCM25: DISSERTATION PHASE-I

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M.Tech – III Sem (CAD/CAM)	**L**	**T**	**P**	**C**
	0	**0**	**0**	**2**

25BCM26: INDUSTRY INTERNSHIP

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M.Tech – III Sem (CAD/CAM)	**L**	**T**	**P**	**C**
	0	**0**	**0**	**1**

25BCM27: Co-Curricular Activities

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M.Tech – IV Sem (CAD/CAM)

L	T	P	C
0	0	32	16

25BCM30: DISSERTATION PHASE-II