MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)
Sponsored by CMR Educational Society
(Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade - ISO 9001:2015 Certified)
Maisammaguda, Dhulapally (Post Kompally), Secunderabad – 500100, Telangana State, India.
Contact Number: 040-23792146/64634237, E-Mail ID: mrcet2004@gmail.com, website: www.mrcet.ac.in

BACHELOR OF TECHNOLOGY
MECHANICAL ENGINEERING

ACADEMIC REGULATIONS
COURSE STRUCTURE AND SYLLABUS

For
(B.TECH. FOUR YEAR DEGREE COURSE)
(Batches admitted from the academic year 2015 - 2016)

Note: The regulations hereunder are subjected to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already pursuing the program) as may be decided by the Academic Council.

PRELIMINARY DEFINITIONS AND NOMENCLATURES

- ”Autonomous Institution /College” means an institution/college designated as autonomous institute / college by University Grants Commission (UGC), as per the UGC Autonomous College Statutes.

- “Academic Autonomy” means freedom to a College in all aspects of conducting its academic programs, granted by the University for promoting excellence.

- “Commission” means University Grants Commission.

- “AICTE” means All India Council for Technical Education.

- “University” means Jawaharlal Nehru Technological University, Hyderabad.

- “College” means Malla Reddy College of Engineering & Technology, Secunderabad unless indicated otherwise by the context.

- “Program” means:
    - Bachelor of Technology (B.Tech) degree program
    - UG Degree Program: B.Tech

- “Branch” means specialization in a program like B.Tech degree program in Mechanical Engineering, B.Tech degree program in Aeronautical Engineering etc.

- “Course” or “Subject” means a theory or practical subject, identified by its course – number and course-title, which is normally studied in a semester.

- T–Tutorial, P–Practical, D–Drawing, L-Theory, C-Credits

FOREWORD

The autonomy is conferred on Malla Reddy College of Engineering & Technology (MRCET) by UGC 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 UGC 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.

Malla Reddy College of Engineering & Technology (MRCET) is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, and also improving upon the values and beliefs 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 JNTU Hyderabad 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 experts drawn from academics, industry and research, in accordance with the vision and mission of the college which reflects the mindset of the institution in order 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, if 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 institution and brighter prospects of engineering graduates.

"A thought beyond the horizons of success committed for educational excellence"

PRINCIPAL

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

Sponsored by CMR Educational Society(Affiliated to JNTU, Hyderabad, Approved by AICTE - Accredited by NBA & NAAC – 'A' Grade - ISO 9001:2015 Certified)

Maisammaguda, Dhulapally (Post Kompally), Secunderabad – 500100, Telangana State, India.

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VISION

- To become a model institution in the fields of Engineering Technology and Management.
- To have a perfect synchronization of the ideologies of MRCET with challenging demands of International Pioneering Organizations

MISSION

- To establish a pedestal for the integral innovation, team spirit, originality and competence in the students, expose them to face the global challenges and become pioneers of Indian vision of modern society

QUALITY POLICY

- To implement best practices in Teaching and Learning process for both UG and PG courses meticulously.
- To provide state of art infrastructure and expertise to impart the quality education.
- To groom the students to become intellectually creative and professionally competitive.
- To channelize the activities and tune them in heights of commitment and sincerity, the requisites to claim the never ending ladder of SUCCESS year after year.

For more information: www.mrcet.ac.in

ACADEMIC REGULATIONS FOR B. TECH. (REGULAR)

Applicable for the students of B. Tech. (Regular) from the Academic Year 2015-16 and onwards

1. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

1.1 The candidate shall pursue a course of study for not less than four academic years and not more than eight academic years.

1.2 After eight academic years of course of study, the candidate is permitted to write the examinations for two more years.

1.3 The candidate shall register for **192 credits** and secure **192 credits** with compulsory subjects as listed in Table-1

Table 1: Compulsory Subjects

S.No	Subject Particulars
1	All practical Subjects
2	Mini Project
3	Technical Seminar
4	Project Work

1.4 In addition to 1.3, the candidate has to register for Mandatory courses (Non-credit course), 50% of scoring is required for the award of the degree.

2. The students, who fail to fulfill all the academic requirements for the award of the degree within ten academic years from the year of their admission, shall forfeit their seats in B. Tech. course.

3. Courses of study

The following courses of study are offered at present as specializations for the B. Tech. Course:

S.No	Department
01	Aeronautical Engineering
02	Computer Science Engineering
03	Electronics & Communication Engineering
04	Information Technology
05	Mechanical Engineering
06	Mining Engineering

4. Credits

Particulars	Semester	
	Periods per week	Credits
Theory	05	04
	04	03
Practical	03	02
Drawing	03	02
	06	04
Mini Project	--	04
Technical Seminar	06	02
Major Project	15	10

***Duration of each period is 50 minutes.**

5. Distribution and Weightage of Marks

5.1 The performance of a student in each semester shall be evaluated subject-wise for a maximum of 100 marks for a theory and 75 marks for a practical subject. In addition, Mini Project, Technical seminar and Major Project work shall be evaluated for 100, 50 and 300 marks, respectively.

5.2 For theory subjects the distribution shall be 25 marks for Internal Evaluation and 75 marks for the End-Examination.

5.3 For theory subjects, during a semester there shall be 2 mid-term examinations. Each mid- term examination consists of a descriptive paper and assignment. The descriptive paper shall be for 20 marks with a total duration of 2 hours. The descriptive paper shall contain 6 full questions out of which, the student has to answer 4 questions, each carrying 5 marks. While the first mid-term examination shall be conducted from 1 to 2 units of the syllabus, the second mid-term examination shall be conducted from 3 to 5 units**.** Five (5) marks are allocated for Assignments (as specified by the subject teacher concerned). The first Assignment should be submitted before the conduct of the first mid-examination, and the second Assignment should be submitted before the conduct of the second mid-examination. The total marks secured by the student in each mid-term examination are evaluated for 25 marks, and the average of the two mid-term examinations shall be taken as the final marks secured by each candidate.
However, if any student is absent/scoring internal marks less than 40% in any subject of a mid-term examination he/she will be given a chance to write the internal exam once again after he/she re-registering for the internal exam in the concerned subject and paying stipulated fees as per the norms.

The end examination will be conducted for 75 marks with Part A as a compulsory question for 25 marks. Part B is for maximum of 50 marks with 5 questions consisting of two parts each (a) and (b), out of which the student has to answer either (a) or (b), not both. Each question in Part B carries 10 marks.

5.4 For practical subjects there shall be a continuous evaluation during a semester for 25 sessional marks and 50 end semester examination marks. Out of the 25 marks for internal evaluation, day-to-day work in the laboratory shall be evaluated for 15 marks and internal practical examination shall be evaluated for 10 marks conducted by the laboratory teacher concerned. The end semester examination shall be conducted with an external examiner and the laboratory teacher. The external examiner shall be appointed from the clusters of colleges which are decided by the examination branch of the College.

5.5 For the subject having design and/or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and Estimation, the distribution shall be 25 marks for internal evaluation (15 marks for day-to-day work and 10 marks for internal tests) and 75 marks for end semester examination. There shall be two internal tests in a Semester and the average of the two shall be considered for the award of marks for internal tests.

5.6 There shall be a Mini Project to be taken up during the vacation after III year II Semester examination. However, the Mini-Project and its report shall be evaluated along with the Major Project work in IV year II Semester. The Mini Project shall be submitted in a report form and presented before the committee. It shall be evaluated for 100 marks. The committee consists of an External Examiner, Head of the Department, and the Supervisor of the Mini Project and a Senior Faculty member of the department. There shall be no internal marks for Mini Project.

5.7 There shall be a Technical Seminar presentation in IV year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his understanding of the topic, and submit it to the department. It shall be evaluated by the departmental committee consisting of head of the department, seminar supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for the seminar.

5.8 Out of a total of 300 marks for the Major Project work, 100 marks shall be allotted for Internal Evaluation and 200 marks for the End Semester Examination (Viva Voce). The End Semester Examination of the Major Project work shall be conducted by the same committee as appointed for the mini-project. In addition, the project supervisor shall also be included in the committee. The topics for mini project, seminar and project work shall be different from one another. The evaluation of project work shall be made at the end of the IV year. The Internal Evaluation shall be on the basis of two seminars given by each student on the topic of his project.

5.9 The Laboratory marks and the sessional marks awarded by the College are subject to scrutiny and scaling by the college wherever necessary. In such cases, the sessional and laboratory marks awarded by the College will be referred to Academic Council. The Academic Council will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the Academic Council are final and binding. The laboratory records and internal test papers shall be preserved in the College as per the Affiliation University rules and produced before the Committees/Academic Council as and when asked for.

6. Attendance Requirements

6.1 A student is eligible to write the University examinations only if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

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

6.3 Shortage of Attendance below 65% in aggregate shall not be condoned.

6.4 A student who is short of attendance in semester may seek re-admission into that semester when offered within 4 weeks from the date of the commencement of class work.

6.5 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class and their registration stands cancelled.

6.6 A stipulated fee as determined by the examination branch shall be payable towards condonation of shortage of attendance.

6.7 **A student will be promoted to the next semester if he satisfies the attendance requirement of the present semester, as applicable, including the days of attendance in sports, games, NCC and NSS activities.**

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

7. Course Registration:

7.1 Every student has to register for a set of Courses in each Semester, with the total number of their Credits being limited by considering the permissible weekly Contact Hours (typically: 30/Week); For this, an average Course Registration of minimum 20 Credits/Semester (e.g., 6-7 Courses) and a maximum of 28 credits are generally acceptable on recommendation of concerned academic advisor by satisfying the pre-requisite conditions.

7.2 Approval of the Course Registration will be informed by the concerned Head of the Department on the beginning of the semester by taking the number of students registered (minimum **one-third** students per class) and availability of the faculty into consideration.

7.3 Dropping of the Course Registration can be permitted up to two weeks from the commencement of the semester. Thereafter no droppings are permitted.

7.4 Interchanging of Course Registrations are not permitted.

7.5 The Pre-requisite conditions for the additional course(s) registration by the students are based on the slots available in the Time Table, Class rooms and Faculty availability.

8. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in item no.6.

8.1 A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/project and secures not less than 35% of marks in the end semester exam, and minimum 40% of marks in the sum total of the mid-term and end semester exams.
8.2 A student shall be promoted from I year to II year upon fulfilling the minimum required attendance.
8.3 A student will be eligible to be promoted from II year to III year, upon fulfilling the academic requirements of 50 % credits up to II year I semester examinations and secures prescribed minimum attendance in II year.
8.4 A student will be eligible to be promoted from III year to IV year, upon fulfilling the academic requirements of 50 % credits up to III year I semester examinations and secures prescribed minimum attendance in III year.
8.5 A student shall register and put up minimum attendance in all 192 credits and shall earn a minimum of 184 credits for the award of B.Tech degree. Further, marks obtained in the 184 credits shall be considered for the calculation of percentage of marks as well as overall CGPA.
8.6 Students who fail to earn 184 credits as indicated in the course structure within ten academic years (8 years of study + 2 years additionally for appearing for exams only) from the year of their admission, shall forfeit their seat in B.Tech course and their admission stands cancelled.

9. Course pattern

9.1 The entire course of study is for four academic years. I,II, III and IV years shall be on semester pattern.

9.2 A student, eligible to appear for the end examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject during the period of supplementary exams.

9.3 When a student is detained for lack of credits/shortage of attendance, he may be re-admitted into the next semester. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

10. Award of Class

In assessing the performance of the students in examinations, the usual approach is to award marks based on the examinations conducted at various stages (sessional, mid-term, end-semester etc.,) in a semester. As per UGC Autonomous guidelines, the following system is implemented in awarding the grades and CGPA under the **Choice Based Credit System (CBCS).**

Letter Grades and Grade Points:

The UGC recommends a 10-point grading system with the following letter grades as given below:

Grades	Points	Marks secured (%)
O (Outstanding)	10	≥ 90
A+(Excellent)	9	85 – 89
A(Very Good)	8	75 – 84
B+(Good)	7	70 – 74
B(Above Average)	6	60 – 69
C(Average)	5	50 – 59
P(Pass)	4	40 – 49
F(Fail)	0	<40
Ab(Absent)	0	-

A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

13.1 A student shall register and put up minimum attendance in all 192 credits and shall earn a minimum of 184 credits for the award of B.Tech degree. Further, marks obtained in the 184 credits shall be considered for the calculation of percentage of marks as well as overall CGPA ≥ 5.0, within 8 academic years from the date of commencement of the first academic year, shall be declared to have **'qualified'** for the award of the B.Tech. Degree in the chosen branch of Engineering as selected at the time of admission.

13.2 A student who qualifies for the award of the degree as listed in 13.1 shall be placed in the following classes.

13.3 Students with final CGPA (at the end of the under graduate programme) ≥ 7.50, and shall be placed in **'first class with distinction'**.

13.4 Students with final CGPA (at the end of the under graduate programme) ≥ 6.50 but < 7.50, shall be placed in **'first class'**.

13.5 Students with final CGPA (at the end of the under graduate programme) ≥ 5.50 but < 6.50, shall be placed in **'Second class'.**

13.6 All other students who qualify for the award of the degree (as per item 13.1), with final CGPA (at the end of the under graduate programme) ≥ 5.00 but < 5.50, shall be placed in **'pass class'.**

13.7 A student with final CGPA (at the end of the under graduate programme) < 5.00 will not be eligible for the award of the degree.

13.8 Students fulfilling the conditions listed under item 13.3 alone will be eligible for award of **'university rank'** and **'gold medal'.**

Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The 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 (Si) = Σ(Ci x Gi) / ΣCi

where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

CGPA = Σ(Ci x Si) / Σ Ci

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

11 Minimum Instruction Days

The minimum instruction days for each semester shall be 90days.

12 There shall be no branch transfers after the completion of the admission process.

13 WITHHOLDING OF RESULTS

If the student has not paid the dues, if any, to the university or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His degree will be withheld in such cases.

14. TRANSITORY REGULATIONS

14.1 Discontinued, detained, or failed candidates are eligible for readmission as and when next offered.

14.2 After the revision of the regulations, the students of the previous batches will be given two chances for passing in their failed subjects, one supplementary and the other regular. If the students cannot clear the subjects in the given two chances, they shall be given equivalent subjects as per the revised regulations which they have to pass in order to obtain the required number of credits.

14.3 In case of transferred students from other Universities, the credits shall be transferred to JNTUH as per the academic regulations and course structure of the MRCET.

15. General

15.1 Wherever the words he , him , his , occur in the regulations, they include she , her , hers .

15.2 The academic regulation should be read as a whole for the purpose of any interpretation.

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

15.4 The regulations hereunder are subject to amendments as may be made by the Academic Council of the College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already pursuing the program) as may be decided by the Academic Council.

15.5 The students seeking transfer to colleges affiliated to JNTUH from various other Universities/Institutions, have to pass the failed subjects which are equivalent to the subjects of prescribed curriculum of the institute, and also pass the subjects of prescribed curriculum of the institute which the candidates have not studied at the earlier Institution on their own without the right to sessional marks. Further, though the students have passed some of the subjects at the earlier institutions, if the same subjects are prescribed in different semesters of prescribed curriculum of the institute, the candidates have to study those subjects in prescribed curriculum of the institute in spite of the fact that those subjects are repeated.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
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 and sent to the University.
3.	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 practicals 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 imposter is an outsider, he will be handed over to the police and a case is registered against him.
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 performance in that subject and all the 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.	Using 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.
6.	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-incharge, 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 of 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 means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	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.
7.	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 performance in that subject and all the 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.
8.	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 the seat.
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.	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 for the remaining examinations of the subjects of that semester/year.
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 University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)

(i) A show cause notice shall be issued to the college.

(ii) Impose a suitable fine on the college.

(iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

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Department of Mechanical Engineering

VISION:

To develop the department as a center for excellence with state of the art Research facilities in the field of mechanical engineering; To arise enthusiasm and intellect among the students continually in rapidly developing disciplines and enable them to involve in the research and development activities.

MISSION:

The Department of Mechanical Engineering is dedicated for transforming the students into highly competent Mechanical engineers to meet the needs of the industry, in a changing and challenging technical environment, by Providing sound knowledge in the fundamentals of engineering sciences with high level of motivation, professional skills and self-confidence for achieving excellent results in their professional pursuits.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: PREPARATION To provide sound foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems.
PEO2: CORE COMPETANCE To provide thorough knowledge in Mechanical Engineering subjects including theoretical knowledge and practical training for preparing physical models pertaining to Thermodynamics, Hydraulics, Heat and Mass Transfer, Dynamics of Machinery, Jet Propulsion, Automobile Engineering, Finite Element Analysis, Production Technology, Mechatronics etc.
PEO3: INVENTION, INNOVATION AND CREATIVITY To make the students to design, experiment, analyze, interpret in the core field with the help of other inter disciplinary concepts wherever applicable.
PEO4: CAREER DEVELOPMENT To inculcate the habit of lifelong learning for career development through successful completion of advanced degrees, professional development courses, industrial training etc.
PEO5: PROFESSIONALISM To impart technical knowledge, ethical values for professional development of the student to solve complex problems and to work in multi disciplinary ambience, whose solutions lead to significant societal benefits.

Program Specific Outcomes(PSOs)

1. **Manufacturing Engineering :** An ability to apply the principles of manufacturing engineering and technology to develop techno commercial skills.

2. **Thermal Engineering :** An ability to apply fundamentals to design and analyze the thermo-hydraulic systems.

3. **Design Engineering :** An ability to design and analyze mechanical components and processes to predict the behavior of engineering systems.

4. **CAD/CAM :** Develop and implement new ideas on product design and development with the help of modern CAD/CAM tools, while ensuring best manufacturing practices.

5. **Management Practices :** To work professionally in industries or as an entrepreneur by applying manufacturing and management practices.

PROGRAM OUTCOMES (POs)

- An ability to identify, formulate and solve engineering problems.
- An ability to design and conduct experiments to interpret data and analyze the results.
- An ability to design system components or processes to satisfy the needs of the society within realistic constraints such as economical, social, political, ethical, health, safety and manufacturing.
- An ability to function with multi-disciplinary teams.
- An ability to understand professional and ethical responsibilities.
- An ability to use techniques, skills and modern engineering tools necessary for engineering practice.
- Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- An ability to communicate effectively and professionally through oral, written and graphical media.
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

COURSE STRUCTURE

I Year B. Tech (MECH) – I Semester

S.NO	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX.MARKS	
						Int	Ext
1	R15A0001	ENGLISH	3		2	25	75
2	R15A0021	MATHEMATICS-I	5	1	4	25	75
3	R15A0011	ENGINEERING PHYSICS-I	3		2	25	75
4	R15A0014	ENVIRONMENTAL STUDIES	4		3	25	75
5	R15A0501	COMPUTER PROGRAMMING WITH C	4		3	25	75
6	R15A0301	ENGINEERING MECHANICS	5	1	4	25	75
7	R15A0581	COMPUTER PROGRAMMING LAB	-	3	2	25	50
8	R15A0084	IT WORKSHOP/ENGINEERING WORKSHOP	-	3	2	25	50
9	R15A0081	ENGLISH LANGUAGE COMMUNICATION SKILLS LAB-I	-	3	2	25	50
*10	R15A0003	*HUMAN VALUES AND SOCIETAL PERSPECTIVES	2	-	-	50	-
		TOTAL	**26**	**11**	**24**	**275**	**600**

***Mandatory course: Non-credit subject, 50% of scoring is required for the award of the degree**

I Year B. Tech (MECH) – II Semester

S.NO	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX.MARKS	
						Int	Ext
1	R15A0002	PROFESSIONAL ENGLISH	3		2	25	75
2	R15A0022	MATHEMATICS-II	5	1	4	25	75
3	R15A0012	ENGINEERING PHYSICS-II	3		2	25	75
4	R15A0013	ENGINEERING CHEMISTRY	4		3	25	75
5	R15A0502	OBJECT ORIENTED PROGRAMMING	4	1	3	25	75
6	R15A0302	ENGINEERING DRAWING	2	-3-	4	25	75
7	R15A0582	OBJECT ORIENTED PROGRAMMING LAB	-	3	2	25	50
8	R15A0083	ENGINEERING PHYSICS/ENGINEERING CHEMISTRY LAB	-	3	3	25	50
9	R15A0082	ENGLISH LANGUAGE COMMUNICATION SKILLS LAB-II	-	3	2	25	50
		TOTAL	**21**	**14**	**24**	**225**	**600**

II Year B. Tech (ME) – I Semester (5 Core Subjects + 1 Open Elective + 2 Labs)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						Int	Ext
1	R15A0303	Engineering Thermodynamics	5	1	4	25	75
2	R15A0304	Material Science	4	-	3	25	75
3	R15A0206	Electrical and Electronics Engineering	4	-	3	25	75
4	R15A0305	Strength of Materials	5	-	4	25	75
5	R15A0306	Kinematics of Machinery	4	1	3	25	75
6		**Open Elective- I**	4	1	3	25	75
	R15A0024	Probability and Statistics					
	R15A0507	Java Programming					
	R15A0067	Technology Management					
7	R15A0282	Electrical and Electronics Engineering Lab	-	3	2	25	50
8	R15A0381	Material Science and Strength of Materials Lab	-	3	2	25	50
*9	R15A0004 R15A0005	Foreign Language : French **(or)** Foreign Language : German	2	-	-	50	-
Total			**28**	**09**	**24**	**250**	**550**

***Mandatory course: Non-credit course, 50% of scoring is required for the award of the degree**

II Year B. Tech (ME) – II Semester (5 Core Subjects + 1 Open Elective + 2 Labs)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						Int	Ext
1	R15A0307	Dynamics of Machinery	4	1	3	25	75
2	R15A0308	Thermal Engineering	4	-	3	25	75
3	R15A0309	Fluid Mechanics and Hydraulic Machinery	4	1	3	25	75
4	R15A0310	Machine Drawing	3	3	3	25	75
5	R15A0311	Manufacturing Science	4	-	3	25	75
6		**Open Elective- II**	4	-	3	25	75
	R15A0312	Industrial Engineering					
	R15A0069	Intellectual Property Rights					
	R15A0064	Enterprise Resource Planning					
7	R15A0382	Manufacturing Science Lab	-	3	2	25	50
8	R15A0383	Fluid Mechanics and Hydraulic Machinery Lab	-	3	2	25	50
9*	R15A0006	Gender Sensitization	-	3	2	75	-
Total			23	14	24	275	550

***Mandatory course: Non-credit course, 50% of scoring is required for the award of the degree**

III Year B. Tech (ME) – I Semester (4 Core Subjects+1 Core Elective+1 Open Elective+2 Labs)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						Int	Ext
1	R15A0313	Advanced Thermal Engineering	5	1	4	25	75
2	R15A0314	Machine Design - I	5	1	4	25	75
3	R15A0315	Machine Tools	4	-	3	25	75
4	R15A0316	Metrology and Surface Engineering	4	-	3	25	75
		Core Elective -I		-			
5	R15A0317	Alternative fuels for IC Engines	4	-	3	25	75
	R15A0318	Vehicular Pollution and Control					
	R15A0319	Combustion Technology					
6		**Open Elective -III**	4	-	3	25	75
	R15A0061	Managerial Economics and Financial Analysis					
	R15A0520	Web Technologies					
	R15A0320	Solid waste Management					
7	R15A0386	Machine Tools and Metrology Lab	-	3	2	25	50
8	R15A0387	Thermal Engineering Lab	-	3	2	25	50
Total			**26**	**8**	**24**	**200**	**550**

III Year B. Tech (ME) – II Semester (4 Core Subjects+1 Core Elective+1 Open Elective+2 Labs)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX MARKS	
						Int	Ext
1	R15A0321	Machine Design -II	5	1	4	25	75
2	R15A0322	Finite Element Method	4	1	3	25	75
3	R15A0323	Heat Transfer	5	1	4	25	75
4	R15A0324	Refrigeration and Air Conditioning	4		3	25	75
5		**Core Elective - II**	4	-	3	25	75
	R15A0325	Compressible Fluid Flow					
	R15A0326	Computational Fluid Dynamics					
	R15A0327	Composite Materials					
6		**Open Elective- IV**	4	-	3	25	75
	R15A0568	App Design and Development					
	R15A0328	Production and Operations Management					
	R15A0329	Nano Materials					
7	R15A0388	Heat Transfer Lab	-	3	2	25	50
8	R15A0389	CAD Lab	-	3	2	25	50
9*	R15A0007	Technical Communication and Soft Skills	2	-	-	50	-
Total			**28**	**9**	**24**	**250**	**550**

***Mandatory course: Non-credit course, 50% of scoring is required for the award of the degree**

IV Year B. Tech (ME) – I Semester (4 Core Subjects+2 Core Electives+2 Labs)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX. MARKS	
						Int	Ext
1	R15A0330	Operations Research	5	1	4	25	75
2	R15A0331	CAD/CAM	5	1	4	25	75
3	R15A0332	Mechanical Measurements and Control Systems	4	-	3	25	75
4	R15A0333	Automobile Engineering	4		3	25	75
5		**Core Elective -III**	4	-	3	25	75
	R15A0334	Power Plant Engineering					
	R15A0335	Jet Propulsion and Rocket Engineering					
	R15A0336	CNC Technology					
6		**Core Elective- IV**	4	-	3	25	75
	R15A0337	Modern Machining Processes					
	R15A0338	Robotics					
	R15A0339	Mechanical Vibrations					
7	R15A0390	Computer Aided Design and Computer Aided Manufacturing Lab	-	3	2	25	50
8	R15A0391	Mechanical Measurements and Control Systems Lab / Production Drawing Practice Lab	-	3	2	25	50
Total			**26**	**8**	**24**	**200**	**550**

IV Year B. Tech (ME) – II Semester (2 Core Electives + Project)

S.NO.	SUBJECT CODE	SUBJECT	L	T/P/D	C	MAX. MARKS	
						Int	Ext
1		**Core Elective- V**	5	1	4	25	75
	R15A0340	Production Planning and Control					
	R15A0341	Maintenance and Safety Engineering					
	R15A0342	Material Handling Systems					
2		**Core Elective -VI**	5	1	4	25	75
	R15A0343	Manufacturing Management					
	R15A0344	Automation in Manufacturing					
	R15A0345	Tribology					
3	R15A0392	Mini Project	-	-	4	-	10
4	R15A0393	Technical Seminar	-	6	2	50	-
5	R15A0394	Major Project	-	15	10	100	20
Total			**10**	**23**	**24**	**200**	**450**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ME-I Sem

L	T/P/D	C
5	1	4

(R15A0313) ADVANCED THERMAL ENGINEERING

Objectives:

- Applications and the principles of thermodynamics to components and systems.
- The purpose of this course is to enable the student to gain an understanding of how thermodynamic principles govern the behavior of various systems
- Student have knowledge of methods of analysis and design of complicated thermodynamic systems

UNIT-I

Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance - Regeneration & reheating.

UNIT-II

Boilers: Classification - Working principles with sketches including H.P. Boilers - Mountings and Accessories - Working principle.

Steam Nozzles: Function of nozzle - Applications and Types- Flow through nozzles- Thermodynamic analysis.

UNIT-III

Steam Turbines: Classification - Impulse turbine; Mechanical details - Velocity diagram - Effect of friction - Power developed, Axial thrust, Blade or diagram efficiency - Condition for maximum efficiency.

Reaction Turbine: Mechanical details - Principle of operation, Thermodynamic analysis of a stage, Degree of reaction - Velocity diagram - Parson's reaction turbine - Condition for maximum efficiency. Steam Condensers: Requirements of steam condensing plant - Classification of condensers - Working principle of different types.

UNIT-IV

Gas Turbines: Simple gas turbine plant - Ideal cycle, essential components - Parameters of performance - Actual cycle - Regeneration, Inter cooling and Reheating - Closed and Semi - closed cycles - Merits and Demerits - Brief Concepts about compressors- Combustion chambers and turbines of Gas Turbine plant.

UNIT-V

Jet Propulsion: Principle of Operation - Classification of jet propulsive engines - Working Principles with schematic diagrams and representation on T-S diagram- Thrust, Thrust Power and Propulsion Efficiency - Turbo jet engines - Needs and Demands met by Turbo jet - Schematic Diagram, Thermodynamic Cycle, Performance Evaluation Thrust Augmentation - Methods.

Rockets: Application - Working Principle - Classification - Propellant Type - Thrust, Propulsive Efficiency - Specific Impulse - Solid and Liquid propellant Rocket Engines.

TEXT BOOKS:

1. Thermal Engineering / Rajput / Lakshmi Publications.
2. Gas Turbines / V. Ganesan / TMH.
3. Thermal Engineering /P.L. Ballaney / Khanna Publishers, NewDelhi.

REFERENCE BOOKS:

1. Gas Turbines and Propulsive Systems / P. Khajuria & S.P. Dubey / Dhanapatrai Pub.
2. Thermal Engineering / R.S. Khurmi & J.K. Gupta / S. Chand Pub.
3. Thermodynamics and Heat Engines / R. Yadav / Central Book Depot

OUTCOMES:

- To be able to recognize main and supplementary elements of SI and CI engines and define operational principles.
- To be able to describe the most important combustion concepts and problems in concern with SI engines and CI engines.To be able to analyze energy distribution in an internal combustion engine. Develop problem solving skills through the application of thermodynamics.
- Solve problems associated with rotodynamic compressors. Solve problems associated with reciprocating compressors and expanders and internal combustion engines. To understand the velocity triangles in compressors.

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III Year B. Tech, ME-I Sem

L	T/P/D	C
5	1	4

(R15A0314) MACHINE DESIGN-I

Note: Data Books Permitted (I) Machine Design Data Book by P.S.G. College of Technology
(ii Machine Design Data Book by P. Mahadevan
(iii) Machine Design Data Book by V.B.Bandari
(iv) Machine Design Data Book by SMD. Jalaluddin .

Objectives:

- To study basic principles of machine design.
- To acquaint with the concepts of strength design related to various components.
- To make conversant with preparation of working drawings based on designs.

UNIT-I

Introduction: General considerations in the design of Engineering Materials and their properties-selection -Manufacturing consideration in design. BIS codes of steels.

Stresses in machine members: Simple stresses - Combined stresses - Torsional and Bending stresses - impact stresses - stress strain relation - Various theories of failure - factor of safety – Design for strength and rigidity - preferred numbers. Stress concentration - Theoretical stress Concentration Factor - Fatigue stress concentration factor notch sensitivity - Design for fluctuating stresses –Endurance Limit - Estimation of Endurance strength - Goodman's line - Soderberg's line - Modified Goodman's line.

UNIT-II

Design of Fasteners: Riveted and welded joints - Design of joints with initial stresses – strength equations- efficiency of riveted joints-eccentrically loaded riveted joimnts.

Welded joints: Design of fillet welds – axial loads – circular fillet welds- bending and torsion.

Bolted joints - Design of bolts with pre-stresses - Design of joints under eccentric loading – locking devices- both of uniform strength, different seals

UNIT-III

Shafts: Design of solid and hollow shafts for strength and rigidity - Design of shafts for combined bending and axial loads - Shaft sizes - BIS code. Use of internal and external circlips, Gaskets and seals (Stationary & rotary).

Shaft coupling: Rigid couplings - Muff, Split muff and Flange couplings. Flexible couplings - Flange coupling (Modified), PIN-Bush coupling.

UNIT–IV

keys, cotters and knuckle joints: Design of Keys-stresses in keys-cottered joints-spigot and socket, sleeve and cotter, jib and cotter joints-Knuckle joints.

UNIT–V

Mechanical Springs: Stresses and deflections of helical springs - Extension -compression springs - Springs for fatigue loading- natural frequency of helical springs - Energy storage capacity - helical torsion springs - Co-axial springs, leaf springs.

TEXT BOOKS:

1. Machine Design, V.Bandari Tmh Publishers
2. Machine Design, S MD Jalaludin, AnuRadha Publishers
3. Machine Design By Pandya & Shah.

REFERENCE BOOKS:

1. Design of Machine Elements / V.M. Faires
2. Machine Design by Sigheley TMH
3. Machine Design By Khurmi & Guptha s.Chand Publications

OUTCOMES:

- Student will be able to Demonstrate understanding of various design considerations
- Apply basic principles of machine design, Design machine elements on the basis of strength concept**.**
- Acquire skill in preparing production drawings pertaining to various designs.

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III Year B. Tech, ME-I Sem

L	T/P/D	C
4	0	3

(R15A0315) MACHINE TOOLS

Objectives:

- To introduce students to the basic concepts of manufacturing via shaping, forming, machining and assembly.
- To develop a knowledge of appropriate parameters to be used for various machining operations.
- To introduce students to the scientific principles underlying material behaviour during manufacturing processes so as to enable them to undertake calculations of forces, tool stresses and material removal rates.

UNIT–I

Elementary treatement of metal cutting theory : Element of cutting process – Geometry of single point tool and angles , chip formation and types of chips – built up edge and its effects chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, coolants, machinability – Tool materials. Kinematic schemes of machine tools – Constructional features of speed gear box and feed gear box.

UNIT–II

Engine lathe : Principle of working, specification of lathe – types of lathe – work holders, tool holders – Box tools ,Taper turning, thread cutting – for Lathes and attachments.

Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes – tool layout and cam design.

UNIT–III

Shaping slotting and planing machines: Principles of working – Principal parts – specification classification, operations performed. Kinematic scheme of the shaping, slotting and planning machines, machining time calculations.

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine. Deep hole drilling machine. Kinematics scheme of the drilling and boring machines

UNIT–IV

Milling machine: Principles of working – specifications – classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – machining operations Types geometry of milling cutters – milling cutters – methods of indexing – Accessories to milling machines, kinematic scheme of milling cutters – milling cutters – methods of indexing.

Grinding machine – Fundamentals – Theory of grinding – classification of grinding machine – cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Different types of abrasives – bonds, specification of a grinding wheel and selection of a grinding wheel ,Kinematic scheme of grinding machines.

UNIT-V

Lapping, honing and broaching machines: comparison to grinding – lapping and honing. Kinematics scheme of Lapping, Honing and Broaching machines. Constructional features of speed and feed Units, machining time calculations Principles of design of Jigs and fixtures and uses. Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices. Typical examples of jigs and fixtures.

TEXT BOOKS:

1. R.K. Jain and S.C. Gupta.-Production Technology , Khanna Publications 2004.
2. B.S.Raghu Vamshi -Workshop Technology –– Vol II, Dhanpatrai 2007
3. P.C .Sharma - Production Technology, S.Chand 2006.

REFERENCE BOOKS:

1. C.Elanchezhian and M. Vijayan - Machine Tools, Anuradha Publications 2014.
2. Production Technology by H.M.T. (Hindustan Machine Tools).hand book, TMH,2001
3. P.N.Rao- Manufacturing Technology , Volume II, McGraw Hill 2013.

OUTCOMES:

- To analyze various machining processes and calculate relevant quantities such as velocities, forces and powers.
- Identify and explain the function of the basic components of a machine tool.
- Understand the procedures and techniques involved for the manufacturing of components, and keep up to date with innovation through literature search.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ME-I Sem

L	T/P/D	C
4	0	3

(R15A0316) METROLOGY AND SURFACE ENGINEERING

Objectives:

- The objective of this subject is to provide basic concepts of measuring devices in the manufacturing process.
- Student able to learn Linear Measurements.
- Student able to learn Optical Measuring Instruments.

UNIT-I

Systems of Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system – British standard system, International Standard system for plain ad screwed work.

UNIT–II

Linear Measurement: Length standard, line and end standard, slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

Measurement of Angles and Tapers : Different methods – Bevel protractor – angle slip gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

Limit Gauges : Taylors principle – Design of go and No go gauges, plug ring, snap, gap, taper, profile and position gauges.

UNIT–III

Optical Measuring Instruments : Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer.

Flat Surface Measurement : Measurement of flat surfaces – instruments used – straight edges – surface plates – optical flat and auto collimator.

UNIT–IV

Surface Roughness Measurement : Differences between surface roughness and surface waviness-Numerical assessment of surface finish – CLA,R, R.M.S Values – Rz values, Rz value, Methods of measurement of surface finish-profilograph. Talysurf, ISI symbols for indication of surface finish.

UNIT-V

Measurement through Comparators: Comparators – Mechanical, Electrical and Electronic Comparators, pneumatic comparators and their uses in mass production.

Screw Thread Measurement: Element of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch, profile thread gauges.

Coordinate Measuring Machines: Types of CMM, Role of CMM, and Applications of CMM.

TEXT BOOKS:

1. Engineering Metrology / I C Gupta./ Danpath Rai
2. Engineering Metrology / R.K. Jain / Khanna Publishers
3. Handbook of Tribology: Materials, Coating, and Surface Treatments/ Bharat Bhushan and B.K.Gupta.

REFERENCE BOOKS:

1. BIS standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
2. Fundamentals of Dimensional Metrology 4e / Connie Dotson / Thomson
3. Surface Engineering for corrosion and wear resistance / JR Davis/ Woodhead Publishers.

OUTCOMES:

- The students shall be able to know how to make use of measuring devices effectively.
- Student gets the exposure Machine Tool Alignment Tests.
- Student gets the exposure Measurement through Comparators.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ME- I Sem

L	T/P/D	C
4	0	3

(R15A0317) ALTERNATIVE FUELS FOR IC ENGINES (CORE ELECTIVE-I)

Objectives:

- The course provides detailed understanding of internal combustion engines and the factors responsible for the design/ performance.
- Student able to learn about different types of Solid and Liquid fuels.
- Student able to learn about different characteristics and additives of IC engines.

UNIT-I

Introduction : Availability and Suitability and properties of Potential Alternative Fuels – Ethanol, Methanol, DEE, DME, Hydrogen, LPG, Natural Gas, Producer Gas, Bio gas and Bio-diesel, Properties, Merits and Demerits.

UNIT-II

Liquid Fuels for S.I. Engines : Requirements of fuels for SI engines-Different Techniques of utilizing alternative liquid fuels– Blends, Neat form, Reformed Fuels - Manufacturing, Storage and Safety-Performance and Emission Characteristics of alternative liquid fuels.

UNIT-III

Liquid Fuels in C.I. Engines: Requirements of fuels for CI engines- Different Techniques for their utilization-Blends, Fuel modifications to suit CI engines, Neat fuels, Reformed fuels, Emulsions, Dual fuelling, Ignition accelerators and other additives– Performance and emission characteristics.

UNIT-IV

Gaseous Fuels in S.I. Engines: Use of Hydrogen, CNG, LPG, Natural Gas, Producer gas and Bio gas in SI engines– Safety Precautions – Engine performance and emissions.

UNIT-V

Gaseous Fuels in C.I. Engines : Use of Hydrogen, Producer Gas, Biogas, LPG, Naturalgas, CNG in CI engines. Dual fuelling, Performance and emission characteristics.

TEXT BOOKS:

1.Osamu Hi rao and Richard K.Pefley, Present and Future Automotive Fuels, John Wiley and Sons, 1988.

2.Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications, 1990.

3.IC Engines By DomaKundawar

REFERENCE BOOKS:

1.Automotive Lubricants Reference Book, Second Edition, Roger F. Haycock and John E. Hillier, SAE InternationalPublications, 2004.

2. IC Engines by V. Ganeshan

3. Richard L.Bechtold, Automotive Fuels Guide Book, SAE Publications, 1997.

OUTCOMES:

- Fundamental understanding of internal combustion engines and its operation, engine design and performance, operating parameters, combustion cycles.
- Comparison between spark ignition and compression ignition engines, thermodynamic analysis of spark ignition engines, different types of diesel combustion systems, and engine tribology,
- Lubrication systems and lubricant requirements, tail pipe emissions, after-treatment devices and awareness of new/upcoming engine technologies

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III Year B. Tech, ME-I Sem

L	T/P/D	C
4	0	3

(R15A0318) VEHICULAR POLLUTION AND CONTROL
(CORE ELECTIVE – I)

Objectives:

- To provide an introduction to vehicular Pollution.
- To develop an understanding of the causes, chemistry and effects of pollution.
- To build awareness of the strategies used to control and manage vehicular. Pollution to make aware of vehicular emission control Laws& Acts .

UNIT-I

Introduction: Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming, types of emission, transient operational effects on pollution.

UNIT-II

Pollutant Formation in SI Engines: Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NOx formation in SI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

UNIT-III

Pollutant Formation in CI Engines: Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions. Nox formation and control - Noise pollution from automobiles, measurement and standards.

UNIT-IV

Control of Emissions from SI and CI Engines: Design of engine, optimum selection of operating variables for control of emissions, EGR, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, Two stroke engine pollution control.

UNIT-V

Measurement Techniques Emission Standards and Test Procedure: Orsat Apparatus, NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, driving cycles - USA, Japan, Euro and India. Test procedures - ECE, FTP Tests. SHED Test - chassis dynamometers, dilution tunnels.

TEXT BOOKS:

1. Paul Degobert, Automobiles and Pollution, SAE International ISBN-1-56091-563-. 3,1991.
2. Ganesan, V- Internal Combustion Engines- Tata McGraw-Hill Co - 2003.
3. SAE Transactions-Vehicle Emission - 1982 (3 volumes).

REFERENCE BOOKS:

1. Obert.E.F.- Internal Combustion Engines, 1988.
2. Marco Nute- Emissions from two stroke engines, SAE Publication-1998.
3. Vehical Pollution by Anil Gupta & R K Sharma

OUTCOMES:

- Understand contemporary pollution issues. Have insight into specific examples of vehicular pollution.
- Understand the causes and effects of key types of vehicular pollution.
- Appreciate different pollution control strategies. Awareness of vehicular emission control Laws &Acts.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

III Year B. Tech, ME-I Sem

L	T/P/D	C
4	0	3

(R15A0319) COMBUSTION TECHNOLOGY
(CORE ELECTIVE – I)

Objectives:

- The course is intended to provide students with knowledge of fuel quantity and engine technology effects on emissions.
- Understand the combustion phenomena.
- Understand the concept of laminar and turbulent flame propagation and different methods to reduce air pollution.

UNIT-I

Solid Fuel: Classification of fuel, Origin, Composition, Characteristics and analysis of coal washing & storage of coal, Physical & chemical processing of coal, Various classification systems of coal briquetting, Carbonization, Gasification of coal. Liquid Fuel: Origin, Composition and classification, Properties, Chemical processing – Cracking, Reforming, Polymerization, Alkylation and Isomerization. Gaseous Fuel: Classification of gaseous fuel, Natural gas, LPG, Refinery gas, Producer gas, Water gas.

UNIT-II

Fuel Combustion Calculation: Fundamentals of various combustion calculations with numerical examples.

UNIT-III

Combustion Process: General Principles of combustion, Flame, Draught, Limits of Inflammability, Types of combustion Process- Surface, Submerged, Pulsating, Slow combustion.

UNIT-IV

Energy Conservation: Energy consumption pattern in various sectors, various ways of energy conservation in various process industries including petroleum.

UNIT-V

Non – Conventional Energy Technologies: General principles with applications and technology of Biomass Energy, Solar Energy, Geothermal Energy, Wind Energy, Nuclear Energy, Hydal, Tidal and Ocean Energy.

TEXT BOOKS:

1. Fuel combustion Energy Technology by S.N. Saha , Dhanpat Rai Publication Co. Pvt. Ltd. New Delhi
2. Combustion Engineering by A. K. Sarkar, New Age International
3. Lean Combustion: Technology and Control 1st Edition by Derek Dunn-Rankin

REFERENCE BOOKS:

1. Green Energy Technology by Maria Carvalho
2. Fundamentals of Combustion Processes (Mechanical Engineering Series) by Karen Iverson
3. Fundamentals of Combustion ProcessesAuthors: McAllister, Sara, Chen, Jyh-Yuan, Fernandez-Pello, A. craloeo

OUTCOMES:

- Upon completion of the subject, students will be able to have the knowledge of fuel thermo-chemistry and fuel quality effects on emissions, engine technologies, engine combustion-related emissions and control technologies.
- Extend their knowledge of fuels and engines to different situations of engineering context and professional practice.
- Demonstrate how to design burners and assess their performance **.**

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III Year B. Tech, ME-I Sem

L	T/P/D	C
4	0	3

(R15A0061) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (OPEN ELECTIVE-III)

Objectives:

- To enable the student to understand and appreciate, with a practical insight, the importance of certain basic issues governing the business operations that are needed for sound economic decision making.
- The main purpose is to provide inputs on an overall analysis of an individual firm namely demand and supply, production function, cost analysis, markets etc.
- To understand and analyse the financial formats of the organisation for smooth running of the business.

UNIT-I

Introduction to Managerial Economics: Definition, Nature and scope of Managerial economics, Micro and Macroeconomic concepts.

Demand Analysis: Demand Determinants, Law of Demand and exceptions. Elasticity Of Demand: Definition, Types, Measurement and Significance of elasticity of Demand. Demand Forecasting, Factors governing demand Forecasting, methods of demand Forecasting.

UNIT-II

Production & Cost Analysis: Production Function- Isocost and Isoquants MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.

Cost Analysis: Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

UNIT-III

Markets & New Economic Environment: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Objectives and Policies of Pricing- Methods of Pricing.

Business: Features of different forms of Business Organisation, Changing Business Environment in Post-liberalization scenario.

UNIT-IV

Introduction to Capital and Financial Accounting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance – Trading forecast, Capital Budget, Cash Budget. Accounting Definition, Concepts and Conventions (GAAP), Formats for preparation of Trial Balance and Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet).

UNIT-V

Investment Decision: Features of capital budgeting proposals, Methods of Capital

Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems).

Financial Analysis: Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability ratios.

TEXTBOOKS:

1. A.R.Aryasri, Managerial Economics, Sultan Chand, 2009.
2. S.A. Siddiqui & A.S. Siddiqui, Managerial Economics and Financial Analysis, New Age International Publishers, Hyderabad 2013
3. M. Kasi Reddy & Sarawathi, Managerial Economics and Financial Analysis, PHI, New Delhi, 2010.

REFERENCE BOOKS:

1. S.N.Maheswari & S. K. Maheswari, Financial Accounting, Vikas, 2012.
2. D.N. Dwivedi, Managerial Economics, Vikas, 2012.
3. Justin Paul, Leena, Sebastian, Managerial Economics, Cengage, 2012

OUTCOMES:

- Students should be able to understand the basic economic principles, forecast demand and supply.
- Students should be able to estimate cost and understand market structure.
- Students should be able to know pricing practices and able to interpret the financial results of the organization.

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(R15A0521) WEB TECHNOLOGIES
(OPEN ELECTIVE-III)

Objectives:

- Giving the students the insights of the Internet programming and how to design and implement complete applications over the web.
- Design Methodologies with concentration on Object-Oriented concepts, Client-Side Programming, Server-Side Programming, Active Server Pages.
- Database Connectivity to web applications, Adding Dynamic content to web applications.

UNIT-I

Web Basics and Overview: Introduction to Internet, World wide web, Web Browsers, URL, MIME, HTTP, Web Programmers Tool box.

HTML Common tags: List, Tables, images, forms, Frames; Cascading Style sheets. Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script.

UNIT-II

Introduction to XML: Document type definition, XML Schemas, Document Object model, Presenting XML ,Introduction to XHTML, Using XML Processors: DOM and SAX.

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's.

UNIT-III

Web Servers and Servlets: Tomcat web server, Installing the Java Software Development Kit, Tomcat Server & Testing Tomcat, Introduction to Servlets: Lifecycle of a Servlet, JSDK, The Servlet API, The javax. Servlet Package, Reading Servlet 150 parameters, Reading Initialization parameters. The javax.servlet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues.

UNIT-IV

Database Access: Database Programming using JDBC, JDBC drivers, Studying Javax.sql.* package, Accessing a Database from a Servlet. Introduction to JSP: The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC Setting Up and JSP Environment.

UNIT-V

JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing : Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations, Accessing a Database from a JSP page, Deploying JAVA Beans in a JSP Page, Introduction to struts framework.

TEXT BOOKS:

1. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech (UNIT s 1, 2)
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson (UNITs 3,4,5)
3. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES By Marty Hall and Larry Brown Pearson

REFERENCE BOOKS:

1. Programming world wide web-Sebesta,Pearson Education ,2007.
2. Internet and World Wide Web – How to program by Dietel and Nieto PHI/Pearson Education Asia.
3. Jakarta Struts Cookbook, Bill Siggelkow, S P D O'Reilly for chap 8.

OUTCOMES:

- Analyze a web page and identify its elements and attributes. Create web pages using XHTML and Cascading Styles sheets.
- Installation and usage of Server software's.
- Database Connectivity to web applications. Build web applications using Served and JSP

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(R15A0320) SOLID WASTE MANAGEMENT
(OPEN ELECTIVE –III)

Objectives:

- To gain insight into the collection, transfer, and transport of municipal solid waste.
- To understand the design and operation of a municipal solid waste landfill.
- Student able to learn about the disposable wastes in the nature.

UNIT-I

Introduction: Types and sources of solid wastes, Municipal, solid waste, Industrial solid wastes and Hazardous wastes, Present scenarios of municipal and industrial waste management in India.

UNIT-II

Properties of Solid Wastes: Physical and chemical composition of municipal solid wastes, waste generation rates, factors effecting waste generation rates .

UNIT-III

Management of Solid Wastes in India : Prevalent SWM practices and deficiencies : Storage of waste at source, segregation of wastes, Primary collection of waste, transportation of waste, disposal of wastes, institutional deficiencies.

UNIT-IV

Engineered Systems of Solid Waste Management: Design specifications of primary waste collection tools, waste storage bins, transportation vehicles, route selection and provision of transfer stations.

Disposal of Wastes: Site selection, rapid EIA of proposed sites, disposal technologies such as **Composting :** Aerobic composting, Anaerobic composting, mechanical composting, vermin composting; advantages and limitations of composting technologies, Economics of composting.

Anaerobic digestion : Traditional digestors such as KVIC model, Deenbandhu model, emerging technologies for waste stabilisation. Incineration: Fuel Pellets, Refuse derived fuels, mechanical incinerators; advantages and limitations of incineration.

Sanitary landfilling : Method of preparing sanitary landfill site, land filling techniques, operation and maintenance of landfill sites including leachate collection and treatment, recovery of methane from landfill sites for power generation**.**

UNIT-V

Hazardous Waste Management : The Hazards, Definition & classification of Hazardous Waste Hazardous Waste Management, Treatment Technologies, Land disposal, Biomedical Waste & its Management.

TEXTBOOKS

1. Solid Waste Management Principles and Practice by Chandrappa**,** Ramesha, Brown**,** Jeff.
2. Solid Waste Management - An India Perspective by M.S. Bhatt & Asheref Illiyan**.**
3. Textbook of Solid Wastes Management by Iqbal H.Khan & Naved Ahsan**.**

REFERENCE BOOKS:

1. Solid Wastes Energy Principles & Management by Techno banoglus, Theisen & Elvasebm, McGrawHills.
2. Standard handbook of Hazardous Waste Treatment & Disposal, by Freeman H.M., McGraw Hills.
3. Solid waste Management by K.Sasikumar and Sanoop Gopi Krishna, PHI Publishers.

OUT COMES:

- Understand the design and operation of a resource recovery facility.
- Demonstrate the design and operation of a waste-to-energy facility.
- Student able to understand about the different wastages.

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(R15A0386) MACHINE TOOLS AND METROLOGY LAB

Objectives:

- To understand the working principles of various machines viz lathe , Drilling, milling, shaping.
- Student able to learn about Mechanical parameter measuring systems.
- Student able to learn about different alignment techniques.

PART A : MACHINE TOOLS

1. Introduction of general purpose machines -Lathe, Drilling machine, Milling machine, Shaper, Planning machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on -lathe machine.
4. Drilling and Tapping
5. Shaping and Planning
6. Slotting
7. Milling
8. Cylindrical Surface Grinding
9. Grinding of Tool angles.

PART B : METROLOGY

1. Measurement of lengths, heights, diameters by Vernier calipers micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, Vernier calipers and checking the Chordal Addendum and Chordal
. Height of spur gear.
4. Machine tool “Alignment of test on the lathe.
5. Machine tool alignment test on milling machine.
6. Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by Two wire/ Three wire method or Tool makers microscope.

Note: Total 10 experiments are to be conducted.

OUT COMES:

Students get exposure to

- Various job Operation on machine tools.
- Exposure to various measuring systems.
- To know about various grinding and shaping machines .

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III Year B. Tech ME - I Sem

L	P	C
0	3	2

(R15A0387) THERMAL ENGINEERING LAB

Objectives:

- Student able to learn about the valve timing and port timing diagrams.
- Student able to learn about the working principles of Two Stroke and Four Stroke engines and their performances.
- Student able to learn about different characteristics IC Engine.

LIST OF EXPERIMENTS

1. I.C. Engine Valve / Port Timing Diagrams
2. I.C. Engine Performance Test for 4 Stroke SI engines
3. I.C. Engine Performance Test for 2 Stroke SI engines
4. I.C. Engine Morse/ Retardation/ Motoring Tests
5. I.C. Engine Heat Balance - CI/SI Engines
6. I.C. Engine Economical speed Test on a SI engine
7. I.C. Engine Effect of A/F Ratio in a SI engine
8. Performance Test on Variable Compression Ratio of IC Engine
9. IC Engine Performance Test on a 4S CI Engine at constant speed
10. Volumetric efficiency of Air - Compressor Unit
11. Dis-assembly / Assembly of Engines
12. Study of Boilers

Note: Total 10 experiments are to be conducted.

OUTCOMES:

- Students get exposure to different types of engine power and efficiency calculations
- Students get exposure to study of various operating characteristics of two stroke and four stroke I.C Engines.
- Students get exposure of boilers, mountings and accessories.

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(R15A0321) MACHINE DESIGN–II

Note: Data Books Permitted (I) Machine Design Data Book by P.S.G. College of Technology
(ii Machine Design Data Book by P. Mahadevan
(iii) Machine Design Data Book by V.B.Bandari
(iv) Machine Design Data Book by SMD. Jalaluddin .

Objectives:

- To study functional and strength design of important machine elements**,**
- To study selection of rolling element bearing and design of hydrodynamic bearing,
- To familiarize with use of design data books & various codes of practice.

UNIT–I

Bearings: Types of Journal bearings – Lubrication – Bearing Modulus – Full and partial bearings –Clearance ratio – Heat dissipation of bearings, bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, Bearing life.

UNIT–II

Design of IC Engine Parts : Connecting Rod : Thrust in connecting rod – stress due to whipping action on connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung and center cranks– Crank pins, Crank shafts. Pistons, Forces acting on piston – Construction Design and proportions of piston, Cylinder and Cylinder liners.

UNIT–III

Power Transmissions Systems and Pulleys : Transmission of power by Belt and Rope drives, Transmission efficiencies, Belts – Flat and V types – Ropes - pulleys for belt and rope drives- Materials and Chain drives.

UNIT–IV

Spur & Helical Gear Drives : Spur gears- Helical gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur gears – Estimation of centre distance, module and face width, check for plastic deformation, Check for dynamic and wear considerations.

UNIT–V

Design of Power Screws : Design of screw, Square ACME , Buttress screws, design of nut, compound screw, differential screw, ball screw- possible failures.

TEXT BOOKS:

1. Machine Design by R.S.Khurmi and J.K.Gupta, S.Chand Publishers,New Delhi.
2. Machine Design, S MD Jalaludin, Anuradha Publishers.
3. Machine Design, Kannaiah/ Scietech Publishers.

REFERENCE BOOKS:

1. Machine Design by Pandya and Shah, Chortar Publications.
2. Machine Design / R.N. Norton
3. Mechanical Engineering Design / JE Shigley.

OUTCOMES:

- Students will be able to Select appropriate gears for power transmission on the basis of given load and speed.
- Select bearings for a given applications from the manufacturers catalogue, Use design data books and various standard codes of practices.
- Students know about ISO, ASME standards.

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(R15A0322) FINITE ELEMENT METHODS

Objectives:

- It covers the fundamental and theoretical approach beginning with a review of differential equations, boundary conditions, integral forms, interpolation, parametric geometry, numerical integration, and matrix algebra.
- Next, engineering applications to field analysis, stress analysis and vibrations are introduced. Time dependent problems are also treated.
- Students are also introduced, by means of selected tutorials, to the commercial finite element system Solid Works which is similar to one they could be expected to use upon graduation. Graduate students will also be introduced to the more powerful (and difficult to use) ANSYS system.

UNIT–I

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Strain – Displacement relations. Stress – strain relations. One Dimensional problems : Finite element modeling coordinates and shape functions. Potential Energy approach : Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT–II

Analysis of Trusses : Stiffness matrix for plane truss element, Stress calculations and problems.

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions.

UNIT–III

Finite element modeling of Axisymmetric solids subjected to Axisymmetric loading with triangular elements. Two dimensional four noded isoparametric elements and numerical integration.

UNIT–IV

Steady state heat transfer analysis : One dimensional analysis of a fin and two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

UNIT-V

Dynamic Analysis : Formulation of finite element model, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

Finite element modulation to 3D problems in stress analysis, convergence requirement, Mesh generation, techniques such as semi automatic and fully automatic use of softwares such as ANSYS,NISA,NASTRAN etc.

TEXT BOOKS:

1. Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu /Prentice – Hall.
2. Introduction to Finite Element Analysis by S.Md.Jalaluddin, Anuradha Publishers.
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.

REFERENCE BOOKS:

1. An introduction to Finite Element Method / JN Reddy / Me Graw Hill
2. The Finite Element Methods in Engineering / SS Rao / Pergamon.
3. Finite Element Method/ C.S.Krishna Murthy.

OUTCOMES:

- Upon completion of the course students should be able to correlate a differential equation and its equivalent integral form.
- Understand parametric interpolation and parametric geometry enforce essential boundary conditions to a matrix system
- Graduate students to know the more powerful and difficult to use Ansys system.

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(R15A0323) HEAT TRANSFER

***Note:** Heat and Mass Transfer data books are permitted

Objectives:

- The objective of this subject is to provide knowledge about Heat transfer through conduction, convection and radiation.
- Student able to learn different modes of Heat Transfer.
- Student able to learn about the dimensional analysis .

UNIT-I

Introduction: Basic modes of heat transfer- Rate equations- Generalized heat conduction equation in Cartesian, Cylindrical and Spherical coordinate systems. Steady state heat conduction solution for plain and composite slabs, cylinders and spheres- Critical thickness of insulation- Heat conduction through fins of uniform and variable cross section- Fin effectiveness and efficiency.

Unsteady state Heat Transfer conduction- Transient heat conduction- Lumped system analysis, and use of Heisler charts.

UNIT-II

Convection: Continuity, momentum and energy equations- Dimensional analysis- Boundary layer theory concepts- Free, and Forced convection- Approximate solution of the boundary layer equations- Laminar and turbulent heat transfer correlation- Momentum equation and velocity profiles in turbulent boundary layers- Application of dimensional analysis to free and forced convection problems- Empirical correlation.

UNIT-III

Radiation: Black body radiation- radiation field, Kirchhoff's laws- shape factor- Stefan Boltzman equation- Heat radiation through absorbing media- Radiant heat exchange, parallel and perpendicular surfaces- Radiation shields.

UNIT-IV

Heat Exchangers: Types of heat exchangers- Parallel flow- Counter flow- Cross flow heat exchangers- Overall heat transfer coefficient- LMTD and NTU methods- Fouling in heat exchangers- Heat exchangers with phase change.

Boiling and Condensation: Different regimes of boiling- Nucleate, Transition and Film boiling. Condensation: Laminar film condensation- Nusselt's theory- Condensation on vertical flat plate and horizontal tubes- Drop wise condensation.

UNIT-V

Mass Transfer: Conservation laws and constitutive equations- Isothermal equimass, Equimolal diffusion- Fick's law of diffusion- diffusion of gases, Liquids- Mass transfer coefficient.

TEXT BOOKS:

1. Heat Transfer, by J.P.Holman, Int.Student edition, McGraw Hill Book Company.
2. Fundamentals of Heat and Mass Transfer- Sachdeva.
3. Heat transfer by Arora and Domakundwar, Dhanpat Rai & sons, New Delhi..

REFERENCE BOOKS:

1. Heat Transfer by Sukhatme.
2. Heat and Mass Transfer by R.K.Rajput, Laxmi Publications, New Delhi.
3. Heat transfer by Yunus A Cengel.

OUTCOMES:

- Knowledge and understanding how heat and energy is transferred between the elements of a system for different configurations.
- Solve problems involving one or more modes of heat transfer**.**
- Student gets the exposure of different modes of Heat Transfer.

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(R15A0324) REFRIGERATION AND AIR CONDITIONING

Note : Usage of Refrigeration Tables and Steam Tables are permitted.

Objectives:

- The objective of this subject is to provide knowledge about different cycles
- Student able to learn about refrigeration and air conditioning.
- Student able to learn about deferent air conditioning equipments.

UNIT–I

Introduction to Refrigeration: Necessity and applications – Unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycles of refrigeration.

Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems – Actual air refrigeration system problems – Refrigeration needs of Air crafts.

Principles of Evaporators: classification – Working Principles, Expansion devices – Types – Working Principles Refrigerants – Desirable properties – classification refrigerants used – Nomenclature – Ozone Depletion– Global Warming.

UNIT–II

Vapour compression refrigeration: working principle and essential components of the plant – simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – numerical Problems.

UNIT-III

Vapor Absorption System – Calculation of max COP – description and working of NH3 – water system and Li Br – water (Two shell & Four shell) System. Principle of operation Three Fluid absorption system, salient features.

Steam Jet Refrigeration System – Working Principle and Basic Components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube, Pulse tube refrigeration system, Thermionic refrigeration system, Production of low temperature- Dry ice refrigeration system.

UNIT–IV

Introduction to Air Conditioning: Psychometric Properties & Processes – Characterization of Sensible and latent heat loads –– Need for Ventilation, Consideration of Infiltration – Load concepts of RSHF, GSHF- Problems, Concept of ESHF and ADP.

UNIT-V

Requirements of human comfort and concept of effective temperature- Comfort chart – Comfort Air conditioning – Requirements of Industrial air conditioning , Air conditioning Load Calculations.

Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers. Heat Pump – Heat sources – different heat pump circuits.

TEXT BOOKS:

1. Refrigeration and Air Conditioning / CP Arora / TMH Publishers
2. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai Publications
3. Refrigeration and Air Conditioning / R.S. Khurmi & J.K Gupta / S.Chand – Eurasia Publishing House (P) Ltd

REFERENCE BOOKS:

1. Refrigeration and Air Conditioning/ P.L.Bellaney/Khanna Publishers
2. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH Publishers
3. Refrigeration and Air Conditioning / Manohar Prasad / New Age International Publ.

OUTCOMES:

- It will give learners a basic - but solid - understanding of the fundamentals of refrigeration.
- The main system types and components, the range of applications, including air conditioning and heat pumps.
- The use of controls, and the key provisions and impact of recent legislation on the sector.

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(R15A0325) COMPRESSIBLE FLUID FLOW
(CORE ELECTIVE–II)

Note: Usage of Gas Tables are permitted.

Objectives:

- Students will be able to describe assumptions, physical meaning of terms and to utilize key relationships for compressible flow, speed of sound, isentropic and non-isentropic flows, and potential and rotational flows.
- Calculate the effect of area change, shaft work, heat addition, mass addition and friction on flow states in a compressible channel flow, including effects on mass flow capacity and flow regime,
- Estimate the lift and drag for basic aerodynamic shapes in compressible, inviscid flows.

UNIT-I

Basic Concepts and Isentropic Flows : Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers – Use of Gas tables.

UNIT-II

Flow through Ducts: Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties – Use of tables and charts – Generalised gas dynamics.

UNIT-III

Normal and Oblique Shocks : Governing equations – Variation of flow parameters across the normal and oblique shocks –– Prandtl Meyer relations – Use of table and charts – Applications.

UNIT–IV

Jet Propulsion: Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT–V

Space Propulsion: Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

TEXT BOOKS:

1. S.M. Yahya, Fundamentals of Compressible Flow, New Age International (P) Limited, New Delhi,1996.
2. Anderson, J.D., Modern Compressible flow, McGraw Hill, 3rd Edition, 2003.
3. H. Cohen, G.E.C. Rogers and Saravanamutto, Gas Turbine Theory, Longman Group Ltd., 1980.

REFERENCE BOOKS:

1. V. Ganesan, Gas Turbines, Tata McGraw Hill Publishing Co., New Delhi, 1999.
2. PR.S.L. Somasundaram, Gas Dynamics and Jet Propulsions, New Age International Publishers,1996.
3. V. Babu, Fundamentals of Gas Dynamics, ANE Books India, 2008

OUTCOMES:

- Students will be able to explain the starting behavior of supersonic diffusers and inlets.
- Characterize quantitatively the links between flow angle and pressure changes in a supersonic flow and the differences with subsonic flows.
- Student gets to exposure of different propulsion units.

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(R15A0326) COMPUTATIONAL FLUID DYNAMICS (CORE ELECTIVE – II)

Objectives:

- Study basic principles of modeling a system using software**.**
- Study grid generation and discretization methods.
- Student able to learn above difference and Finite volume methods.

UNIT-I

Governing Equations and Boundary Conditions: Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD – Elliptic, Parabolic and Hyperbolic equations.

UNIT-II

Finite Difference and Finite Volume Methods for Diffusion: Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

UNIT-II

Finite Volume Method for Convection Diffusion: Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT-IV

Flow Field Analysis: Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT-V

Turbulence Models and Mesh Generation: Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd.Second Edition, 2007.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.
3. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation,2004. AULibrary.com 99.

REFERENCE BOOKS:

1. Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
2. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
3. Prodip Niyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics", Pearson Education, 2005.

OUTCOMES:

- Demonstrate & explain geometrical model of a fluid flow.
- Describe specific boundary conditions and solution parameters**.**
- Analyze the results and draw the appropriate inferences.

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(R15A0327) COMPOSITE MATERIALS
(CORE ELECTIVE – II)

Objectives:

- To be familiar with classification and characteristics of composite material and their applications.
- To gain the knowledge about manufacturing methods of composites .
- To know the testing methods related to composite materials.

UNIT-I

Introduction: Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.

UNIT-II

Manufacturing methods : Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength. Characterization of systems; carbon fibre/epoxy, glass fibre/polyester, etc.

UNIT-III

Mechanical Properties -Stiffness and Strength: Geometrical aspects – volume and weight fraction. Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements –Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.

UNIT-V

Laminates : Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Plate Stiffness and Compliance, Computation of Stresses, Types of Laminates -, Symmetric Laminates, Anti-symmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Cross-ply Laminate, Angle-ply Laminate. Orthotropic Laminate, Laminate Moduli, Hygrothermal Stresses.

UNIT-V

Joining Methods and Failure Theories : Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.

TEXT BOOKS:

1. K.K. Chawla, (1998), Composite Materials, Springer-Verlag, New York
2. B.T. Astrom, (1997), Manufacturing of Polymer Composites, Chapman & Hall
3. Composite materials by J.N.Reddy

REFERENCE BOOKS:

1. Stuart M Lee, J. Ian Gray, Miltz, (1989), Reference Book for Composites Technology, CRC press
2. Frank L Matthews and R D Rawlings, (2006), Composite Materials: Engineering and Science, Taylor and Francis.
3. D. Hull and T.W. Clyne, (1996), Introduction to Composite Materials, Cambridge University Press

OUTCOMES :

- To provide knowledge on characteristics of composites
- To get knowledge on manufacturing and testing methods and mechanical behavior
- of composites.
- To get the exposure of different materials .

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L	T/P/D	C
4	0	3

(R15A0568) APPS DESIGN AND DEVELOPMENT (OPEN ELECTIVE–IV)

Objectives:

- Knowledge of basic software engineering fundamentals and practices.
- Introducing multimedia practices and graphic fundamental.
- Knowledge of basic java programming under client/server side and data base connection.

UNIT–I

Fundamental concepts: Software Process models**:** The waterfall model, Incremental process models, Evolutionary process models, The Unified process. Multimedia and hypermedia, World Wide Web, overview of multimedia software tools, Graphics data types, file formats, color in image and video: color models in images, color in video.

UNIT–II

HTML Common tags: List, Tables, images, forms, Frames; Cascading Style sheets.

UNIT-III

Introduction to Java Scripts: Objects in Java Script, Dynamic HTML with Java Script.

UNIT-IV

Web Servers: Introduction to Servlets: Lifecycle of a Servlet, The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing, Environment: Installing the Java: Software Development Kit, Tomcat Server. Using Cookies-Session Tracking, Security Issues.

UNIT-V

Database Access: Database Programming using JDBC, Studying Javax.sql.* package, Accessing a Database from a JSP Page, TESTING: Types of software testing, test cases.

TEXT BOOKS:

1. Web Programming ,Building Internet Applications, CHRIS BATES 2nd Edition, Wiley Dreamtech.
2. Programming world wide web ,SEBESTA,PEARSON.
3. Java Complete Reference ,7th edition ,HERBERTSCHILDT,TMH.

REFERENCE BOOKS:

1. Core Servlets And Java Servlets Pages Vol-1:Core Technologies BY MARTY HALL,LARRY BROWN PEARSON.
2. Software Engineering ,ROGERS PRESSMEN, 7th edition,TATA McGraw-HILL.
3. Software Testing Techniques, BORIS BEIZER,DREAMTECH,II EDITION.

OUTCOMES:

- Ability to identify the minimum requirements for the development of application.
- Ability to apply different multimedia development tools to produce web based and stand-alone user interfaces.
- Gain knowledge of client side scripting, understanding of server side scripting with java.

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L	T/P/D	C
4	-	3

(R15A0328) PRODUCTION AND OPERATIONS MANAGEMENT (OPEN ELECTIVE-IV)

Objectives:

- To provide a comprehensive exposure to Production and operations management and its significance in Industries.
- To acquaint students with various activities of Production and operations management and to give insight into the ongoing & futuristic trends in the control of inventory.
- To appraise about need and benefits of functions related to products and processes.

UNIT–I

Introduction to Operations Management:

Introduction to Operations Management - Role of Operations Management in total management System- Interface between the operation systems and systems of other functional areas, Process planning and process design, Production Planning and Control: Basic functions of Production Planning and Control, Production Cycle - characteristics of process technologies. Project, Job Shop, Assembly, batch and Continuous - Inter Relationship between product life cycle and process life cycle.

UNIT–II

Scheduling and control of production operations:

Aggregate planning, MPS, Operations scheduling, Product sequencing: Sequencing of products in multi- product multi-stage situations - Plant Capacity and Line Balancing. Plant layout -different types of layouts. Location and the factors influencing location. Maintenance Management: Objectives – Failure Concept, Reliability, Preventive and Breakdown maintenance, Replacement policies

UNIT–III

Quality control:

Standards and specifications, Quality Assurance and Quality Circles – Statistical Quality Control – Control Charts for Variables- Average, Range and Standard Deviation., Control charts for Attributes- fraction defective and number of defects, Acceptance Sampling Plans, OC Curve Work Study, various techniques in the Methods Study for identifying the most appropriate method. Work measurement - its uses and different methods, computation of allowance and allowed time.

UNIT–IV

Materials Management:

Need and importance of Materials management-Materials Requirement Planning-Materials Budgeting- Techniques for prioritization of materials-Sources of Supply of Materials - selection, evaluation and Performance of suppliers-make or buy decisions and its implications under various circumstances Vendor rating - determinants of vendor rating, concept of waste management

UNIT–V

Stores Management:

Objectives of Stores Management – Requirements for efficient. Management of Stores - safety stock Inventory Control - Different Systems of Inventory Control, Types of Inventory. Costs - Systems of inventory control – ABC, VED and FNSD analyses. Value Analysis – Importance in cost reduction – concepts and procedures.

TEXT BOOKS:

1. Aswathappa K. and Sridhara Bhat, "Production and Operations Management", 2010, HPH.
2. Mahadevan. B, "Operations Management", 2010, Pearson Education.
3. Paneer Selvam - Production and Operations Management , PHI 2006

REFERENCE BOOKS:

1. Buffa E, Modern Production and Operations Management , John wiley 2007
2. Chary SN, Production and Operations Management , TMH,2009
3. P Rama Murthy -Production and Operations Management , New Age International ,2005

OUTCOMES:

- The student will be able to Illustrate production planning functions and manage manufacturing functions in a better way.
- Develop competency in scheduling and sequencing in manufacturing operations and effect affordable manufacturing lead time.
- Manage and control inventory with cost effectiveness. Get conversant with various documents procedural aspects and preparation of orders for various manufacturing methods.

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III Year B. Tech, ME-II Sem

L	T/P/D	C
4	-	3

(R15A0329) NANO MATERIALS
(CORE ELECTIVE–IV)

Objectives:

- To learn about basis of Nano material science.
- preparation method, types and application.
- Able to learn about different properties.

UNIT-I

General Introduction: Basics of Quantum Mechanics, Harmonic oscillator, magnetic Phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, Anisotropy.

Silicon Carbide: Application of Silicon carbide, nano materials preparation, Sintering of SiC, X-ray Diffraction data, electron microscopy sintering of nano particles,

Nano particles of Alumina and Zirconia: Nano materials preparation, Characterization, Wear materials and nano composites,

UNIT-II

Mechanical properties: Strength of nano crystalline SiC, Preparation for strength measurements, Mechanical properties, Magnetic properties,

Electrical properties: Switching glasses with nanoparticles,Electronic conduction with nano particles

Optical properties: Optical properties, special properties and the coloured glasses.

UNIT-III

Process of synthesis of nano powders: Electro deposition, Important naon materials.

Investigaing and manipulating materials in the nanoscale: Electron microscopics, scanning probe microscopics, optical microscopics for nano science and technology, X-ray diffraction.

UNIT-IV

Nanobiology : Interaction between bimolecules and naoparticle surface, Different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, Application of nano in biology, naoprobes for Analytical Applications-A new Methodology in medical diagnostics and Biotechnology, Current status of nano Biotechnology, Future perspectives of Nanobiology, Nanosensors.

UNIT-V

Nano Medicines: Developing of Nanomedicens Nanosytems in use,Protocols for nanodrug Administration, Nanotechnology in Diagnostics applications, materials for used in Diagnostics and Therapeutic applications,

Molecular Nanomechanics, Molecular devices, Nanotribology, studying tribology at nanoscale, Nanotribology applications.

TEXT BOOKS:

1. Nano Materials- A.K.Bandyopadhyay/ New Age Publishers.
2. Nano Essentials- T.Pradeep/TMH
3. G Timp, “Nanotechnology”, AIP press/Springer, 1999.

REFERENCE BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale Characterization of Surfaces & Interfaces”, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000.
3. Akhlesh Lakhtakia,“The Hand Book of Nano Technology, Nanometer Structure, . Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

OUTCOMES:

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

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L	P	C
0	3	2

(R15A0388) HEAT TRANSFER LAB

Objectives :

- Student able to learn about various modes of heat transfer in Composite walls and Powders
- Learn heat exchanger principles
- Student know about different modes of heat transfer.

LIST OF EXPERIMENTS:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin.
6. Experiment on Transient Heat conduction.
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection.
9. Parallel and counter flow heat exchanger.
10. Emissive apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.

Note: Total 10 experiments are to be conducted.

OUTCOMES :

Students get exposure to

- Thermal Conductivity measurement, Convection measurement.
- Determination of effectiveness of heat exchangers .
- Student get the exposures of conduction and convection methods.

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III Year B. Tech, ME-II Sem

L	P	C
0	3	2

(R15A0389) CAD LAB

Objectives:

- Model the 3-D geometric information of machine components including assemblies, and automatically generate 2-D production drawings,
- understand the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program.
- Improve visualization ability of machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting and coloring.

LIST OF EXPERIMENTS:

1. INTRODUCTION to CAD
2. AutoCAD – BASICS
   - 2.1 Starting with AutoCAD
   - 2.2 Layout and sketching
   - 2.3 Drawing environment
   - 2.4 Elements of drawing
     - 2.4.1 Draw commands
   - 2.5. 3D functions
3. 2D – FIGURES for practice USING AutoCAD
4. ISOMETRIC DRAWING for practice USING AutoCAD
5. 3-D SOLID FIGURES USING ACAD
6. INTRODUCTION TO CREO 2.0
   - 6.1 Learning Different Operations like Threading, Sweep, Sweptblend.
   - 6.2 Modeling
   - 6.3 Assembling

Software: Autocad 2013 and CREO - 2

REFERENCE BOOK:

1. Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishes

OUTCOMES:

- Develop knowledge in 2D-Transformations, 3D Transformations.
- Understand the Assembly Modeling,
- Assembly tree, and Assembly Methods.

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III Year B. Tech, ME-II Sem

L	T/P/D	C
2	0	0

(R15A0007) TECHNICAL COMMUNICATION AND SOFT SKILLS

Objectives:

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To equip the students to approach academic subjects more professionally using the theoretical and practical components of the English syllabus.
- To develop the professional skills and communication skills in formal and informal situations and hone the required professional ethics.

UNIT-I

Advanced Grammar : Study of advanced grammar,transformation of sentences,tenses,concord,voices,correction of sentences.

UNIT-II

Principles of effective writing : Technical writing,Writing drafts and revising,Collaborative Writing, technical writing style and language, editing strategies to achieve appropriate technical style.

UNIT-III

ProfessionalCommunication: Extempore,Group discussion ,oral presentation,interviews,Graphic presentation,presentation aids,rapid reading,writing reports,e-mail writing, Official notes,business letters,memos,minutes of meetings.

UNIT-IV

Self Development and Assessment: Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, self esteem.

UNIT-V

Ethics: Business ethics, , Personality Development in social and office settings, netiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Complex problem solving, Creativity, leadership skills ,cubicle Etiquettes, team building.

TEXT BOOKS:

1. David F. Beer and David Mc Murrey, Guide to writing as an Engineer, John Willey. . NewYork, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843) .
3. Shiv Khera, You can win , Macmillan Books,New York , 2003.
4. Raman Sharma ,Technical Communications , Oxford Publication ,London,2004.
5. Meenakshi Raman ,Prakash Singh ,Business Communication ,Oxford Publication, New Delhi 2012.

REFERENCE BOOKS:

1. Dale Jung k, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
2. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
3. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

OUTCOMES:

- The student will become proficient in LSRW skills.
- They develop formal LSRW skills approach to different situations.
- They hone professional ethics and learn to be proficient formally

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L	T/P/D	C
5	1	4

(R15A0330) OPERATIONS RESEARCH

Objectives:

- To familiarize the students with the use of practice oriented mathematical applications for optimization functions in an organization.
- To familiarize the students with various tools of optimization, probability, statistics and simulation,
- To applicable in particular scenarios in industry for better management of various resources.

UNIT–I

Introduction :

Development – Definition– Characteristics and Phases – Types of models – operation Research models– applications.

Resource Allocation: Linear Programming Problem Formulation – Graphical solution – Simplex method –Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

UNIT–II

Transportation Problem: Formulation – Optimal solution, unbalanced transportation problem –Degeneracy. Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem-Traveling Salesman problem.

Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines.

UNIT–III

Replacement Analysis: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement.

Theory of Games: Introduction – Minimax (maximin) – Criterion and optimal strategy – Solution of games with saddle points – Rectangular games without saddle points – 2 X 2 games – dominance principle – m X 2 & 2 X n games -graphical method.

UNIT–IV

Waiting Lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT–V

Dynamic Programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- capital budgeting problem – shortest path problem – linear programming problem.

Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Inventory and Queuing problems – Advantages and Disadvantages – Simulation Languages.

TEXT BOOKS :

1. S.D.Sharma - Operations Research , Kedarnath, Ramnath 2015
2. Hiller & Libermann - Introduction to O.R , Mc Graw Hill 2011
3. Taha - Introduction to O.R , PHI 2010

REFERENCE BOOKS:

1. A.M.Natarajan,P.Balasubramani,A. Tamilarasi -Operations Research , Pearson . Education.
2. R.Pannerselvam - Operations Research ,PHI Publications 2006
3. J.K.Sharma- Operation Research ,MacMilan 2010

OUTCOMES:

- Student will be able to Illustrate the need to optimally utilize the resources in various types of industries.
- Apply and analyze mathematical optimization functions to various applications.
- Demonstrate cost effective strategies in various applications in industry.

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L	T/P/D	C
5	1	4

(R15A0331) CAD/CAM

Objectives:

- The student able to know about the CAD/CAM software.
- computer graphics, drafting, numerical control, group technology.
- CIM and computer aided quality controls

UNIT–I

Introduction: Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices.

Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal.

UNIT–II

Geometric modeling: Requirements, geometric models, geometric construction models, curve representation methods, surface representation methods, modeling facilities desired.

UNIT–III

Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling.

Numerical control: NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming fundamentals, manual part programming methods, Computer Aided Part Programming.

UNIT–IV

Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

UNIT–V

Computer Aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods-nonoptical, computer aided testing, integration of CAQC with CAD/CAM.

Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.

TEXT BOOKS:

1. CAD / CAM Theory and Practice / Ibrahim Zeid / TMH Publishers
2. CAD / CAM /A Zimmers & P.Groover/PE/PHI Publishers
3. Automation, Production systems & Computer integrated Manufacturing/ Groover/ Pearson Education

REFERENCE BOOKS:

1. CAD / CAM / CIM / Radhakrishnan and Subramanian / New Age Publishers
2. Principles of Computer Aided Design and Manufacturing / Farid Amirouche / Pearson Edu
3. CAD/CAM: Concepts and Applications/Alavala/ PHI Publishers Computer Numerical Control Concepts and programming / Warren S Seames / Thomson Publishers

OUTCOMES:

- The learning outcomes are assessed through the assignment and various practical performed modeling, drafting.
- computer aided quality control and computer integrated manufacturing systems.
- Know about different CIM Techniques.

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L	T/P/D	C
4	0	3

` (R15A0332) MECHANICAL MEASUREMENTS AND CONTROL SYSTEMS

Objectives:

- To impart knowledge of architecture of the measurement system**.**
- To deliver working principle of mechanical measurement system.
- To study concept of mathematical modeling of the control system**.** To analyse control system under different time domain

UNIT –I

Definition – Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error, Classification and elimination of error.

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.

UNIT –II

Measurement of Temperature: Classification – Ranges – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor – Thermocouple – Pyrometers – Temperature Indicators.

Measurement of Pressure: Units – classification – different principles used. Manometers, Piston, Bourdon pressure gauges, Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

Measurement of Level: Direct method – Indirect methods – capacitative, ultrasonic, magnetic, cryogenic fuel level indicators – Bubler level indicators.

UNIT –III

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot – wire anemometer, Laser Doppler Anemometer (LDA).

Measurement of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Noncontact type of tachometer

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments – Vibrometer and accelerometer using this principle.

UNIT –IV

Stress Strain Measurements: Various types of stress and strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending compressive and tensile strains – usage for measuring torque, Strain gauge Rosettes.

Measurement of Humidity – Moisture content of gases, sling psychrometer, Absorption psychrometer, Dew point meter.

UNIT –V

Measurement of Force, Torque And Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

Elements of Control Systems: Introduction, Importance – Classification – Open and closed systems Servomechanisms– Examples with block diagrams–Temperature, speed & position control systems.

TEXT BOOKS:

1. Mechanical Measurements / Beck With, Marangoni, Linehar/ PHI Publisher
2. Measurement Systems: Applications & design / D.S Kumar/McGraw Hill Publishers
3. Mechanical Measurements /Shawney/McGraw Hill Publishers

REFERENCE BOOKS:

1. Experimental Methods for Engineers / Holman/ McGraw-Hill Education
2. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers.
3. Instrumentation and Mechanical Measurements / A.K. Tayal / Galgotia Publications.

OUTCOMES:

- Learner should be able to Identify and select proper measuring instrument for specific application Illustrate working principle of measuring instruments**.**
- Explain calibration methodology and error analysis related to measuring instruments
- Mathematically model and analyze.

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L	T/P/D	C
4	0	3

(R15A0333) AUTOMOBILE ENGINEERING

Objectives:

- The objective of this subject is to provide knowledge about various systems involved in automobile engine.
- Able to learn about different components of IC Engines.
- Different automobile engine systems line diagrams.

UNIT –I

Introduction : Components of four wheeler automobile – chassis and body – power unit –power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft..

Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburettor – types – air filters – petrol injection.

C.I. Engines: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps.

UNIT –II

Cooling System : Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporating cooling – pressure sealed cooling – antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

UNIT –III

Emission from Automobiles: – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG,CNG, liquid Fuels and gaseous fuels, electrical-their merits and demerits.

Electrical System : Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT –IV

Transmission System : Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box , over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

UNIT –V

Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toe -in, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

TEXT BOOKS:

1. Automobile Engineering / William Crouse/TMH Education.
2. Automobile Engineering / R.B.Gupta, Standard Publications.
3. Automotive Mechanics / Vol. 1 & Vol. 2 / Kripal Sing/Standard Publishers.

REFERENCE BOOKS:

1. Automotive Mechanics / G.B.S. Narang/Khanna Publishers.
2. Automotive Engines / Srinivasan/ Tata McGraw-Hill Education.
3. Automobile Engineering /K.K. Ramalingam / Scitech Publications (India) PVT. LTD.

OUTCOMES:

- The Automotive Engineering program aims to provide practice-oriented education based on the latest scientific results and methods.
- Which enable students to work independently as automotive engineers .
- Enables to face increasing challenges and standards of global markets.

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L	T/P/D	C
4	0	3

(R15A0334) POWER PLANT ENGINEERING
(CORE ELECTIVE–III)

Objectives:

- To create awareness about working and availability of product/system as and when required and
- Working to its fullest capacity & efficiency to the satisfaction of the end user.
- Able to learn about different power plants.

UNIT–I

Introduction to the Sources of Energy: Resources and Development of Power in India.

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage and Ash handling systems.

Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT –II

Internal Combustion Engine Plant: DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

UNIT –III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

Hydro Projects and Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

Power From Non-Conventional Sources: Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy**.**

Direct Energy Conversion: Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

UNIT –IV

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation.

Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT –V

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS:

1. A Course in Power Plant Engineering: / Arora and S. Domkundwar/ Dhanpat Rai Publisher
2. Power Plant Engineering / P.C.Sharma / S.K.Kataria Publisher
3. A Text Book of Power Plant Engineering / R.K.Rajput / Laxmi Publications

REFERENCE BOOKS:

1. Power Plant Engineering/ P.K.Nag II Edition /TMH Publishers
2. An Introduction to Power Plant Technology / G.D. Rai/Khanna Publishers
3. Power plant Engg /Elanchezhian/I.K. International Publishers

OUTCOMES:

- Students learn about the failures, maintainability and availability of the intended products/systems and services
- Students get the exposure of different pollution standards.
- Students get the exposure of different power distribution techniques.

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L	T/P/D	C
4	0	3

(R15A0335) JET PROPULSION AND ROCKET ENGINEERING (CORE ELECTIVE – III)

Objectives:

- List and explain the characteristics and performance of aerospace propulsion systems.
- Model newly-conceived rocket or air breathing propulsion systems and estimate their performance and behavior.
- Carry out preliminary designs of rocket or air breathing propulsion systems to meet specified requirements

UNIT-I:

Introduction : Ramjet engine, pulse jet engine, turboprop engine, turbojet engine, thrust and thrust equation, specific thrust of turbojet engine, specific thrust of the turbojet engine, efficiencies, parameters effecting the flight performance, thrust augmentation. Duct jet propulsion, rocket propulsion, chemical rocket propulsion, nuclear rocket engines, electric rocket propulsion, applications of rocket propulsion-space launch vehicles, spacecraft, missiles and other applications.

UNIT-II :

Liquid propellant rocket engines: propellants, propellant feed systems, gas feed systems, propellant tanks, tank pressurization, turbo pump feed system and engine cycles, flow and pressure balance, valves and pipe lines, engine support structure. Liquid Propellant properties, liquid oxidizers, liquid fuels liquid monopropellants, gelled propellants, combustion process, analysis, combustion instability.

UNIT-III :

Solid propellant rocket engines : propellant burning rate, basic performance relations, propellant grain and grain configuration, propellant grain stress and strain, attitude control. Motor case – metal cases, wound –filament –reinforced plastic cases, nozzles- classification, design and construction, heat absorption and nozzle materials, rocket motor design approach.

UNIT-IV

Solid propellants: classification, propellant characteristics, propellant ingredients, smokeless propellant, igniter propellants, physical and chemical processes, ignition process, extinction or thrust termination, combustion instability.

UNIT-V

Hybrid propellant rockets: applications and propellants, performance analysis and grain configuration, combustion instability. Rocket propulsion systems - selection process, criteria for selection, interfaces.

TEXT BOOKS:

1. V Ganesan, “Gas Turbines”, Tata McGraw-Hill, 2 nd Edition, 2003.
2. Sutton P and Oscar Biblaz,” Rocket Propulsion Elements”, Wiley India Pvt.Ltd. 2010.
3. Rocket propulsion elements/Sutton/John Wiley & Sons/8th Edition

REFERENCE BOOKS:

1. Khajuria and Dubey, “Gas Turbines & Propulsive System”, DhanpatRai Publications, 2012.
2. Hill and Peterson, “Mechanics and Dynamics of Propulsion”, 2 nd Edition, Prentice Hall,
3. Rocket propulsion by S.M.Yawha.

OUTCOMES :

- Explain the different features and capabilities of chemical and non-chemical rocket propulsion systems. Calculate the specific impulse and mass flow for a rocket engine with the fluid considered as an ideal gas with constant specific heats.
- Estimate the specific impulse and mass flow for a rocket engine accounting for chemical reaction and non-constant specific heats.
- Explain the causes of, and estimate, the stress on rocket casings, turbo machine blades, and blade disks in turbomachines. Estimate the heat transfer rates in rocket nozzles and in aeroengine turbine components.

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L	T/P/D	C
4	0	3

(R15A0336) CNC TECHNOLOGY
(CORE ELECTIVE–III)

Objectives:

- The student will be able to know about the Numerical control machines,
- Able to learn programming, CNC and DNC systems and Adaptive control .
- Able to learn different NC and CNC machines.

UNIT-I

Features of NC Machines: Fundamentals of Numerical Control, advantages of NC systems, classifications of NC systems, point to point, NC and CNC, incremental and absolute, open and closed loop systems, Features of N/C Machine Tools, Design consideration of NC machine tool, methods of improving machine accuracy.

NC Part Programming: Manual Programming- Basic concepts, point to point counter programming canned cycles, parametric programming.

UNIT-II

CNC Machine Elements: Machine Structure- Guide ways- feed drives-spindles- spindle bearings – measuring systems-Tool monitoring systems.

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling systems, modular fixturing, quick change tooling system, automatic head changers.

UNTI-III

Compute-Aided Programming: General information, APT programming Examples Apt programming problems (2D machining only) NC programming on CAD/CAM Systems, the design and implementation of post processors Introduction to CAD/CAM Software, Automatic Tool path generation

UNIT-IV

DNC Systems and Adaptive control: Introduction type of DNC systems, advantages and disadvantages of DNC, adaptive control with optimization, Adaptive control with constraints, Adaptive control of machining process like turning, grinding.

UNIT-V

Micro Controllers: Introduction, Hardware components, I/O pins, ports external memory, counters, timers and serial data I/O INTERRUPTS. Selection of Micro Controllers, Embedded Controllers, Applications and Programming of Micro Controllers.

Programming Logic Controllers (PLC'S): Introduction, Hardware components of PLC, system, basic structure principles of operations, programming mnemonics timers, Internal relays and counters, Applications of PLC'S in CNCMachines.

TEXT BOOKS:

1. Computer Control of Manufacturing systems / Yoram Koren / Mc Graw Hill . Publishers
2. CAD/CAM- /Michel P.Groover / TMH Publishers
3. Computer Numerical Control: Concepts and Programming by Warren S. Seames

REFERENCE BOOKS:

1. Machining Tools Hand Book / Vol 3, (Automation and Control)/ Manfred Week/ . John Wiley and Sons, 1984.
2. Mechatronics / HMT Publishers.
3. Production Technology / HMT Publishers.

OUTCOMES:

- Learner should be know the specific applications of NC,CNC,DNC Microcontrollers, and PLC's in detailed.
- Learner should be know the different circuit diagrams.
- Learn should know about different micro controllers.

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(R15A0337) MODERN MACHINING PROCESSES (CORE ELECTIVE–IV)

Objectives:

- Student get the knowledge about various modern machining methods like Ultrasonic Machining, Abrasive Machining, Water- jet Machining,
- Plasma Machining, Laser Beam Machining and Chemical Machining.
- Student able to know about different Electro Chemical Processes .

UNIT–I

Introduction: Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection - Materials - Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development.

UNIT–II

Abrasive jet machining, Water jet machining and abrasive water jet machine : Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.

Electro – Chemical Processes : Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM – Simple problems for estimation of metal removal rate. Fundamentals of chemical, machining, advantages and applications.

UNIT-III

Thermal Metal Removal Processes : General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT–IV

Generation and control of electron beam for machining: Theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut.

UNIT-V

Plasma Machining : Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries. Chemical machining-principle- maskants –etchants-applications.

Magnetic abrasive finishing, Abrasive flow finishing, Electrostream drilling, Shaped tube electrolytic machining.

TEXT BOOKS:

1. Advanced machining processes/ VK Jain/ Allied publishers.
2. Unconventional machining process / P. K. Mishra / Standard Publishers
3. Modern Machining process by Yaron Korien

REFERENCE BOOKS:

1. Modern Machining Process / Pandey P.C. and Shah H.S./ TMH Publishers
2. New Technology / Bhattacharya A/ The Institution of Engineers/ India 1984.
3. Modern Production and Operations Management / Baffa & Rakesh Sarin/ John Wiley & Sons

OUTCOMES:

- Students will understand the principle of operation of the non-conventional machining techniques (eg :Electro discharge machining (EDM), wire erosion, Ultrasonic Machining, Etching of Electronic printed circuit boards (PCBs), Laser-beam Machining, Plasma-jet Machining),
- specification of components for Non-conventional Machining techniques and Tooling requirements.
- Tooling and ancillary equipment needed to perform non-conventional machining processes.

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IV Year B. Tech, ME-I Sem

L	T/P/D	C
4	0	3

(R15A0338) ROBOTICS
(CORE ELECTIVE–IV)

Objectives:

- The objective of this subject is to provide knowledge of automation of Industries.
- To know about design of robot arm, kinematics and dynamics.
- To know about Trajectory planning of robot and its applications.

UNIT–I

Introduction: Automation and Robotics, CAD/CAM and Robotics – An over view of Robotics – present and future applications – classification by coordinate system and control system.

Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.

UNIT–II

Motion Analysis: Homogeneous transformations as applicable to rotation and translation – problems.

Manipulator Kinematics: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward kinematics – problems.

UNIT–III

Differential transformation and manipulators : Jacobians – problems.Dynamics: Lagrange – Euler and Newton – Euler formations – Problems.

Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion – Robot programming, languages and software packages.

UNIT-IV

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

UNIT-V

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading- `Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

TEXT BOOKS:

1. Industrial Robotics / Groover M P /Pearson Edu.
2. Robotics and Control / Mittal R K & Nagrath I J / TMH.
3. Robotic Engineering / Richard D. Klafter, Prentice Hall

REFERENCE BOOKS:

1. Robotics / S.K.Fu / McGraw Hill.
2. An Introduction to Robot Technology, / P. Coiffet and M. Chaironze / Kogam Page Ltd. 1983 London.
3. Introduction to Robotics / John J Craig / Pearson Edu.

OUTCOMES:

After Completion of this course students will be able to

- Classify robots based on joints and arm configurations.
- Design application specific End Effectors for robots.
- Compute forward and inverse kinematics of robots and determine trajectory plan.

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L	T/P/D	C
4	0	3

(R15A0339) MECHANICAL VIBRATIONS
(CORE ELECTIVE–IV)

Objectives:

- Fully understand and appreciate the importance of vibrations in mechanical design of machine parts
- Operate in different vibratory conditions**.**
- To know about different degrees of freedom.

UNIT- I

Single degree of freedom systems : Un-damped and damped free vibrations; forced vibrations coulomb damping; Response to excitation; rotating unbalance and support excitation; vibration isolation and transmissibility- Response to Non Periodic Excitations: unit impulse, unit step and unit Ramp functions; response to arbitrary excitations, The Convolution Integral; shock spectrum; System response by the Laplace Transformation method.

UNIT-II

Two degree freedom systems: Principal modes- Un-damped and damped free and forced vibrations; Un-damped vibration absorbers.

UNIT-III

Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion; Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

UNIT-IV

Vibration measuring instruments: Vibrometers, velocity meters & accelerometers.

UNIT-V

Numerical methods: Raleigh’s stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods.

TEXT BOOKS:

1. Mechanical Vibrations/Groover/Nem Chand and Bros
2. Elements of Vibration Analysis by Meirovitch, TMH, 2001
3. Mechanical Vibrations/Schaum Series/ McGraw Hill

REFERENCE BOOKS:

1. Mechanical Vibrations / SS Rao/ Pearson/ 2009, Ed 4,

2. Vibration problems in Engineering / S.P. Timoshenko.
3. Theory and Practice of Mechanical Vibrations/JS Rao & K. Gupta/New Age Intl. Publishers/Revised 2nd Edition.

OUTCOMES:

- Ability to analyze the mechanical model of a linear vibratory system
- To get the exposure of its response.
- Know about different Vibrometers.

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IV Year B. Tech ME - I Sem

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(R15A0390) COMPUTER AIDED DESIGN AND COMPUTER AIDED MANUFACTURING LAB

Objectives:

The students will learn to:

- Explain basic concepts of CIM systems
- Develop machining programs for CNC equipment
- Develop PLC-based control systems for manufacturing cells

LIST OF EXPERIMENTS:

1) Determination of deflection and stresses in 2D and 3D trusses and beams.
2) Determination of deflections component and principal and Von-mises stresses in . plane stress, plane strain and Axisymmetric components.
3) Determination of stresses in 3D and shell structures (at least one example in each . case)
4) Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
5) Steady state heat transfer Analysis of plane and Axisymmetric components.
6) Development of process sheets for various components based on tooling Machines.
7) Development of manufacturing and tool management systems.
8) Study of various post processors used in NC Machines.
9) Development of NC code for free form and sculptured surfaces using CAM packages.
10) Machining of simple components on NC lathe by transferring NC Code / from a CAM package.

Any Three Software Packages from the following:

Use of Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM,Master CAM etc.

Open source Softwares :

MAT LAB, NASTRON, HYPERMESH, PATRAN

OUTCOMES:

This course primarily contributes to Mechanical Engineering program outcomes:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design a system, component, or process to meet desired needs within realistic constraints.
- Economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

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IV Year B. Tech ME - I Sem

L	P	C
0	3	2

(R15A0391) MECHANICAL MEASUREMENTS AND CONTROL SYSTEMS LAB / PRODUCTION DRAWING PRACTICE LAB

Objectives:

- To prepare the students have successful career in industry and motivate for higher education.
- To provide strong foundation in basic science and mathematics necessary to formulate, solve and
- analyze Control and Instrumentation problems
- To provide strong foundation in circuit theory, control theory and signal processing concepts.
- To provide good knowledge of Instrumentation systems and their applications.
- To provide knowledge of advanced control theory and its applications to engineering problems.
- Student able to learn about representation of materials, fits and estimation of limits , tolerances

MECHANICAL MEASUREMENTS AND CONTROL SYSTEMS LAB

LIST OF EXPERIMENTS:

1. Calibration of Pressure Gauges
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for temperature measurement.
4. Calibration of thermocouple for temperature measurement.
5. Calibration of capacitive transducer for angular displacement.
6. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
7. Study and calibration of Mcleod gauge for low pressure.

PRODUCTION DRAWING PRACTICE LAB

UNIT-I

Conventional representation of Materials – conventional representation of parts – screw joints, welded joints, springs, gears, electrical, hydraulic and pneumatic circuits – methods of indicating notes on drawings.

UNIT-II

Limits and Fits: Types of fits, exercises involving selection/interpretation of fits and estimation of limits from tables.

UNIT-III

Form and Positional Tolerances: Introduction and indication of the tolerances of from and position on drawings, deformation of runout and total runout and their indication.

UNIT-IV

Surface roughness and its indication: Definitions – finishes obtainable from various manufacturing processes, recommended surface roughness on mechanical components.

UNIT-V

Detailed and Part drawings: Drawing of parts from assembly drawings with indications of size, tolerances, roughness, form and position errors etc.

Heat treatment and surface treatment symbols used on drawings.

TEXT BOOKS:

1. Production and Drawing – K.L. Narayana & P. Kannaiah/New Age
2. Machine Drawing with Auto CAD – Pohit and Ghosh.PE
3. Machine Drawing by Venkat Reddy and Kannaiah.

REFERENCE BOOKS:

1. Geometric dimensioning and tolerancing- James D. Meadows/B.S Publications.
2. Engineering Metrology,R.K. Jain, Khanna Publications .
3. Machine Drawing by R.K.Jain/ Khanna Publications, New Delhi.

OUTCOMES:

- Ability to understand and apply differential equations, integrals, matrix theory, probability theory and Laplace, Fourier and Z transformations for engineering problems
- Ability to understand and apply basic science, circuit theory, control theory signal processing and apply them to engineering problems.
- Ability to model and analyze transducers.
- Ability to understand and analyze Instrumentation systems and their applications to various industries.
- Student get expourse of limits, fits, tolerences and different symbols used in drawing practice.

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5	1	4

(R15A0340) PRODUCTION PLANNING AND CONTROL
(CORE ELECTIVE – V)

Objectives:

- The objective of this subject is to provide knowledge of Planning and control of Industry.
- Able learn about different forecasting techniques.
- Able learn about Inventory Management.

UNIT –I

Introduction : Definition – Objectives of production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

UNIT –II

Forecasting: Importance of forecasting – Types of forecasting, their uses – General principles of forecasting – Forecasting techniques – qualitative methods and quantitive methods.

UNIT –III

Inventory management: Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems, Introduction to MRP & ERP, LOB (Line of Balance), JIT inventory, and Japanese concepts.

UNIT –IV

Routing : Definition –Routing procedure –Route sheets – Bill of material – Factors affecting routing procedure. Schedule –definition – Difference with loading, Scheduling Policies – Techniques, Standard scheduling methods. Job shop, flow shop

UNIT –V

Line Balancing: Aggregate planning, Chase planning, Expediting, controlling aspects. Dispatching – Activities of dispatcher – Dispatching procedure – follow-up – definition – Reason for existence of functions – types of follow-up, applications of computer in production planning and control.

TEXT BOOKS:

1. Elements of Production Planning and Control / Samuel Eilon / Macmillan Publishers
2. Modern Production and operation managements / Baffa & Rakesh Sarin / John Wiley Publishers
3. Operations Management / Joseph Monks / McGraw-Hill Ryerson Publishers

REFERENCE BOOKS:

1. Operations Management / S.N. Chary/ TMH Publishers
2. Reliability Engineering & Quality Engineering / Dr. C. Nadha Muni Reddy and Dr. K.Vijaya Kumar Reddy / Galgotia Publications, Pvt., Limited.
3. Production Control A Quantitative Approach / John E. Biegel/ Prentice-Hall

OUTCOMES:

- Student should be able to understand the co-ordination between Production, Planning and control systems in manufacturing.
- Student should know about line balancing.
- Student should know about routing and scheduling.

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IV Year B. Tech, ME-II Sem

L	T/P/D	C
5	1	4

(R15A0341)MAINTANANCE AND SAFETY ENGINEERING (CORE ELECTIVE–V)

Objectives:

- To ensure the desired plant availability at an optimum cost within the safety prescription.
- Student able to know about the objectives of maintenance .
- To minimize the total cost of unavailability and resources.

UNIT-I

Introduction to the Development of Industrial Safety and Management: History and development of Industrial safety: Implementation of factories act, Formation of various councils, Safety and productivity, Safety organizations. Safety committees, safety committee structure, Roll of management and roll of Govt. in industrial safety, Safety analysis.

UNIT-II

Accident Preventions, Protective Equipments and the Acts: Personal protective equipment, Survey the plant for locations and hazards, Part of body to be protected, Education and training in safety, Prevention causes and cost of accident, Housekeeping, First aid, Fire fighting equipment, Accident reporting, Investigations, Industrial psychology in accident prevention, Safety trials.

UNIT-III

Safety Acts: Features of Factory Act, Introduction of Explosive Act, Boiler Act, ESI Act, Workman's compensation Act, Industrial hygiene, Occupational safety, Diseases prevention, Ergonomics, Occupational diseases, stress, fatigue, health, safety and the physical environment, Engineering methods of controlling chemical hazards, safety and the physical environment, Control of industrial noise and protection against it, Code and regulations for worker safety and health.

UNIT-IV

Principles and Practices of Maintenance Planning: Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability, Equipment Life cycle, Measures for Maintenance Performance: Equipments breakdowns, Mean Time Between Failures, Mean Time To Repair, Factors of availability, Maintenance organization, Maintenance economics.

UNIT-V

Maintenance Policies and Preventive Maintenance:

Maintenance categories – Comparative merits of each category – Preventive maintenance, Maintenance schedules: Repair cycle, Principles and methods of lubrication, Fault Tree Analysis, Total Productive Maintenance: Methodology and Implementation.

TEXT BOOKS:

1) Industrial Maintenance Management Srivastava, S.K. - S. Chand and Co.
2) Occupational Safety Management and Engineering Willie Hammer - Prentice Hall
3) Installation, Servicing and Maintenance Bhattacharya, S.N. - S. Chand and Co.

REFERENCE BOOKS:

1) Occupational Safety Management and Engineering Willie Hammer - Prentice Hall
2) Reliability, Maintenance and Safety Engineering by Dr. A. K. Gupta
3) A Textbook of Reliability and Maintenance Engineering by Alakesh Manna.

OUTCOMES:

- Assemble, dismantle and align mechanisms in sequential order.
- Carry out plant maintenance using tri-bology, corrosion and preventive maintenance.
- Student gets the exposure of Maintenance Policies and Preventive Maintenance.

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L	T/P/D	C
5	1	4

(R15A0342) MATERIAL HANDLING SYSTEMS (CORE ELECTIVE–V)

Objectives:

- To provide knowledge of Layout planning and different material handling equipments.
- To provide knowledge of Flexible hoisting appliances.
- To provide knowledge of Load handling attachments and Arresting gear.

UNIT–I

Introduction : Types of interplant transporting facility, principal groups of material handling equipments, choice of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments.

UNIT–II

Flexible hoisting appliances: Ropes and chains, welded load chains, roller chains, selection of chains hemp rope and steel wire rope, selection of ropes, fastening of chains and ropes , different types of load suspension appliances, fixed and movable pulleys, different types of pulley systems, multiple pulley systems . Chain and rope sheaves and sprockets.

UNIT–III

Load handling attachments: Standard forged hook, hook weights, hook bearings, cross piece and casing of hook, crane grab for unit and piece loads, carrier beams and clamps, load platforms and side dump buckets, electric lifting magnets, grabbing attachments for loose materials, crane attachments for handling liquid materials.

UNIT–IV

Arresting gear: Ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thruster operated, controller brakes, shoe brakes, thermal calculations of shoe brakes and life of linings, safety handles, load operated constant force and variable force brakes general theory of band brakes, its types and construction.

UNIT–V

Methods to minimize cost of material handling-Maintenance of Material Handling Equipments, Safety in handling Ergonomics of Material Handling equipment. Design, Miscellaneous equipments.

TEXT BOOKS:

1. Materials Handling Equipment – N. Rudenko , Envee Publishers , New Delhi
2. Materials Handling Equipment – M.P. Alexandrov. Mie publicat ions, Masko
3. Introduction to Materials Handling Ray, Siddhartha .

REFERENCE BOOKS:

1. Material Handling HDBK (Mcgraw-Hill Handbooks) by David E. Mulcahy
2. Materials Handling Equipment by Nikola Ƒeodos'evich Rudenko, Nikolaĭ Feodos'evich Rudenko.
3. Materials Management By P GOPALAKRISHNAN, M SUNDARESAN

OUTCOMES:

- The students shall be able to know different handling equipment in manufacturing industry at different stages.
- Student gets the exposure of Methods to minimize cost of material handling.
- Student gets the exposure of Chain and rope sheaves and sprockets.

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(R15A0343) MANUFACTURING MANAGEMENT (OPEN ELECTIVE–VI)

Objectives:

- To plan production facilities in the best possible manner along with the proper systematic planning of production activities.
- Providing men, machines, materials etc. of right quality, quantity and also providing them at the right time forms a very important factor.
- Able to learn about different Forecasting Methods.

UNIT-I

Manufacturing Systems Designs: Definition, Systems, Subsystems, Systems Approach Fundamentals, Systems Approach for designing, Manufacturing Systems, Systematic Layout Planning (SLP),Computerized Plant Layout- CRAFT, ALDEP, CORELAP, Assembly Line balancing, Problems and solutions of assembly lines, Group Technology & Cellular Systems, Classification & Grouping, overview of FMS. Strategic consideration for comparison of various systems.

UNIT-II

Manufacturing Systems Economics: Concept of time value of money, Preparation of time profile of project, Single payment, Equal Series payment, various machine and project selection & evaluation techniques: Payback period, Present worth, Equivalent annual cost, Cost- benefit ratio, Evaluation for both equal & unequal life. Depreciation concept, various methods-straight line, declining balance, Sum of the digits, Sinking fund.

UNIT-III

New Product Development (NPD): Product Development, Customer Need, Strategies for New Product Development, Product life cycle, Product status. PUGH total Design approach, PAHL & BEITZ Approach, Project Approach, Cross functional Integration –Design, manufacturing, Marketing, Concurrent Engineering, Modular Design, Standardization Value Engineering & Analysis.

Manufacturing Planning & Control Systems: Overview of Aggregate Planning Models, Linear Decision Rules, Management Coefficient, Direct Search Methods, Master Production Schedule, Modular Bill and Materials, Capacity planning & control, language, medium range, short range capacity planning, Just- in Time (JIT), Manufacturing –Philosophy, Elements, KANBAN, effects on layout, workers & vendors, Optimized Production Technology (OPT).

UNIT-IV

Forecasting Methods: Forecasting Framework, Forecasting cost and accuracy, Forecasting Uses and Methods – Delphi, Exponential Smoothing, Forecasting 109 Errors – MAD, Regression Methods _ Linear Model for single & multiple variables, Brief idea of computerized forecasting systems.

Material Requirements Planning (MRP): Definition of MRP systems. MRP versus Order point, MRP Elements, Types of MRP – MRP I & II. Structured Bill of Materials. Regenerative & Net change MRP, Operating an MRP, Integration of Production & Inventory Control.

UNIT-V

Maintenance & Reliability: Concept of preventive & breakdown maintenance, maintenance cost, optimal preventive maintenance simple replacement models individual and group replacement, MAPI - methods, reliability definitions, failure analysis and curve, systems reliability- series parallel, redundancy, methods of improving reliability, MTBF, MTTR, Maintainability, availability, brief concept of tero-technology.

TEXT BOOKS:

1. Management in Engineering – FREEMAN-BALL & BALKWILL, PHI, New Delhi.
2. Operations Management – SCHOROEDER, MGH, New York.
3. Production Operations Management – CHARY, TMH, New Delhi.

REFERENCE BOOKS:

1. Production Operations Management – ADAM & EBERT, PHL, New Delhi
2. Operational Management –MONKS, McGraw Hill, Int.
3. Evolutionizing Product Development – WHEELWRIGHT & CLARK, Free Press.

OUTCOMES:

- Apply advanced manufacturing concepts and the technologies that will support manufacturers which replace obsolete methods and processes within an overall structure.
- Explore the evolution of ERP/MRP systems, how a variety of manufacturing companies use this tool to plan, monitor and improve productivity, and
- Student expose to use the data generated to support strategic decision making.

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(R15A0344) AUTOMATION IN MANUFACTURING (CORE ELECTIVE–VI)

Objectives:

- To perform one or more processing and/or assembly operations on a starting raw material, part, or set of parts.
- To perform a sequence of automated or mechanized assembly operations Flexible manufacturing system (FMS)—a highly automated machine cell that produces part
- To know product families often consists of workstations comprising CNC machine tools.

UNIT –I

Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools, Mechanical Feeding and to changing and machine tool control transfer the automation.

UNIT –II

Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines .

UNIT –III

Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT –IV

Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

Automated storage systems: Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT –V

Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in manufacturing.

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

TEXT BOOKS:

1. M.P.Groover 3e - Automation, Production Systems and Computer Integrated Manufacturing, PHI,2009.
2 Frank Lamb - Industrial Automation , Mc Graw Hill,2013
3. W. Buekinsham - Automation ,

REFERENCE BOOKS:

1. Nick Dawkins - Automation and Controls
2. Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang - Computer Aided Manufacturing, Pearson 2009
3. Peter G. Martin and Gregory Hale - Automation Made Easy

OUTCOMES:

- Students will get exposure to workstation, which refers to the location in the factory where some well-defined task or operation is accomplished by an automated machine.
- Worker-and-machine combination, or a worker using hand tools
- Student gets exposure on portable power tools.

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5	1	4

(R15A0345) TRIBOLOGY
(CORE ELECTIVE–VI)

Objectives:

- After successful completion of this course, students will be ableto know about properties of lubricants, modes of lubrication, additives etc.
- To Select suitable/proper grade lubricant for specific application.
- To select suitable material combination for tribological contact.

UNIT-I

Study of various parameters: Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used. Hydrostatic lubrication: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

UNIT-II

Hydrodynamic theory of lubrication: Various theories of lubrication, petroffs equation, Reynold's equation in two dimensions -Effects of side leakage - Reynolds equation in three dimensions, Friction in sliding bearing, hydro dynamic theory applied to journal bearing, minimum oil film thickness, oil whip and whirl anti-friction bearing.

UNIT–III

Friction and power losses in journal bearings : Calibration of friction loss friction in concentric bearings,bearing modulus, Sommerfield number, heat balance, practical consideration of journal bearing design considerations.

UNIT-IV

Air lubricated bearing: Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.

Bearing materials : General requirements of bearing materials, types of bearing materials.

UNIT-V

Types of bearing oil pads: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings. Study of current concepts of boundary friction and dry friction.

TEXT BOOKS:

1. Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI
2. Tribology in Industry **:** Sushil Kumar Srivatsava, S. Chand &Co.
3. Neale MJ, (Editor) — Tribology hand Book||Neumann Butterworths, 1975

REFERENCE BOOKS:

1. Tribology – B.C. Majumdar
2. Rowe WW& O' Dionoghue,||Hydrostatic and Hybrid bearing design — Butterworths . & Co.Publishers Ltd,1983.
3. Collacott R.A,|| Mechanical Fault diagnosis and condition monitoring||, Chapman and Hall, London 1977.

OUTCOMES:

- For these simplified course contents, student develops confidence in him/her to fulfill course objectives.
- He/she proves himself/herself to be excellent practical engineer in any tribological industry.
- To get the exposure about suggest an explanation to the cause of tribological failures.

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ME-II Sem

L	T/P/D	C
0	0	4

(R15A0392) MINI PROJECT

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ME-II Sem

L	T/P/D	C
0	6	2

(R15A0393) TECHNICAL SEMINAR

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

IV Year B. Tech, ME-II Sem

L	T/P/D	C
0	15	10

(R15A0394) MAJOR PROJECT