ACADEMIC REGULATIONS, COURSE STRUCTURE

AND DETAILED SYLLABUS
UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from the Academic Year 2015-16

M. Tech. Two Year Degree Course

(MR-15 Regulations)

in

Thermal Engineering (T E)

Department of Mechanical Engineering

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

(An Autonomous Institution approved by UGC and affiliated to JNTUH, Approved by AICTE & Accredited by NAAC with 'A' Grade and NBA & Recipient of World Bank Assistance under TEQIP Phase – II, S.C 1.1)

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

MR 15– ACADEMIC REGULATIONS (CBCS) FOR M. Tech. (REGULAR) DEGREE PROGRAMME

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

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

INSTITUTION VISION

A Culture of excellence , the hallmark of MREC as world class education center to impart Technical Knowledge in an ambience of humanity, wisdom, intellect, creativity with ground breaking discovery, in order to nurture the students to become Globally competent committed professionals with high discipline, compassion and ethical values.

INSTITUTION MISSION

Commitment to progress in mining new knowledge by adopting cutting edge technology to promote academic growth by offering state of art Under graduate and Post graduate programmes based on well-versed perceptions of Global areas of specialization to serve the Nation with Advanced Technical knowledge.

DEPARTMENT VISION

To provide world class platform for education, Research and knowledge technical skill in Mechanical Engineering and to create leaders with passion for innovation to ensure environment friendly development needs of the society.

DEPARTMENT MISSION

Create innovative learning atmosphere with superior and environment friendly infrastructure, for better understanding of the technical knowledge in practical situations, so as to make them effective ethical and global leaders.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO I : To prepare students for their successful career in industry to meet the needs of Indian and Global companies with sound scientific and Engineering Knowledge for life long learning and introduce them to professional ethics and sustainable development.

PEO-II: To develop the ability among students to synthesize data, interpret them appropriately and be able to apply concepts to thermal system design or to a mechanical subsystem of an interdisciplinary system.

PEO-III: To provide opportunity for the students to work in their individual capacity as well as to function as teams in multidisciplinary projects and to develop attitude towards self employment through entrepreneurship.

PROGRAMME OUTCOMES (POs)

PO1: PG Students can acquire in depth knowledge in their specialized area of Thermal Engineering.

PO2: PG Students can exhibit their ability in analyzing the complex Engineering problems in the field of Thermal Engineering apart from solving the subject problems.

PO3: PG Students can demonstrate their ability to think and work independently in providing various solutions to a problem without supervision, by due considering the importance level of the technical requirement.

PO4: PG Students can have the opportunity of working in research and development environment in both private and government organizations, also able to develop intellectual property, patents.

PO5: PG Students can become familiar with modern Engineering software tools and equipment which enables them industry ready, enhances the career opportunities.

PO6: PG Students can transform their ideas in developing new products by becoming self entrepreneurs and modernize & benefit the society, empower themselves society responsible.

PO7: PG Students are capable of generating technical documents or reports with high standards, which was imparted to them through training on communication skills, particularly verbal and written.

PO8: PG Students can achieve the targets of the organization and improve the business by managing a team and building interpersonal relationship in a team environment with their communication skills.

PO9: PG Students can opt for higher education particularly in research field of their specialization, can update their technical knowledge through continuous learning process, being a member of professional body through research publications and in turn contribute back to the technical community.

PO10: PG Students can demonstrate their professional, ethical values expected from the society.

PO11: PG Students can realize the importance and impact of Thermal Engineering on to the global environmental perspective and exhibit their skills and knowledge for continuous development.

1.0 ELIGIBILITY FOR ADMISSIONS :

Admission to the above programme shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.
Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the Government of Telangana or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.0 AWARD OF M.Tech. DEGREE :

2.1 A student shall be declared eligible for the award of the M.Tech. Degree, if the student pursues a course of study in not less than two and not more than four academic years. However, the student is permitted to write the examinations for two more years after four academic years of course work, failing which the student shall forfeit the seat in M. Tech. programme.

2.2 The student shall register for all 88 credits and secure all the 88 credits.

2.3 The minimum instruction days in each semester are 90.

3.0 COURSES OF STUDY :

The following specializations are offered at present for the M. Tech. programme of study.

1. Computer Science and Engineering
2. Digital Systems and Computer Electronics
3. Electrical Power Systems
4. Embedded Systems
5. Geotechnical Engineering
6. Machine Design
7. Structural Engineering
8. Thermal Engineering
9. VLSI System Design

and any other programme as approved by the University from time to time.

3.1 Departments offering M. Tech. Programmes with specializations are noted below:

CE	GTE	Geo Technical Engineering
	SE	Structural Engineering
EEE	EPS	Electrical Power Systems
ME	MD	Machine Design
	TE	Thermal Engineering
ECE	DSCE	Digital Systems and Computer Electronics
	ES	Embedded Systems
	VLSI SD	VLSI System Design
CSE	CSE	Computer Science and Engineering

4 COURSE REGISTRATION :

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

4.2 Academic Section of the College invites 'Registration Forms' from students within 15 days from the commencement of class work for the first semester through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE Registration Requests for any 'SUBSEQUENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'CURRENT SEMESTER'.

4.3 A Student can apply for ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from the Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries during ON-LINE Registration for the Subject(s) / Course(s) under a given/ specified Course Group/ Category as listed in the Course Structure, only the first mentioned Subject/ Course in that Category will be taken into consideration.

4.5 Subject/ Course Options exercised through ON-LINE Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

5 ATTENDANCE :

The programmes are offered on a unit basis with each subject/course being considered as a unit.

5.1 Attendance in all classes (Lectures/Laboratories etc.) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the days of attendance in sports, games, NCC and NSS activities for appearing for the Semester End examination (SEE). A student shall not be permitted to appear for the Semester End Examinations (SEE) if his attendance is less than 75%.

5.2 Condonation of shortage of attendance in each subject up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee (CAC).

5.3 Shortage of Attendance below 65% in each subject shall not be condoned.

5.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their end Semester End Examination of that subject and their registration shall stand cancelled.

5.5 A fee prescribed by the CAC, shall be payable towards Condonation of shortage of attendance.

5.6 A Candidate shall put in a minimum required attendance in atleast three (3) theory subjects in I semester for promoting to II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements

of the subjects, as per the course structure.

5.7 A student shall not be promoted to the next semester unless the student satisfies the attendance requirement of the present Semester, as applicable. The student may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, the student shall not be eligible for readmission into the same class.

6 EVALUATION - DISTRIBUTION AND WEIGHTAGE OF MARKS: :

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Continuous Internal Evaluation and Semester End Examinations. For all Subjects/ Courses, the distribution shall be 40 marks for CIE, and 60 marks for the SEE

6.1 Theory Courses :

6.1.1 Continuous Internal Evaluation (CIE):

The CIE consists of two Assignments each of 05 marks and two mid-term examinations each of 35 marks. The CIE shall be finalized based on the 70% of the best performed and 30% of the other performance.The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

First Assignment should be submitted before the conduct of the first mid-term examinations, and the Second Assignment should be submitted before the conduct of the second midterm examinations. The Assignments shall be as specified by the concerned subject teacher.. Each mid-term examination shall be conducted for a total duration of 120 minutes, for 35 marks.

The division of marks for CIE is as given below:

Mid – Term Examination				
Part	**Type of Questions**	**No. of questions**	**Marks per question**	**Total**
Part A	Multiple-choice questions	10	0.5	05
	Fill-in the blanks	10	0.5	05
	Sub-Total			10
Part B	Compulsory questions	5	2	10
Part C	Choice questions (3 out of 5)	3	5	15
			Mid-Term Exam Total	35
			Assignment	05
			Grand Total	40

6.1.2 Semester End Examination (SEE):

The division of marks for SEE is as given below:

Semester End Examination				
Part	**Type of Questions**	**No. of questions to be answered**	**Marks per question**	**Total**
Part A	Compulsory Questions (One from each module)	5	4	20
Part B	Choice Questions (5 out of 8) (Minimum one from each module)	5	8	40
			Grand Total	60

6.2 **Practical Courses:**

6.2.1 Continuous Internal Evaluation (CIE):

There will be CIE for 40 marks, shall be awarded with a distribution of 20 marks for day-to-day performance and timely submission of lab records, 5 marks for viva-voce, 15 marks for internal lab exam (best out of two exams).

6.2.2 Semester End Examination (SEE):

There will be SEE for 60 marks, shall be awarded with a distribution of 20 marks for write-up on the given experiment, 20 marks for proficiency in the exam, 10 marks for results and 10 marks for viva-voce. For conducting SEE, one internal examiner and one external examiner will be appointed by the Chief Controller of Examinations of the College. The external examiner should be selected from outside the College among the autonomous/reputed institutions, from a panel of three examiners submitted by the concerned Head of the Department.

6.3 **Seminar:**

There shall be two seminar presentations during I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 100 marks with a distribution of 30 marks for the report, 50 marks for presentation and 20 marks for the queries. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

6.4 Comprehensive Viva-Voce:

There shall be a Comprehensive Viva-Voce in III Semester. The Comprehensive Viva-Voce is intended to assess the students' understanding of various subjects studied during the M. Tech. course of study. The Head of the Department shall be associated with the conduct of the Comprehensive Viva-Voce through a Committee. The Committee consists of the Head of the Department, one senior faculty member and an external examiner. The external examiner shall be appointed by the Chief Controller of Examinations from a panel of three examiners submitted by the concerned Head of the Department. There are no

internal marks for the Comprehensive Viva-Voce and evaluates for maximum of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examinations.

6.5. **General:** A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the Semester End Examination and a minimum of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together. In case the candidate does not secure the minimum academic requirement in any subject he has to reappear for the Semester End Examination in that subject. A candidate shall be given one chance to re-register for the subject if the internal marks secured by the candidate are less than 50% and failed in that subject. This is allowed for a maximum of three subjects and should register within two weeks of commencement of that semester class work. In such a case, the candidate must re-register for the subjects and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon the eligibility for writing the Semester End Examination in those subjects. In the event of the student taking another chance, the student's Continuous Internal Evaluation (CIE) marks and Semester End Examination (SEE) marks obtained in the previous attempt stands cancelled.

7 EXAMINATIONS AND ASSESSMENT - THE GRADING SYSTEM :

7.1 Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab / Practicals, or Seminar, or Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

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

% of Marks Secured (Class Intervals)	Grade Points	Letter Grade (UGC Guidelines)
≥ 80%	10	O (Outstanding)
≥ 70% to < 80%	9	A+ (Excellent)
≥ 60% to < 70%	8	A (Very Good)
≥ 55% to < 60%	7	B+ (Good)
≥ 50% to < 55%	6	B (Above Average)
< 50%	0	F (Fail)
Absent	Ab	Ab

7.3 A student obtaining F Grade in any Subject shall be considered 'failed' and is be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those Subjects will remain the same as those he obtained earlier.

7.4 A student not appeared for examination then 'Ab' Grade will be allocated in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conducted.

7.5 A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.

7.6 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'.

7.7 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding 'Credit Points' (CP) is computed by multiplying the Grade Point with Credits for that particular Subject/ Course.
Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

7.8 The Student passes the Subject/ Course only when he gets GP ≥ 6(B Grade or above).

7.9 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (∑CP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as:

$$\text{SGPA} = \left\{\sum_{i=1}^{N} C_i G_i\right\} / \left\{\sum_{i=1}^{N} C_i\right\} \ldots \text{For each Semester}$$

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N'is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), C_i is the no. of Credits allotted to the i^{th} Subject, and G represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i^{th} Subject.

7.10 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the II Semester onwards, at the end of each Semester, as per the formula

$$\text{CGPA} = \left\{\sum_{j=1}^{M} C_j G_j\right\} / \left\{\sum_{j=1}^{M} C_j\right\} \ldots \text{for all S semesters registered}$$
(i.e., upto and inclusive of S semesters, S ≥ 2)

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the j^{th} Subject, and G_j represents the Grade Points (GP)corresponding to the Letter Grade awarded for that j^{th} Subject. After registration and completion of I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

7.11 For Calculations listed in Item 7.6 – 7.10, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/Courses will also be included in the multiplications and summations.

8. EVALUATION OF PROJECT/DISSERTATION WORK :

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

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

8.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

8.3 After satisfying 8.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

8.5 A candidate shall submit his project status report in two stages at least with a gap of 3 months between them.

8.6 The work on the project shall be initiated at the beginning of the III Semester and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.
Note: *The project supervisor/guide has to ensure that the student has to publish a minimum of one paper related to the thesis in a National/International Conference/Journal.*

8.7 For the final approval by the PRC, the soft copy of the thesis should be submitted for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less than 24%, then only thesis will be accepted for submission.

8.8 Three copies of the Project Thesis certified by the supervisor, HOD and Principal shall be submitted to the Chief Controller of Examinations for project evaluation (viva voce).

8.9 For Project work part-I in III Semester there is an internal marks of 50, the evaluation should be done by the PRC for 30 marks and Supervisor will evaluate for 20 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain. A candidate has to secure a minimum of 50% of marks to be declared successful for Project work part-I. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examination.

8.10 For Project work part-II in IV Semester there is an internal marks of 50, the

evaluation should be done by the PRC for 30 marks and Supervisor will evaluate for 20 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. A candidate has to secure a minimum of 50% of marks to be declared successful for Project work part-II. If the student fails to fulfill minimum marks, the student has to reappear during the supplementary examination.

8.11 For Project Evaluation (Viva Voce) in IV Semester there is an external marks of 150 and the same evaluated by the External examiner appointed by the Chief Controller of Examinations. For this, the Head of the Department shall submit a panel of 3 examiners, eminent in that field, with the help of the supervisor/guide concerned. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

8.12 If the student fails to fulfill as specified in 8.11, based the recommendation of the external examiner, the student will reappear for the Viva-Voce examination with the revised thesis only after three months. In the reappeared examination also, fails to fulfill, the student will not be eligible for the award of the degree.

8.13 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva-Voce examination.

9. AWARD OF DEGREE AND CLASS :

9.1 A Student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **88** Credits (with CGPA $\geq$ 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with specialization as he admitted.

9.2 Award of Class

After a student has satisfied the requirements prescribed for the completion of the programme and is eligible for the award of M. Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	CGPA
First Class with Distinction	≥ 7.75
First Class	≥ 6.75 and < 7.75
Second Class	≥ 6.00 and < 6.75

9.3 A student with final CGPA (at the end of the PGP) < 6.00 will not be eligible for the Award of Degree.

10. 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.

11. TRANSITORY REGULATIONS :

11.1 If any candidate is detained due to shortage of attendance in one or more subjects, they are eligible for re-registration to maximum of three earlier or equivalent subjects at a time as and when offered.

11.2 The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per MR15 Academic Regulations.

12. GENERAL :

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

12.2 **Credit Point:** It is the product of grade point and number of credits for a course.

12.3 Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her".

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

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

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	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 SEE)	Expulsion from the examination hall and cancellation of the performance in that course 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 course 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 that course of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the courses of that Semester. The Hall Ticket of the candidate shall be cancelled.
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 courses of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme 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 course and all the other courses the candidate has already appeared including practical examinations and

		project work and shall not be permitted for the remaining examinations of the courses of that semester. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that course.
6	Refuses to obey the orders of the Chief Controller of Examinations (CCE) / Controller of Examinations (CE) / Assistant Controller of Examinations (ACE) / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction 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 course and all other courses the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the courses of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police cases 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 course and all the other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all SEE. The continuation of the programme 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. 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.	Expulsion from the examination hall and cancellation of the performance in that course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester. 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 course and all other courses the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the courses of that semester.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that course and all other courses the candidate has appeared including practical examinations and project work of that SEE.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the CCE for further action toward suitable punishment.	

Note: ***The student(s) found indulging in malpractices during the CIE also will be punished based on the recommendations of the College Academic Committee.***

MALLA REDDY ENGINEERING COLLEGE (Autonomous)

Academic Year 2015-16 (Choice Based Credit System)

COURSE STRUCTURE – M.TECH THERMAL ENGINEERING (TE)

(MR15 Regulations)

I SEMESTER

S. No.	Category	Course Code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CC I	53101	Advanced Thermodynamics	4	--	--	4	40	60	100
2	CC II	53102	Advanced I.C Engines	4	--	--	4	40	60	100
3	CC III	53103	Advanced Fluid Mechanics	4	--	--	4	40	60	100
4	PE I	53104	Non-Conventional Energy Sources	4	--	--	4	40	60	100
		53105	Refrigeration & Air Conditioning							
		53106	Turbo- Machines							
5	PE II	53107	Thermal and Nuclear Power Plants	4	--	--	4	40	60	100
		53108	Thermal Measurements and Process Controls							
		53109	Advanced materials for thermal systems							
6	OE I	50B16	Advanced Optimization Techniques & Applications	4	--	--	4	40	60	100
		53110	Solar Energy Technology							
		53111	Nano Technology							
7	Laboratory I	53112	Thermal Engineering Lab	--	--	4	2	40	60	100
8	Seminar I	53113	Seminar - I	--	--	4	2	100	--	100
			Total	24	--	8	28	Contact Periods: 32		

II SEMESTER

S. No.	Category	Course Code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CC IV	53114	Fuel Combustion & Environment	4	--	--	4	40	60	100
2	CC V	53115	Advanced Heat & Mass Transfer	4	--	--	4	40	60	100
3	CC VI	53116	Computational Fluid Dynamics	4	--	--	4	40	60	100
4	PE III	53117	Alternate fuels.	4	--	--	4	40	60	100
		53118	Cryogenic Engineering							
		53119	Jet Propulsion & Rocket Engineering							
5	PE IV	53120	Convective Heat Transfer	4	--	--	4	40	60	100
		53121	Equipment design for thermal systems.							
		53122	Computer Simulation of SI & CI Engine							
6	OE II	53123	Advanced Finite Element Analysis	4	--	--	4	40	60	100
		53124	Energy Management							
		53125	Nano fluids							
7	Laboratory II	53126	Computational Methods Lab	--	--	4	2	40	60	100
8	Seminar II	53127	Seminar - II	--	--	4	2	100	--	100
Total				24	--	8	28	Contact Periods: 32		

III Semester

S. No.	Category	Course Code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	CV	53128	Comprehensive Viva-Voce	--	--	--	4	--	100	100
2	PR I	53129	Project work Part I	--	--	16	8	50	--	50
			Total	--	--	16	12	Contact Periods: 16		

IV Semester

S. No.	Category	Course Code	Name of the course	Contact hours/week			Credits	Scheme of Valuation		Total Marks
				L	T	P		Internal (CIE)	External (SEE)	
1	PR II	53130	Project work Part II	--	--	16	8	50	--	50
2	PR III	53131	Project Viva-Voce	--	--	--	12	--	150	150
			Total	--	--	16	20	Contact Periods: 16		

*** CC – Core Course, PE – Professional Elective, CV – Comprehensive Viva – Voce, PR – Project Work**

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Course Code: 53101 **Credits: 4**

M.Tech - I Semester

ADVANCED THERMO DYNAMICS

MODULE – I: Thermo dynamic Laws and Corollaries: **[12 periods]**

Transient Flow Analysis – Second law of thermodynamics – Entropy - Availability and unavailability – Irreversibility – Thermo dynamic Potentials – Maxwell Relations – Specific Heat Relations – Mayer's relation - Evaluation of Thermodynamic properties of working substance.

MODULE – II: P.V.T. surface: **[10 periods]**

Equations of state – Real Gas Behaviour – Vander Waal's equation - eneralised compressibility Factor – Energy properties of Real Gases – Vapour pressure – Clausius – lapeyron Equation – Throttling – Joule – Thompson coefficient.Non-reactive Mixture of perfect Gases – Governing Laws – Evaluation of properties – Pychrometric Mixture properties and psychrometric chart – Air conditioning processes – Cooling Towers – Real Gas Mixture.

MODULE – III: Combustion: **[11 periods]**

Combustion Reactions – Enthalpy of Formation – Entropy of Formation – Reference Levels for Tables – Energy of formation – Heat of Reaction – Aiabatic flame Temperature General product – Enthalpies – Equilibrium. Chemical Equilibrium of Ideal Gases – Effects of Non-reacting Gases Equilibrium in Multiple Reactions. The vant Hoff's Equation. The chemical potential and phase Equilibrium – The Gibbs phase Rule.

MODULE- IV: **Power cycles:** **[12periods]**

Review Binary vapour cycle, co-generation and Combined cycles – Refrigeration cycles. Thermo Dynamics off irreversible processes – Introduction – phenomenological laws – Onsagar Reciprocity Relation – Applicability of the phenomenological Relations – Heat Flux and Entropy Production – Thermo dynamic phenomena – Thermo electric circuits.

MODULE- V: **Direct Energy Conversion Introduction:** **[8 periods]**

Fuel Cells - Thermo electric energy – Thermo-ionic power generation -Thermodynamic devices Magneto Hydrodynamic Generations – Photo voltaic cells.

TEXT BOOKS:

1) P.K. Nag, **"Basic and Applied Thermodynamics"**, TMH, 2nd Edition, 2010
2) Holman, **"Thermo dynamics"**, Mc Graw Hill, 4th Edition, 1988

REFERENCE BOOKS:

1. Doolittle "**Thermo dynamics for Engineers",**John Wiley & Sons,1984
2. Sonnatag & Van Wylen, **"Fundamentals of Thermo dynamics"**, Wiley, 8th Edition,2014
3. S.R. de Groot, **"Non Equillibrium Thermo Dynamics"** Courier corporation, 1st Edition,2013
4. PL.Dhar, **"Engg. Thermo dynamics" Elsevier,** 2008**.**

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53102 **Credits: 4**

M.Tech - I Semester

ADVANCED I.C. ENGINES

MODULE- I: Introduction **[10 periods]**

Historical Review – Engine Types – Design and operating Parameters.

Cycle Analysis: Thermo-chemistry of Fuel – Air mixtures, properties – Ideal Models of Engine cycles – Real Engine cycles - differences and Factors responsible for – Computer Modeling.

MODULE-II: Gas Exchange Processes **[8 periods]**

Volumetric Efficiency – Flow through ports – Supercharging and Turbo charging.

Charge Motion: Mean velocity and Turbulent characteristics – Swirl, Squish – Pre-chamber Engine flows.

MODULE–III: Combustion: **[14 periods]**

Combustion in S.I engines: Combustion and Speed – Cyclic Variations – Ignition – Abnormal combustion Fuel factors, MPFI, SI engine testing.

Combustion in CI engines: Essential Features – Types off Cycle. Pr. Data – Fuels, Types Of Fuels Spray Behavior – Ignition Delay – Mixing Formation and control, Common rail fuel injection system

MODULE-IV: Pollutant Formation and Control: **[10 periods]**

Nature and extent of problems – Nitrogen Oxides, Carbon monoxide, unburnt Hydrocarbon and particulate – Emissions – Measurement – Exhaust Gas Treatment, Catalytic converter, SCR, Particulate Traps, Lean, NOx, Catalysts.

MODULE-V: **Engine Heat Transfer:** **[14 periods]**

Importance of heat transfer, heat transfer and engine energy balance, Convective heat transfer, radiation heat transfer, Engine operating characteristics. Fuel supply systems for S.I. and C.I engines to use gaseous fuels like LPG, CNG and Hydrogen.

Modern Trends in IC Engines

- Lean Burning and Adiabatic concepts
- Rotary Engines.
- Modification in I.C engines to suit Bio - fuels.
- HCCI and GDI concepts

TEXT BOOKS:

1. Heywood **"I.C. Engines Fundamentals",** Mc Graw Hill, 1st Edition, 1988.
2. Teylor **"The I.C. Engine in theory and Practice"** Vol.I,, IT Prof. And Vol.II, 2nd Edition,1995.

REFERENCES BOOKS

1. Obert **"I.C. Engine"s** /Int – **TEXT BOOKS:** Co., 1st Edition, 1973.
2. Maleev **"I.C. Engines"** 2nd Edition, 1975.
3. Lichty **"Combustion Engine Processes"** 2nd Edition, 1975.
4. Ferguson **"I.C. Engines"** 2nd Edition, 1975.
5. Switzer **"Scavenging of Two – stroke Cycle Engines"** 2nd Edition, 1990.
6. V.Ganesan **"I.C.Engines",** 4th Edition,2012.

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Course Code: 53103 **Credits: 4**

M.Tech - I Semester

ADVANCED FLUID MECHANICS

MODULE- I: Non – viscous flow of incompressible Fluids: **[8 periods]**

Lagrangian and Eulerain Descriptions of fluid motion- Path lines, Stream lines, Streak lines, stream tubes – velocity of a fluid particle, types of flows, Equations of three dimensional continuity equation- Stream and Velocity potential functions.

Basic Laws of fluid Flow: **[8 periods]**

Condition for irrotationality, circulation & vorticity Accelerations in Cartesystems normal and tangential accelerations, Euler's, Bernouli equations in 3D– Continuity and Momentum Equations.

MODULE-II: Principles of Viscous Flow: **[10 periods]**

Derivation of Navier-Stoke's Equations for viscous compressible flow – Exact solutions to certain simple cases : Plain Poisoulle flow - Coutte flow with and without pressure gradient - Hagen Poisoulle flow - Blasius solution.

MODULE-III: Boundary Layer Concepts: **[10 periods]**

Prandtl's contribution to real fluid flows – Prandtl's boundary layer theory - Boundary layer thickness for flow over a flat plate – Approximate solutions – Creeping motion (Stokes) – Oseen's approximation - Von-Karman momentum integral equation for laminar boundary layer — Expressions for local and mean drag coefficients for different velocity profiles.

MODULE-IV: Introduction to Turbulent Flow: **[6 periods]**

Fundamental concept of turbulence – Time Averaged Equations – Boundary Layer Equations - Prandtl Mixing Length Model - Universal Velocity Distribution Law: Van Driest Model – Approximate solutions for drag coefficients – More Refined Turbulence Models – k-epsilon model - boundary layer separation and form drag – Karman Vortex Trail, Boundary layer control, lift on circular cylinders

Internal Flow: **[6 periods]**

Smooth and rough boundaries – Equations for Velocity Distribution and frictional Resistance in smooth rough Pipes – Roughness of Commercial Pipes – Moody's diagram.

MODULE-V: Compressible Fluid Flow – I: **[5 periods]**

Thermodynamic basics – Equations of continuity, Momentum and Energy - Acoustic Velocity Derivation of Equation for Mach Number – Flow Regimes – Mach Angle – Mach Cone – Stagnation State

Compressible Fluid Flow – II: **[5 periods]**

Area Variation, Property Relationships in terms of Mach number, Nozzles, Diffusers – Fanno and Releigh Lines, Property Relations – Isothermal Flow in Long Ducts – Normal Compressible Shock, Oblique Shock: Expansion and Compressible Shocks – Supersonic Wave Drag.

TEXT BOOKS:

1. Schlichting H – "**Boundary Layer Theory"** Springer Publications, 8th Edition, 2003.
2. Michael E. Crawford **"Convective Heat and Mass Transfer"**, McGrawhill, 2nd Edition, 1983
3. W.M. Kays, M.E. Crawford **"Convective Heat and Mass Transfer"**, McGrawhill, 4th Edition,2005
4. Rajput **"Fluid Mechanics and Hydraulic Machines".** S.Chand, 1st Edition,2011

REFERENCE BOOKS:

1. Yuman S.W, "**Foundations of Fluid Mechanics",** Prentice-Hall, 1967
2. Pai, "**An Introduction to Compressible Flow",** Literary Licensing, LLC, 2013
3. Ascher H. Shapiro, "**The dynamics and thermodynamics of compressible fluid flow"** Ronald Press Co., 1953
4. D. Rama Durgaiah, "**Fluid Mechanics and Machinery"**, New Age International, 1st Edition, 2007
5. William F. Hughes & John A. Brighton "**Fluid Dynamics**", McGraw-Hill, 1967

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Course Code: 53104 **Credits: 4**

M.Tech - I Semester

NON CONVENTIONAL ENERGY SOURCES

(Professional Elective-I)

MODULE– I: Introduction: **[14 periods]**

Energy Sinario - Survey of Energy Resources – Classification – Need for Non-Conventional Energy Resources. **Solar Energy:** The Sun – Sun-Earth Relationship – Basic matter to waste heat energy circuit – Solar radiation – Attention – Radiation measuring instruments.

Solar Energy Applications: Solar water heating, space heating – active and passive heating – energy storage – selective surface – solar stills and ponds – solar refrigeration – photovoltaic generation.

MODULE– II: Geothermal Energy: **[6 periods]**

Structure of Earth – Geothermal Regions – Hot springs – Hot Rocks – Hot Aquifers – Analytical Methods to estimate Thermal Potential – Harnessing Techniques – Electricity Generating Systems.

MODULE– III: Direct Energy Conversion: Nuclear Fusion: **[8 periods]**

Fusion – Fusion Reaction- P-P Cycle carbon Cycle, Deuterium cycle – condition for controlled Fusion. Fuel Cells and Photovoltaic –Thermionic and Thermoelectric Generation – MHD Generator.

Hydrogen gas a Fuel: **[6 periods]**

Production methods – Properties – I.C. Engines Applications – Utilization Strategy – Performances.

MODULE– IV: Bio – Energy: **[6 periods]**

Biomass Energy Sources – Plant Productivity, Biomass Wastes – Aerobic and Anaerobic bio-conversion processes. The Energetics and Economics of Biomass Systems – Biomass gasification. Raw Materials and properties of Bio-gas-Bio-gas plant Technology and Status.

MODULE– V: Wind Energy: **[6 periods]**

Wind – Beaufort number – characteristics – wind energy conversion systems – types – Betz model – Interference Factor – Power Coefficient – Torque Coefficient and thrust coeff.- Lift machines and drag machines – matching – electricity generation.

Energy from Oceans: **[6 periods]**

Tidal Energy; Tides – Diurnal and Semi – Diurnal Nature – Power from Tides.

Wave Energy; Waves – Theoretical Energy Available – Calculation of period and phase velocity of waves – wave power systems – submerged devices. Ocean Thermal Energy: principles – Heat Exchangers – Pumping requirements – Practical Considerations.

TEXT BOOKS:

1. G.N.Tiwari and M.K.Ghosal **"Renewable Energy Resources – Basic Principles and Applications"** –, Narosa Pub, 2005.

REERENCE BOOKS:

1. John Twidell & Tony Weir **"Renewable Energy Resources"** 1st Edition, 2006.
2. Malcolm Flescher & Chrris Lawis **"Biological Energy Resources"** 6th Edition, 2007.

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Course Code: 53105 **Credits: 4**

M.Tech - I Semester

REFRIGERATION AND AIR CONDITIONING

(Professional Elective-I)

MODULE–I: Vapour Compression Refrigeration: **[4 periods]**

Performance of Complete vapor compression system.

Components of Vapor Compression System: **[6 periods]**

The condensing MODULE– Evaporators – Expansion valve – Refrigerants – Properties – ODP & GWP - Load balancing of vapor compression unit.

Compound Compression: **[4 periods]**

Flash inter-cooling – flash chamber – Multi-evaporator & Multistage systems.

MODULE–II: Production of low temperature: **[8 periods]**

Liquefaction system: Cascade System – Applications.– Dry ice system.**Vapor absorption system** – Simple and modified aqua – ammonia system – Representation on Enthalpy –Concentration diagram. Lithium – Bromide system Three fluid system – HCOP.

MODULE–III: Air Refrigeration: **[6 periods]**

Applications – Air Craft Refrigeration -Simple, Bootstrap, Regenerative and Reduced ambient systems – Problems based on different systems.

Steam Jet refrigeration system: **[6 periods]**

Representation on T-s and h-s diagrams – limitations and applications.

Unconventional Refrigeration system:Thermo-electric – Vortex tube & Pulse tube – working principles.

MODULE–IV: Air –conditioning: **[10 periods]**

Psychrometric properties and processes – Construction of Psychrometric chart. Requirements of Comfort Air –conditioning – Thermodynamics of human body – Effective temperature and Comfort chart – Parameters influencing the Effective Temperature. Summer, Winter and year round air – conditioning systems. Cooling load Estimation: Occupants, equipments, infiltration, duet heat gain fan load, Fresh air load.

MODULE–V: Air –conditioning Systems: **[10 periods]**

All Fresh air , Re-circulated air with and without bypass, with reheat systems – Calculation of Bypass Factor, ADP,RSHF, ESHF and GSHF for different systems. **Components:**Humidification and dehumidification equipment – Systems of Air cleaning – Grills and diffusers – Fans and blowers – Measurement and control of Temperature and Humidity.

TEXT BOOKS:

1. C.P. Arora, "**Refrigeration & Air Conditioning",** Tata McGraw-Hill Education, 2001
2. Arora & Domkundwar, Dhanpat Rai **"Refrigeration & Air Conditioning,** Dhanpat Rai, 3rd Edition, 1980

REFERENCE BOOKS:

1) Manohar Prasad **"Refrigeration and Air Conditioning**" New Age International, 2nd Edition, 2003.
2) Stoecker **"Refrigeration and Air Conditioning**: – Mc Graw Hill, 2nd Edition, 1982.
3) Dossat **"Principles of Refrigeration,** (Pearson), 4th Edition,2009.
4) Ananthanarayana **"Refrigeration and Air Conditioning**: (TMH), 4th Edition, 2013.
5) Jordan **"Refrigeration and Air Conditioning",** Prentice Hall, 2nd Edition, 1982.
6) Threlkeld **"Thermal Environmental Engg**", Prentice Hall, 3rd Edition, 1998.
7) P.L. Ballaney **"Refrigeration and Air Conditioning",** Khanna, 6th Edition,1983.
8) SC Jain **"Refrigeration and Air Conditioning",** S.Chand and Co. Ashrae Hand Book: 2 Vols.

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Course Code: 53106 **Credits: 4**

M.Tech - I Semester

TURBO MACHINES

(Professional Elective-I)

MODULE– 1: Fundamentals of Turbo machines: **[8 periods]**

Classification, Applications Thermodynamic analysis; Isentropic flow, Energy transfer; Efficiencies; static and Stagnation conditions; continuity equation; Euler's flow through variable cross sectional area; unsteady flow in turbo machines.

MODULE–II: Steam Nozzles: **[6 periods]**

Convergent and Convergent – Divergent nozzles; Energy balance; effect of back – pressure on the analysis; Design of nozzles.

Steam Turbines: **[6 periods]**

Impulse Turbines: Compounding; work done and velocity triangles; Efficiencies; Constant Reaction Blading; Design of blade passages, angles and height; Secondary flow; leakage losses; Thermodynamic analysis of steam turbines.

MODULE–III: Gas Dynamics: **[6 periods]**

Fundamentals thermodynamic concepts; Isentropic conditions; Mach number and Area – Velocity relation; Dynamic pressure; normal shock relations for perfect gas; supersonic flow, oblique shock waves ; normal shock recovery ; detached shocks ; Aerofoil theory.

Centrifugal Compressor: **[6 periods]**

Types; Velocity triangles and efficiencies; Blade passage design; Diffuser and pressure recovery; slip factor; stanitz and stodolas formulae; Effect of inlet mach number; Prewirl; performance.

MODULE–IV: Axial Flow Compressors: **[6 periods]**

Flow analysis, work and velocity triangles ; Efficiencies; Thermodynamic analysis; stage pressure rise ; Degree of reaction ; stage loading ; general design, effect of velocity incidence ; performance.

Cascade Analysis: **[4 periods]**

Geometry and Terminology; Blade forces, Efficiency; losses; free and forced vortex blades.

MODULE–V: Axial Flow Gas Turbines: **[10 periods]**

Work done; velocity triangles and efficiencies; thermodynamic flow analysis; degree of reaction; Zweifels relation; Design cascade analysis – Soderberg – Hawthrone – ainley-correlations; secondary flow; Free-vortex blades; Blade angles for variable degree of reaction; Actuator disc theory; stresses in blades; Blade assembling; materials and cooling of blades; performance; Matching of compressor and turbine; off-design performance.

TEXTBOOKS

1 Shephard **"Principles of Turbo machinery", Macmillian Information, 1991.**

2. G. Gopalakrishnan & D. Prithviraj **"Tritise on Turbomachines"** SciTech Publishers, 2008.

REFERENCE BOOKS:

1. W.J. Kearton, **"steam turbine Theory and practice"** Pitman, 7th Edition, 1960**.**
2. D.Zucker, "**Fundamentals of Gas dynamics",** John wiley & sons ,2nd Edition, 2002.
3. H.W.Liepman, A.Roshko **"Elements of Gas Dynamics"** Courier Corporation, 2013.
4. A.S.Rangawala "Theory and Practice in Gas Turbines" New Academic science, 2nd Edition, 2012.
5. S.M.Yahya **"Turbines, Compressors & Fans" TMH, 2005.**

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Course Code: 53107 **Credits: 4**

M.Tech - I Semester

THERMAL AND NUCLEAR POWER PLANTS

(Professional Elective-II)

MODULE-I: Introduction [14 periods]

Sources of Energy, types of Power Plants, Direct Energy Conversion System, Energy Sources in India, Recent developments in Power Generation. Combustion of Coal, Volumetric Analysis, Gravimetric Analysis, Flue gas Analysis.

Steam Power Plants: Introduction – General Layout of Steam Power Plant, Modern Coal-fired Steam Power Plants, Power Plant cycles, Fuel handling, Combustion Equipment, Ash handling, Dust Collectors.

Steam Generators: Types, Accessories, Feed water heaters, Performance of Boilers, Water Treatment, Cooling Towers, Steam Turbines, Compounding of Turbines, Steam Condensers, Jet & Surface Condensers.

MODULE-II: Gas Turbine Power Plant: **[6 periods]**

Cogeneration, Combined cycle Power Plants, Analysis, Waste-Heat Recovery, IGCC Power Plants, Fluidized Bed Combustion – Advantages & Disadvantages.

MODULE-III: Nuclear Power Plants: **[10 periods]**

Nuclear Physics, Nuclear Reactors, Classification – Types of Reactors, Site Selection, Methods of enriching Uranium, Applications of Nuclear Power Plants.

Nuclear Power Plants Safety: By-Products of Nuclear Power Generation, Economics of Nuclear Power Plants, Nuclear Power Plants in India, Future of Nuclear Power.

MODULE-IV: Economics of Power Generation: [10 periods]

Factors affecting the economics, Load Factor, Utilization factor, Performance and Operating Characteristics of Power Plants. Economic Load Sharing, Depreciation, Energy Rates, Criteria for Optimum Loading, Specific Economic energy problems.

MODULE- V: Power Plant Instrumentation: [8 periods]

Classification, Pressure measuring instruments, Temperature measurement and Flow measurement. Analysis of Combustion gases, Pollution – Types, Methods to Control.

TEXT BOOKS:

1. P.K. Nag "**Power Plant Engineering",** TMH, 2nd Edition, 2002.
2. R.K. Rajput "**Power Plant Engineering",** Lakshmi Publications, 4th Edition, 2015.

REFERENCE BOOKS:

1. P.C.Sharma "**Power Plant Engineering"**, Kotaria Publications,2009
2. Wakil "**Power Plant Technology"**, TMH, Edition 2010.

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Course Code: 53108 **Credits: 4**

M.Tech - I Semester

THERMAL MEASUREMENTS AND PROCESS CONTROLS

(Professional Elective-II)

MODULE-I: General concepts: **[12 periods]**

Fundamental elements of a measuring instrument. Static and dynamic characteristics – errors in instruments – Different methods of measurement and their analysis – Sensing elements and transducers.

Measurement of pressure – principles of pressure measurement, static and dynamic pressure, vacuum and high pressure measuring – Measurement of low pressure, Manometers, Calibration methods, Dynamic characteristics- design principles.

MODULE-II: Measurement of Flow: **[8 periods]**

Obstruction meters, variable area meters. Pressure probes, compressible fluid flow measurement, Thermal anemometers, calibration of flow measuring instruments. Introduction to design of flow measuring instruments.

MODULE-III: **Temperature Measurement**: **[10 periods]**

Different principles of Temperature Measurement, use of bimetallic thermometers – Mercury thermometers, Vapor Pressure thermometers,

Thermo positive elements, thermocouples in series & parallel, pyrometry, measurement of heat flux, calibration of temperature measuring instruments. Design of temperature measuring instruments.

MODULE-IV: Level Measurement: **[14 periods]**

Direct & indirect methods, manometric methods, float level meters, electrical conductivity, Capacitive, Ultrasonic, and Nucleonic Methods.

Measurement of density – Hydrometer, continuous weight method, Gamma rays, Gas impulse wheel.

Velocity Measurement – Coefficient of viscosity, Ostesld method, free fall of piston under gravity, torque method. Measurement of moisture content and humidity. Measurement of thermal conductivity of solids, liquids and gases.

MODULE-V: Process Control: **[8 periods]**

Introduction and need for process control principles, transfer functions, block diagrams, signal flow graphs, open and closed loop control systems – Analysis of First & Second order systems with examples of mechanical and thermal systems.

Control System Evaluation – Stability, steady state regulations, and transient regulations.

TEXT BOOKS:

1. E.O. Doeblin, **"Measurement System: Application & Design"** McGraw-Hill,Edition 2004
2. M. Gopal, **"Control Systems, Principles & Design"**, TMH, 3rd Edition, 2008.

REFERENCE BOOKS:

1. R.K. Jain, "**Mechanical and Industrial Measurements"**, Khanna Publishers. ,11th Edition, 2013
2. Beckwith , **"Mechanical Measurements"** Pearson. ,6th Edition,2007.

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Course Code: 53109 **Credits: 4**

M.Tech - I Semester

ADVANCED MATERIALS FOR THERMAL SYSTEMS

(Professional Elective-II)

MODULE– I: Review of Mechanical Properties: **[16 periods]**

Fundamentals And Tensile, Hardness, And Impact Testing: The Tensile Test: Use of the Stress – Strain Diagram, True Stress and True Strain, The Bend Test for Brittle Materials, Hardness of Materials, Strian Rate effects and Impact Behaviour Heat Treatment of Steels and Cast Irons: Designations and Classification of Steels, Simple Heat treatments, Isothermal Heat treatments, Quench and Temper Heat treatments, Surface treatments, Weldability of Steel. Fracture Mechanics, Fatigue, And Creep Behaviour: Fracture Mechanics, The Importance of Fracture Mechanics, Microstructural Features of Fracture in Metallic Materials., Microstructural Features of Fracture in Ceramics, Glasses, and Composites, Fatugue, Result of the Fatigue test, Application of Fatigue test, Creep, Stress Ruptur, and Stress Corrosion, Evaluation of creep Behaviour

MODULE-II: Nuclear Power Plant and Their Materials: **[12 periods]**

Nuclear reactor, pressurised reactor, breeder reactor. Materials for fuel, control rods, coolant, moderator, shielding.Effects of Radiation on Materials Properties: Effects of ,, rays on creep, fatigue, tensile, and other properties of metals, alloys, ceramics, polymers, rubbers etc. Effects on electrical, electronic and magnetic behaviour of materials, Effects on crystal structure, grain size etc.

MODULE-III: Materials in Fuel cells and Solar Cells: **[8 periods]**

Electrocatalyst materials for low temperature fuel cells, Conductive membranes for low-temperature fuel cells, Materials for high temperature fuel cells , silicon, quantum dots for solar energy, nanomaterials for solar thermal energy and photovoltaic.

MODULE-IV: Materials in Thermal Power Generation: **[8 periods]**

Superalloys, steels, ceramics, TBC, hydrogen membrane materials, sensor and sensor materials, biomass, coal, flyash,etc.

MODULE-V: Energy storage: **[10 periods]**

Artificial photosynthesis/solar to fuels, CO2 separation and utilization, Safer nuclear waste disposal, biofuels production, biological fuel cell technologies, reduction of energy use in manufacturing processes, Improved grid technologies, sustainable energy economy

TEXT BOOKS:

1. Bryan, J. C., **"Experiments in Nuclear Science"**, CRC Press. Edition, 2010.
2. G.S. Was, "**Fundamentals of Radiation Materials Science"**, Springer, Edition 2007.
3. B.M. Ma, "**Nuclear Reactor Materials and Applications"**, Springer, Edition 1982.
4. C.O. Smith, "**Nuclear Reactor Materials"**, Addison-Wesley Publishing Company, Edition 2006.

REFERENCE BOOKS:

1. D.R. Olander, "**Fundamentals Aspects of Nuclear Fuel Elements"**,Technical information center,Edition 2007,.
2. J. T. A. Roberts, **"Structural Materials in Nuclear Power Systems"**,Springer Science,Edition 2013.
3. Wolf Vielstich, Arnold Lamm, Hubert A. Gasteiger, and Harumi Yokokawa, **"Handbook of Fuel Cells"**, John Wiley and Sons,Edition 2009.
4. D Roddy, "**Advanced power plant materials, design and technology",** Elsevier, Edition 2010.

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Course Code: 50B16 **Credits: 4**

M.Tech - I Semester

ADVANCED OPTIMIZATION TECHNIQUES AND APPLICATIONS

(Open Elective-I)

MODULE- I: Single Variable Non-Linear Unconstrained Optimization: [10 periods]

One dimensional Optimization methods:- Uni-modal function, elimination methods, ,Fibonacci method, golden section method, interpolation methods – quadratic & cubic interpolation methods.

MODULE- II:Multi variable non-linear unconstrained optimization: **[10 periods]**

Direct search method – Univariant method - pattern search methods – Powell's- Hook -Jeeves, Rosenbrock search methods- gradient methods, gradient of function, steepest decent method, Fletcher Reeves method, variable metric method.

MODULE- III: Geometric Programming: [6 periods]

Polynomials – arithmetic - geometric inequality – unconstrained G.P- constrained G.P

Dynamic Programming: [8 periods]

Multistage decision process, principles of optimality, examples, conversion of final problem to an initial value problem, application of dynamic programming, production inventory, allocation, scheduling replacement.

MODULE- IV: Linear Programming: [10 periods]

Formulation – Sensivity analysis. Change in the constraints, cost coefficients, coefficients of the constraints, addition and deletion of variable, constraints.

Simulation – Introduction – Types- steps – application – inventory – queuing – thermal system.

MODULE- V: Integer Programming: [6 periods]

Introduction – formulation – Gomory cutting plane algorithm – Zero or one algorithm, branch and bound method

Stochastic Programming: [6 periods]

Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution- stochastic linear, dynamic programming.

TEXT BOOKS:

1. S.S Rao, **"Optimization theory & Applications",** New Age International,4th Edition,2009.
2. Kasan & Kumar, **"Introductory to operation research" ,**Springar, Edition 2004.
3. M.C Joshi, **"Optimization Techniques theory and practice"**, Narosa Publications, Edition 2004.

REFERENCE BOOKS:

1. H.A. Taha, **"Operation Research",** TMH, 8th Edition, 2011.
2. R.L Rardin, **"Optimization in operations research",** 3rd Edition, 1998.
3. Benugundu & Chandraputla ,**"Optimization Techniques",** Person Asia,2nd Edition,2014

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53110 **Credits: 4**

M.Tech - I Semester

SOLAR ENERGY TECHNOLOGY

(Open Elective-I)

MODULE-I: Introduction: **[12 periods]**

Solar energy option, specialty and potential – Sun – Earth – Solar radiation, beam and diffuse – measurement – estimation of average solar radiation on horizontal and tilted surfaces – problems – applications.

Capturing solar radiation – physical principles of collection – types – liquid flat plate collectors – construction details – performance analysis – concentrating collection – flat plate collectors with plane reflectors – cylindrical parabolic collectors – Orientation and tracking – Performance Analysis.

MODULE-II: Design of solar water heating system and layout: **[10 periods]**

Power generation – solar central receiver system – Heliostats and Receiver – Heat transport system – solar distributed receiver system – Power cycles, working fluids and prime movers.

MODULE-III: Thermal energy storage: **[12 periods]**

Introduction – Need for – Methods of sensible heat storage using solids and liquids – Packed bed storage – Latent heat storage – working principle – construction – application and limitations. Other solar devices – stills, air heaters, dryers, Solar Ponds & Solar Refrigeration. Active and Passive heating systems.

MODULE-IV: Direct energy conversion: **[10 periods]**

Solid-state principles – semiconductors – solar cells – performance – modular construction – applications. Conversion efficiencies calculations.

MODULE- V: Economics: **[8 periods]**

Principles of Economic Analysis – Discounted cash flow – Solar system – life cycle costs – cost benefit analysis and optimization – cost based analysis of water heating and photo voltaic applications.

TEXT BOOKS:

1. Kreith and Kerider **"Principles of Solar Engineering",** 2nd Edition, 2007.
2. Duffie and Beckman **"Solar energy thermal processes",** 4th Edition, 2013.
3. Sukhatme **"Solar energy"** 3rd Edition, 2008.

REFERENCE BOOKS:

1. Garg **"Solar energy"** Revised Edition,2006
2. Magal **"Solar energy"** Edition, 2003.
3. Tiwari and Suneja **"Solar energy"** Edition, 2002.
4. El Waki **"Power plant technology"** 2nd Edition, 2002

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53111 **Credits: 4**

M.Tech - I Semester

NANO TECHNOLOGY

(Open Elective-I)

MODULE-I: General Introduction [6 periods]

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

Silicon Carbide: [4 periods]

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: **[4 periods]**

Nano materials preparation, Characterization, Wear materials and nano composites,

MODULE-II: Mechanical properties [4 periods]

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

Electrical properties: [4 periods]

Switching glasses with nanoparticles,Electronic conduction with nano particles

Optical properties: **[4 periods]**

Optical properties, special properties and the coloured glasses

MODULE-III: Investigating and manipulating materials in the nanoscale [8 periods]

Process of synthesis of nano powders, Electro deposition, important naon materials

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

MODULE- IV: Nanobiology [8 periods]

Interaction between bimolecules and nano particle 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.

MODULE- V: Nano Medicines [8 periods]

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. A.K.Bandyopadhyay, "**Nano Materials",** New Age Publishers,2011.
2. T.Pradeep "**Nano Essentials" ,**TMH Publishers,2007.

REFERENCE BOOKS:

1. Charles P.Poole Jr.,Frank J.Owens,"**Introduction to Nanotechnology"** Wiley India Pvt. Ltd,2003
2. Chatopadhya.K.K, Benerjee A.N. **"Introduction to Nano science and Nanotechnology"** ,PHI Publisherm, 2009
3. Phani Kumar**, "Introduction to Nanotechnology**" ,

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53112 **Credits: 2**

M. Tech - I Semester

THERMAL ENGINEERING LABORATORY

1) Compressibility factor measurement of different real gases.
2) Dryness fraction estimation of steam.
3) Flame propagation analysis of gaseous fuels.
4) Performance test and analysis of exhaust gases of an I.C. Engine.
5) Heat Balance sheet, Volumetric Efficiency and air fuel ratio estimation of an I.C. Engine.
6) COP estimation of vapour compression refrigeration test.
7) Performance analysis of Air conditioning unit.
8) Performance analysis of heat pipe.
9) Solar Flat Plate Collector
10) Evacuative tube concentrator

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53114 **Credits: 4**

M.Tech - II Semester

FUELS, COMBUSTION AND ENVIRONMENT

MODULE–I: **Fuels** **[10 periods]**

Detailed classification – Conventional and Unconventional Solid, Liquid, gaseous fuels and nuclear fuels – Origin of Coal – Analysis of coal.

Coal – Carborisation, Gasification and liquification – Lignite: petroleum based fuels – problems associated with very low calorific value gases: Coal Gas – Blast Furnace Gas Alcohols and Biogas.

MODULE–II: **Principles of combustion** **[12 periods]**

Chemical composition – Flue gas anlaysis – dew point of products – Combustion stoichiometry. Chemical kinetics – Rate of reaction – Reaction order – Molecularity – Zeroth, first, second and third order reactions - complex reactions – chain reactions. Theories of reaction Kinetics – General oxidation behavior of HC's.

MODULE – III: Thermodynamics of combustion **[8 periods]**

Enthalpy of formation – Heating value of fuel - Adiabatic flame Temperature – Equilibrium composition of gaseous mixtures.

MODULE–IV: **Laminar and turbulent flames propagation and structure** **[12 periods]**

Flame stability – Burning velocity of fuels – Measurement of burning velocity – factors affecting the burning velocity. Combustion of fuel, droplets and sprays – Combustion systems – Pulverized fuel furnaces – fixed Entrained and Fluidized Bed Systems.

MODULE– V: **Environmental considerations** **[10 periods]**

Air pollution – Effects on Environment, Human Health etc. Principal pollutants – Legislative Measures – Methods of Emission control.

TEXT BOOKS:

1. Roger A strehlow "**Combustion Fundamentals**" Mc Graw Hill,2nd Edition,1984.
2. Sharma and Chander Mohan **"Fuels and combustion"** – Tata Mc Graw Hill, 3rd Edition,1987.

REFERENCES BOOKS

1. Shaha A.K. **"Combustion Engineering and Fuel Technology"** Oxford and IBH.
2. Kanneth K.Kuo, **"Principles of Combustion**" Wiley and Sons. 2nd Edition, 2014.
3. Sarkar "**Combustion"** – Mc. Graw Hill. 3rd Edition, 1988.
4. Stephen R. Turns, "**An Introduction to Combustion"** Mc. Graw Hill International Edition, 3rd Edition, 2011.
5. Gary L. Berman & Kenneth W. Ragland, "**Combustion Engineering"** Mc. Graw Hill International Edition, 2nd Edition,2011.
6. I. Glassman "**Combustion"** 4th Edition, 2008.

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53115 **Credits: 4**

M.Tech - II Semester

ADVANCED HEAT AND MASS TRANSFER

MODULE- I: **Brief Introduction to different modes of heat transfer** **[6 periods]**

Conduction: General heat conduction equation-Initial and Boundary conditions.

Steady State Heat Transfer: **[4 periods]**

Simplified heat transfer in 1D and 2D – Fins

Transient heat conduction: **[6 periods]**

Lumped system analysis- Heisler charts-semi infinite solid-use of shape factors in conduction - 2D transient heat conduction – product solutions.

MODULE – II: Finite Difference methods for Conduction: **[5 periods]**

1D & 2D steady state and simple transient heat conduction problems – implicit and explicit methods.

Forced Convection: **[5 periods]**

Equations of Fluid Flow – Concepts of Continuity, momentum equations – Derivation of Energy equation - Methods to determine heat transfer coefficient: Analytical Methods - Dimensional Analysis and concept of exact solution. Approximate Method – Integral analysis.

MODULE- III: External flows: **[5 periods]**

Flow over a flat plate: Integral method for laminar heat transfer coefficient for different velocity and temperature profiles. Application of empirical relations to variation geometrics for Laminar and Turbulent flows.

Internal flows: **[5 periods]**

Fully developed flow: Integral analysis for laminar heat transfer coefficient – Types of flow – Constant Wall Temperature and Constant Heat Flux Boundary Conditions - Hydrodynamic & thermal entry lengths; use of empirical correlations.

MODULE- IV: Free convection: **[4 periods]**

Approximate analysis on laminar free convective heat transfer – Boussinesque Approximation - Different geometries – combined free and forced convection

Boiling and condensation: **[4 periods]**

Boiling curve – Correlations- Nusselt's theory of film condensation on a vertical plate – Assumptions & correlations of film condensation for different geometrics.

MODULE- V: **Radiation Heat Transfer:** **[6 periods]**

Radiant heat exchange in grey, non-grey bodies, with transmitting, reflecting and absorbing media, specular surfaces, gas radiation – radiation from flames.

Mass Transfer: **[6 periods]**

Concepts of mass transfer – Diffusion & convective mass transfer Analogies – Significance of non-dimensional numbers.Heat Exchangers.

TEXT BOOKS:

1. M. Necati Ozisik "**Heat Conduction"**John Wiley & Sons, 3rd Edition, 2012.

2. P.S. Ghoshdastidar "**Heat Transfer",** Oxford University Press, 2nd Edition, 2012.
4. Sarit K. Das "**Fundamentals of Heat & Mass Transfer**"**,** Alpha Science International, Edition, 2010

REFERENCE BOOKS:

1. Incroera Dewitt "**Fundamentals of Heat & Mass Transfer",** John Wiley & Sons, 5th Edition, 2009.
2. Yunus Cangel "**Heat& Mass Transfer"**TMH, 4th Edition, 2011.
3. D.S. Kumar "**Heat & Mass Transfer",**S.K.Kataria &Sons,3rd Edition,2009**.**
4. P.K. Nag "**Heat & Mass Transfer"**, TMH, 3rd Edition, 2011**.**
5. Frank Kreith & Mark.Bohn "**Principle of Heat Transfer"** Cenage Learning, 7th Edition, 2010**.**
6. W.M.Kays & M.E.Crawford "**Convective Heat and Mass Transfer",**TMH,4th Edition,2005.
7. M.Sparrow& R.D.Cess "**Radiation Heat Transfer",** Hemi sphear Publishers,3rd Edition,2007.
8. R.Siegel & J.R.Howell "**Thermal Radiation heat transfer",** CRC Press, 4th Edition, 2001.

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53116 **Credits: 4**

M.Tech - II Semester

COMPUTATIONAL FLUID DYNAMICS

MODULE- I: Introduction: **[5 periods]**

Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution methods: **[10 periods]**

Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

MODULE– II: Hyperbolic equations **[8 periods]**

Explicit schemes and Von Neumann stability analysis, implicit schemes, multistep methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge - Kutta method.

MODULE- III: Formulations of Incompressible Viscous Flows: **[10 periods]**

Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods. Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions.

MODULE- IV: Finite Volume Method: **[8 periods]**

Finite volume method via finite difference method, formulations for two and three-dimensional problems.

MODULE- V: Standard Variational Methods: **[8periods]**

Linear fluid flow problems, steady state problems, Transient problems.

TEXT BOOKS:

1. T. J.C'hung, **"Computational fluid dynamics",** Cambridge University press, 2002.
2. Frank Choritonm, "**TEXT BOOKS: of fluid dynamics" ,** CBS Publishers & distributors, 1985
3. Suhas V. Patankar, "**Numerical heat transfer and fluid flow"**, Hema shava Publishers Corporation & Mc Graw Hill.

REFERENCE BOOKS:

1. Sunderajan &Muralidaran "**Computational Fluid Flow and Heat Transfer",**Narosa Publications , 2nd Edition/2010.
2. John D. Anderson, "**Computational Fluid Dynamics: Basics with applications", Mc** Graw Hill, 2010.
3. Tapan K. Sengupta, "**Fundamentals of Computational Fluid Dynamics",** Universities Press, 2004.
4. C. Pozrikidis, **"Introduction to Theoretical and Computational Fluid Dynamics",** Oxford University Press, 2nd Edition, 2011.

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Course Code: 53117 **Credits: 4**

M.Tech - II Semester

ALTERNATE FUELS

(Professional Elective-III)

MODULE-I: Introduction [8 periods]

Estimation of petroleum reserve - World Energy Scenario - Energy Survey of India – Oil industry background and history – survey of oil consumption - Availability of petroleum products – types – uses - air craft fuels – alternate fuels – list of alternate fuels - Need for alternate fuel – Availability of alternate fuels.

MODULE –II: Alcohols [10 periods]

Introduction - properties of alcohol as fuel - uses of alcohol fuels – alcohol availability – alcohol production – methanol – ethanol – impact of incremental vehicle cost – vehicle technology and vehicle emission – use of low level blends – vehicle emission – dedicated vehicles – fuel flexible vehicle – variable fuelled vehicle – air quality benefits of alcohol fuels – methanol vehicles – fuel characteristics – fuel additives – handling of methanol – methanol health and safety.

MODULE –III: Natural Gas, Lpg, Hydrogen And Biogas [10 periods]

Availability of CNG - automotive gasoline – composition – types – properties – additives – effect of emissions - modification required in engines – performance and emission characteristics of CNG and LPG in SI & CI engines. Performance and emission for LPG – Hydrogen – Storage and handling, performance and safety aspects.

MODULE –IV: Vegetable Oils [8 periods]

Introduction - Various vegetable oils for engines – Etherification – Performance in engines – Performance and emission characteristics.

MODULE –V: Electric And Solar Powered Vehicles [8 periods]

Layout of an electric vehicle – advantage and limitations – Specifications – System component, Electronic control system – High energy and power density batteries – Hybrid vehicle – Solar powered vehicles. Fuel cell vehicles.

TEXT BOOKS:

1. Ramalingam. K.K., "**Internal combustion engine"**, SciTech publications, Chennai, 2003.
2. Maheswar Dayal "**Energy today & tomorrow"**, I & B Horish India, 1982.
3. Bechtold,R.L., "**Alternative Fuels Guide Book"**, SAE, 1997.

REFERENCE BOOKS:

1. Nagpal "**Power Plant Engineering"**, Khanna Publishers, 1991.
2. "**Alcohols and motor fuels progress in technology"**, Series No.19, SAE Publication USA 1980.
3. "**SAE Paper Nos.840367, 841156, 841333, 841334**.
4. "**The properties and performance of modern alternate fuels"** – SAE Paper No.841210.
5. Dr.Saty kush "**Automobile pollution"**, IVY Publishing House.

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Course Code: 53118 **Credits: 4**

M.Tech - II Semester

CRYOGENIC ENGINEERING

(Professional Elective-III)

MODULE– I: Cryogenic Systems: **[5 periods]**

Introduction– Mechanical Properties at low temperatures –Properties of cryogenic fluids.

Gas Liquefaction: **[5 periods]**

Minimum work for liquefaction – Methods to produce low temperature – Liquefaction systems for gases other than Neon, Hydrogen and Helium

MODULE– II: **[8 periods]**

Liquefaction systems for Neon, Hydrogen and Helium Components of Liquefaction systems – Heat Exchangers – Compressors and Expanders – expansion valve – Losses for real machines.

MODULE– III: **[8 periods]**

Gas separation and purification systems – Properties of mixtures – Principles of mixtures – Principles of gas separation – Air separation systems.

MODULE–IV: **[10 periods]**

Cryogenic Refrigeration Systems – Working media – Solids, Liquids and gases Cryogenic fluid storage & transfer – Cryogenic storage systems – Insulation – Fluid transfer mechanisms – Cryostat – Cryo Coolers.

MODULE–V: **[8 periods]**

Applications – Space technology – In-flight air seperation and collection of LOX – Gas Industry – Biology – Medicine - Electronics

TEXT BOOKS:

1. R.F. Barron **"Cryogenic Systems"**, Oxford University Press
2. Marshall Sitting **"Cryogenic Research and Applications"**, Von Nostrand Inc, New Jersey

REFERENCE BOOKS:

1. B.A.Hands **"Cryogenics Engineering"**, Academic Press, 1986
2. R. B. Scott **"Cryogenics Engineering"**, Von Nostrand Inc, New Jersey, 1959
3. G.K. White **"Experimental Techniques in Low Temperature Physics"** , Oxford Press, 1968
4. K.D.Timmerhaus & TM Flynn **"Cryogenics process Engineering"** –, Plenum press, 1998
5. R.F. Baron **"Cryogenic Heat Transfer** -.
6. N. N . Falina and J.G. Weisend –II **"Cryogenic Two Phase flow"** –
7. Robort Ackermann **"Cryogenic Regenerative Heat Exchangers"** –, Plenum Press, 1997
8. Thomas M. Flynn **"Cryogenic Engineering",**
9. Fredrick J. Edeskutty and Watter F. Stewart **"Safety in Handling of Cryogenic Fluids"** –, Plenum Press, 1996
10. J.G.Weisend –II, Taylor and Francis **"Hand Book of Cryogenic Engineering"** –, 1998

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Course Code: 53119 **Credits: 4**

M.Tech - II Semester

JET PROPULSION AND ROCKET ENGINEERING

(Professional Elective-III)

MODULE – I: Turbo Jet Propulsion System [5 periods]

Gas turbine cycle analysis – layout of turbo jet engine. Turbo machinery- compressors and turbines, combustor, blade aerodynamics, engine off design performance analysis.

Flight Performance: [5 periods]

Forces acting on vehicle – Basic relations of motion – multi stage vehicles.

MODULE – II: Principles of Jet Propulsion and Rocketry [6 periods]

Fundamentals of jet propulsion, Rockets and air breathing jet engines – Classification – turbo jet , turbo fan, turbo prop, rocket (Solid and Liquid propellant rockets) and Ramjet engines.

Nozzle Theory and Characteristics Parameters: [8 periods]

Theory of one dimensional convergent – divergent nozzles – aerodynamic choking of nozzles and mass flow through a nozzle – nozzle exhaust velocity – thrust, thrust coefficient, A_c / A_t of a nozzle, Supersonic nozzle shape, non-adapted nozzles, summer field criteria, departure from simple analysis – characteristic parameters – 1) characteristic velocity, 2) specific impulse 3) total impulse 4) relationship between the characteristic parameters 5) nozzle efficiency, combustion efficiency and overall efficiency.

MODULE- III: Aero Thermo Chemistry of The Combustion Products [5 periods]

Review of properties of mixture of gases – Gibbs – Dalton laws – Equivalent ratio, enthalpy changes in reactions, heat of reaction and heat of formation – calculation of adiabatic flame temperature and specific impulse – frozen and equilibrium flows.

Solid Propulsion System: [5 periods]

Solid propellants – classification, homogeneous and heterogeneous propellants, double base propellant compositions and manufacturing methods. Composite propellant oxidizers and binders. Effect of binder on propellant properties. Burning rate and burning rate laws, factors influencing the burning rate, methods of determining burning rates.

MODULE-IV: [5 periods]

Solid propellant rocket engine – internal ballistics, equilibrium motor operation and equilibrium pressure to various parameters. Transient and pseudo equilibrium operation, end burning and burning grains, grain design. Rocket motor hard ware design. Heat transfer considerations in solid rocket motor design. Ignition system, simple pyro devices.

Liquid Rocket Propulsion System: [5 periods]

Liquid propellants – classification, Mono and Bi propellants, Cryogenic and storage propellants, ignition delay of hypergolic propellants, physical and chemical characteristics of liquid propellant. Liquid propellant rocket engine – system layout, pump and pressure feed systems, feed system components. Design of combustion chamber, characteristic length, constructional features, and chamber wall stresses. Heat transfer and cooling aspects. Uncooled engines, injectors – various

types, injection patterns, injector characteristics, and atomization and drop size distribution, propellant tank design.

MODULE- V: [8 periods]

Ramjet and Integral Rocket Ramjet Propulsion System: Fuel rich solid propellants, gross thrust, gross thrust coefficient, combustion efficiency of ramjet engine, air intakes and their classification – critical, super critical and sub-critical operation of air intakes, engine intake matching, classification and comparison of IIRR propulsion systems.

TEXT BOOKS:

1. Hill, **"Mechanics and Thermodynamics of Propulsion"**, Pearson Education, 2nd Edition, 2009
2. Sutton, "**Rocket propulsion elements"** John Wile & Sons, 8th Edition,2011

REFERENCES BOOKS:

1. Ganesan **,** "**Gas Turbines"** , Tata McGraw-Hill Education, 3rd Edition, 2010
2. Khajuria & Dubey "**Gas Turbines & Propulsive Systems"**,Dhanpa Rai, 5th Edition, 1992
3. K Ramamurth,"**Rocket propulsion"** , Macmillian Publisher, Edition 2010
4. Nicholas Cumpsty "**Jet propulsion"** Cambridge University Press, 2nd Edition, 2003

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53120 **Credits: 4**

M.Tech - II Semester

CONVECTIVE HEAT TRANSFER

(Professional Elective-IV)

MODULE-I: Introduction [6 periods]

Forced, free & combined convection – convective heat transfer coefficient – Application of dimensional analysis to convection – Physical interpretation of dimensionless numbers.

Equations of Convective Heat Transfer: [6 periods]

Continuity, Navier-Strokes equation & energy equation for steady state flows – similarity – Equations for turbulent convective heat transfer – Boundary layer equations for laminar, turbulent flows – Boundary layer integral equations.

MODULE-II: External Laminar Forced Convection [4 periods]

Similarity solution for flow over an isothermal plate – integral equation solutions – Numerical solutions – Viscous dissipation effects on flow over a flat plate.

External Turbulent Flows: [4 periods]

Analogy solutions for boundary layer flows – Integral equation solutions – Effects of dissipation on flow over a flat plate.

Internal Laminar Flows: [4 periods]

Fully developed laminar flow in pipe, plane duct & ducts with other cross-sectional shapes – Pipe flow & plane duct flow with developing temperature field – Pipe flows & plane duct flow with developing velocity & temperature fields.

Internal Turbulent Flows: [4 periods]

Analogy solutions for fully developed pipe flow –Thermally developing pipe & plane duct flow.

MODULE– III: Natural Convection [5 periods]

Boussineq approximation – Governing equations – Similarity – Boundary layer equations for free convective laminar flows – Numerical solution of boundary layer equations.

Free Convective flows through a vertical channel across a rectangular enclosure – Horizontal enclosure – Turbulent natural convection.

MODULE– IV: Combined Convection [5 periods]

Governing parameters & equations – laminar boundary layer flow over an isothermal vertical plate – combined convection over a horizontal plate – correlations for mixed convection – effect of boundary forces on turbulent flows – internal flows - internal mixed convective flows – Fully developed mixed convective flow in a vertical plane channel & in a horizontal duct.

MODULE- V: Convective Heat Transfer Through Porous Media [6 periods]

Area weighted velocity – Darcy flow model – energy equation – boundary layer solutions for 2-D forced convection – Fully developed duct flow – Natural convection in porous media – filled enclosures – stability of horizontal porous layers.

TEXT BOOKS:

1. Patrick H. Oosthuigen & David Naylor **"Introduction to Convective Heat Transfer Analysis",** McGraw-Hill Science,1998
2. Kays & Crawford **"Convective Heat & Mass Transfer",** McGraw-Hill Education, 4th Edition,2004

REFERENCES BOOKS:

1. Michael E. Crawford **"Convective Heat and Mass Transfer"**, McGrawhill, 2nd Edition, 1983

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53121 **Credits: 4**

M.Tech - II Semester

EQUIPMENT DESIGN FOR THERMAL SYSTEMS

(Professional Elective-IV)

MODULE-I: Classification **of heat exchangers** **[6 periods]**

Introduction, Recuperation & Regeneration – Tubular heat exchangers: double pipe, shell & tube heat exchanger, Plate heat exchangers, Gasketed plate heat exchanger, spiral plate heat exchanger, Lamella heat exchanger, extended surface heat exchanger, Plate fin, and Tubular fin.

Basic Design Methods of Heat Exchanger: **[6 periods]**

Introduction, Basic equations in design, Overall heat transfer coefficient – LMTD method for heat exchanger analysis – parallel flow, counter flow, multipass, cross flow heat exchanger design calculations.

MODULE – II: Double Pipe Heat Exchanger **[5 periods]**

Film Coefficient for fluids in annulus, fouling factors, calorific temperature, average fluid temperature, the calculation of double pipe exchanger, Double pipe exchangers in series-parallel arrangements.

Shell & Tube Heat Exchangers: **[8 periods]**

Tube layouts for exchangers, baffle Heat exchangers, calculation of shell and tube heat exchangers – shell side film coefficients, Shell side equivalent diameter, the true temperature difference in a 1-2 heat exchanger, influence of approach temperature on correction factor, shell side pressure drop, tube side pressure drop, Analysis of performance of 1-2 heat exchanger, and design calculation of shell & tube heat exchangers. Flow arrangements for increased heat recovery, the calculations of 2-4 exchangers.

MODULE-III: Condensation of single vapors **[5 periods]**

Calculation of a horizontal condenser, vertical condenser, De-super heater condenser, vertical condenser – sub-cooler, horizontal condenser – subcooler, vertical reflux type condenser, condensation of steam.

MODULE–IV: Vaporizers, Evaporators and Reboilers **[6 periods]**

Vaporizing processes, forced circulation vaporizing exchangers, natural circulation vaporizing exchangers, calculations of a reboiler.

Extended Surfaces: **[6 periods]**

Longitudinal fins, weighted fin efficiency curve, calculation of a double pipe fin efficiency curve, calculation of a double pipe finned exchanger, calculation of a longitudinal fin shell and tube exchanger.

MODULE- V: Direct Contact Heat Exchanger **[6 periods]**

Cooling towers, relation between wet bulb & dew point temperatures, the Lewis number, and classification of cooling towers, cooling tower internals and the roll of fill, Heat balance, heat transfer by simultaneous diffusion and convection. Analysis of cooling tower requirements, Design

of cooling towers, Determination of the number of diffusion MODULEs, calculation of cooling tower performance.

TEXT BOOKS:

1. D.Q. Kern "**Process Heat Transfer",** McGraw-Hill College, 1st Edition,1950
2. J.D. Gurney "**Cooling Towers",** Maclaren, 2007
3. A.P.Fraas and M.N. Ozisick "**Heat Exchanger Design",** John Wiely & sons, 2nd Edition,1989

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53122 **Credits: 4**

M.Tech - II Semester

COMPUTER SIMULATION OF SI & CI ENGINE

(Professional Elective-IV)

MODULE –I: Simulation Principles [10 periods]

First and second laws of thermodynamics – Estimation of properties of gas mixtures - Structure of engine models – Open and closed cycle models - Cycle studies. Chemical Reactions, First law application to combustion, Heat of combustion – Adiabatic flame temperature. Hess Law - Lechatlier principle. Heat transfer in engines – Heat transfer models for engines. Simulation models for I.C. Engines. (Ideal and actual cycle simulation) Chemical Equilibrium and calculation of equilibrium composition.

MODULE- II: Simulation Of Combustion In SI Engines [8 periods]

Combustion in SI engines, Flame propagation and velocity, Single zone models – Multi zone models

Mass burning rate, Turbulence models – One dimensional models – Chemical kinetics modeling – Multidimensional models, Flow chart preparation.

MODULE- III: Simulation of Combustion in CI Engines [10 periods]

Combustion in CI engines Single zone models – Premixed-Diffusive models – Wiebe' model – Whitehouse way model, Two zone models - Multizone models- Meguerdichian and Watson's model, Hiroyasu's model, Lyn's model – Introduction to Multidimensional and spray modeling, Flow chart preparation.

MODULE- IV: Simulation of Two Stroke Engines [12 periods]

Thermodynamics of the gas exchange process - Flows in engine manifolds – One dimensional and multidimensional models, Flow around valves and through ports Models for scavenging in two stroke engines – Isothermal and non-isothermal models, Heat Transfer and Friction.

MODULE –V: Simulation of Gas Turbine Combustors [10 periods]

Gas Turbine Power plants – Flame stability, Combustion models for Steady Flow Simulation – Emission models. Flow chart preparation.

TEXT BOOKS:

1. Ashley S. Campbell**,** "**Thermodynamic Analysis of Combustion Engines"**, Krieger publication co, 1985.
2. V.Ganesan, "**Computer Simulation of Spark Ignition Engine Processes"**, Universities Press, 2000.
3. V V. Ganesan, "**Computer Simulation of C.I. Engine Processes"**, Universities Press, 2000.

REFERENCES BOOKS:

1. Cohen H. Rogers GEC. – "**Gas Turbine Theory"** – Pearson Education India Fifth edition, 2001.
2. Bordon P. Blair, "T**he Basic Design of two-Stroke engines"**, SAE Publications, 1990.
3. Horlock and Winterbone**,** "**The Thermodynamics and Gas Dynamics of Internal Combustion Engines"**, Vol. I & II, Clarendon Press, 1986.
4. J.I.Ramos, "**Internal Combustion Engine Modeling"**, Butterworth – Heinemann ltd, 1999.
5. J.N.Mattavi and C.A.Amann, "**Combustion Modeling in Reciprocating Engines"**, Plenum Press, 1980

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53123 **Credits: 4**

M.Tech - II Semester

ADVANCED FINITE ELEMENT ANALYSIS

(Open Elective-II)

MODULE-I: Introduction **[12 Periods]**

Introduction to FEM, basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin's Methods. Co-ordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain- displacement relations.

MODULE-II: 1D Structural Problems **[4Periods]**

Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.

Analysis of Trusses: **[4Periods]**

Plane Trusses and Space Truss elements and problems

Analysis of Beams: **[4 Periods]**

Hermite shape functions – stiffness matrix – Load vector – Problems.

MODULE-III: 2D Problems **[6 Periods]**

CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Isoparametric elements – quadrilateral element, shape functions – Numerical Integration. Finite element modelling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements.

3D Problems: **[4 Periods]**

Tetrahedran element – Jacobian matrix – Stiffness matrix.

MODULE-VI: Scalar Field Problems **[8 Periods]**

1D Heat conduction-Slabs – fins - 2D heat conduction problems – Introduction to Torsional problems.

MODULE-V: **[10 Periods]**

Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

TEXT BOOKS:

1. SS Rao "**The Finite Element Methods in Engineering"**Elsevier publisher,5th Edition,2010.
2. Alavala, **"Finite Element Methods: Basic Concepts and applications" ,** PHI,2008.
3. Chandrupatla, Ashok and Belegundu **"Introduction to Finite Elements in Engineering"** Prentice – Hall,3rd Edition,2002.

REFERENCES BOOKS

1. J. N. Reddy **"An Introduction to Finite Element Method",** Mc Grawhill, 3rd Edition, 2006
2. O.C. Zienkiewicz **"The Finite element method in engineering science",** Mc Grawhill, 2nd Edition,2007
3. Robert Cook **"Concepts and applications of finite element analysis",** Wiley, 3rd Edition, 1989
4. K.J Bathe **"Finite Element Procedures in Engineering analysis",** Prentice- Hall,1982
5. S.Md.Jalaludeen **"Introduction to Finite Element Analysis"**, Anuradha Publications,2015
6. G Ram Murthy **"Applied finite element analysis"**, I.K. International, 2nd Edition,2010

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53124 **Credits: 4**

M.Tech - II Semester

ENERGY MANAGEMENT

(Open Elective-II)

MODULE- I: Introduction [10 periods]

Principles of Energy Management – Managerial Organization – Functional Areas for i. Manufacturing Industry ii. Process Industry iii. Commerce iv. Government. Role of Energy Manager in each of these organization. Initiating, Organising and Managing Energy Management Programs.

MODULE- II: Energy Audit [12 periods]

Definition and Concepts, Types of Energy Audits – Basic Energy Concepts – Resources for Plant Energy Studies – Data Gathering – Analytical Techniques.

Energy Conservation: Technologies for Energy Conservation , Design for Conservation of Energy materials – energy flow networks – critical assessment of energy usage – formulation of objectives and constraints – synthesis of alternative options and technical analysis of options – process integration.

MODULE- III: Economic Analysis [8 periods]

Scope, Characterization of an Investment Project – Types of Deprecication – Time Value of money – budget considerations, Risk Analysis.

MODULE- IV: Methods of Evaluation of Projects [10 periods]

Payback – Annualised Costs – Investor's Rate of return – Present worth – Internal Rate of Return – Pros and Cons of the common methods of analysis – replacement analysis.

MODULE- V: Alternative Energy Sources [8 periods]

Solar Energy – Types of devices for Solar Energy Collection – Thermal Storage System – Control Systems-

Wind Energy – Availability – Wind Devices – Wind Characteristics – Performance of Turbines and systems.

TEXT BOOKS:

1. W.C. Turner **"Energy Management Hand book",** 6th Edition,2006
2. H.Koontz and Cyrill O Donnell **"Management",** 3rd Edition,2008

REFERENCES BOOKS

1. S.C. Kuchhal **"Financial Management",8th** Edition,1982.
2. W.R.Murthy and G.Mc Kay **"Energy Management"**,
3. CB Smith **"Energy Management Principles"**, Edition,1981.

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53125 **Credits: 4**

M.Tech - I Semester

NANO FLUIDS

(Open Elective-II)

MODULE-I: **[12periods]**

Introduction to nanofluids, nanostructured materials, base fluids, dispersion, sonication and stable suspension. Various types of nanofluids-volumetric concentration.Thermophysical properties: Density; principles of measurement and apparatus. Theoretical equations and new empirical correlations to determine the density of different nanofluids. Viscosity: principles of measurement and apparatus. Andrade's and other theoretical equations and new empirical correlations to determine the viscosity of different nanofluids. Effect of volumetric concentration and temperature. Effect of subzero temperature on nanofluid viscosity.

MODULE-II: **[10 periods]**

Thermal conductivity: principles of measurement and apparatus. Hamilton-Crosser and other theoretical equations and new empirical correlations to determine the thermalconductivity of different nanofluids. Effect of volumetric concentration and temperature. Effect of Brownian motion on enhancing the thermal conductivity. Specific heat: principles of measurement and apparatus. Buongeorno's thermal equilibrium equation and other theoretical equationsand new empirical correlations to determine the specific heat of different nanofluids. Effect of volumetric concentration and temperature.

MODULE-III: **[12 periods]**

Combined effects of thermophysical properties of nanofluids on the thermal diffusivity, the Prandtl number, the Reynolds number and the Nusselt number. Basic understanding of their effects on frictional loss and Heat transfer. Convective heat transfer: Single-phase fluid equations, laminar flow, entry length and fully developed friction factor and heat transfer coefficient. Graetz number effect in the entry region. Correlations for friction factor and Nusselt number for nanofluids. Turbulent flow: Single phase fluid fully developed flow Dittus-Boelter and Glienilski equations. Blasius and other turbulent friction factor correlations.Their comparison with nanofluidsdata. New correlations for turbulent friction factor and Nusselt number for nanofluids.

MODULE-IV: **[10 periods]**

Principles of measurement and apparatus for the nanofluid convective heat transfer coefficient. Recent empirical relations for convection coefficient of various types of nanofluids. Effect of particle Peclet number. Effect of volumetric concentration. Application of nanofluids to various types of industrial heat exchangers. Heating capacity, mass flow, heat exchanger surface area, LMTD and pumping power for nanofluids versus conventional heat transfer fluids.

MODULE-V: **[10 periods]**

Application to building heating and cooling Comparison of nanofluids performance with glycol solution in hydronic coils.Application to automobile radiators. Comparison of the performance of nanofluids under arctic and sub-arctic temperatures with glycol solutions. Introduction to electronic cooling in microchannels with nanofluids.

REFERENCE BOOKS:

1. C. Sobhan and G. Peterson "**Microscale and Nanoscale Heat Transfer**", CRC Press, 1st Edition, 2008
2. F. M. White "**Fluid Mechanic**", 5th Edition, McGraw-Hill,2003
3. A. Bejan "**Heat Transfer**", John Wiley, 2nd Edition, 2007
4. H.S.Nalwa "**Handbook of Nanostructured Materials and Nanotechnolog**" Vol. I and II -, I edition, American Scientific Publishers,2000.
5. Bharat Bhushan "**Springer Handbook of Nanotechnolog**", , Springer-Verlag publications, 3rd edition,2010

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

L	T	P
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Course Code: 53126 **Credits: 2**

M.Tech - I Semester

COMPUTATIONAL METHODS LABORATARY

Solving Thermal Engineering problems using available packages such as T K Solver,

ANSYS, CFX, STARCD, MATLAB, FLUENT etc…

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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53128 **Credits: 4**

M.Tech - III Semester

Comprehensive Viva-Voce

2015-16

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53129 **Credits: 8**

M.Tech - III Semester

Project work Part I

2015-16

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53130 **Credits: 8**

M.Tech - IV Semester

Project work Part II

2015-16

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)

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Course Code: 53131 **Credits:12**

M.Tech - IV Semester

Project Viva-Voce