MASTER OF TECHNOLOGY
In
THERMAL ENGINEERING

ACADEMIC REGULATIONS, COURSE COVERAGE SUMMARY
&
QUESTION BANK

Department of Mechanical Engineering

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

Sponsored by CMR Educational Society

(Affiliated to JNTUH, Hyderabad, Approved by AICTE - Accredited by NAAC – 'A' Grade - ISO 9001:2015 Certified)

Maisammaguda, Dhulapally, Kompally, Secunderabad – 500100, Telangana State, India.

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MASTER OF TECHNOLOGY
THERMAL ENGINEERING

DEPARTMENT OF
MECHANICAL ENGINEERING

ACADEMIC REGULATIONS
COURSE STRUCTURE AND SYLLABUS
(Batches admitted from the academic year 2019 - 2021)

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

PRELIMINARY DEFINITIONS AND NOMENCLATURES

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

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

*"Commission" means University Grants Commission.

*"AICTE" means All India Council for Technical Education.

*"University" means Jawaharlal Nehru Technological University, Hyderabad.

*"College" means Malla Reddy College of Engineering & Technology, Secunderabad unless indicated otherwise by the context.

*"Program" means:

Master of Technology (M.Tech) degree program

PG Degree Program: M.Tech

*"Branch" means specialization in a program like M.Tech degree program in Mechanical Engineering, M.Tech degree program in Aeronautical Engineering etc.

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

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

FOREWORD

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

Malla Reddy College of Engineering & Technology (MRCET)is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, and also improving upon the values and beliefs for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several experts drawn from academics, industry and research, in accordance with the vision and mission of the college which reflects the mindset of the institution in order to produce quality engineering graduates to the society.

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

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

PRINCIPAL

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

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VISION

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

MISSION

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

For more information: www.mrcet.ac.in

ACADEMIC REGULATIONS R-18 FOR M.TECH (REGULAR) DEGREE COURSE

Academic Regulations of R-18 are applicable for the students of M.Tech (Regular) Course from the Academic Year 2018-20 and onwards. The M.Tech Degree of Malla Reddy College of Engineering & Technology (MRCET), Secunderabad shall be conferred on candidates who are admitted to the program and who fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

1.1 Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.
1.2 Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University (or) State Government (or) on the basis of any other order of merit as approved by the University, subject to norms as laid down by the State 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 he pursues a course of study in not less than two and not more than four academic years.
2.2 A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his admission, shall forfeit his seat in M.Tech. course.
2.3 The student shall register for all 88 credits and secure all the 88 credits.
2.4 The minimum instruction days in each semester are 90.

3.0 A. COURSE OF STUDY

3.1 The following specializations are offered at present for the M.Tech. course of study.
3.2 Aerospace Engineering
3.3 Computer Science and Engineering
3.4 Machine Design
3.5 System and Signal Processing
3.6 VLSI and Embedded Systems
3.7 Thermal Engineering

and any other course as approved by the MRCET from time to time.

3.0B. Departments offering M.Tech. Programmes with specializations are noted below:

Aeronautical Engineering	Aerospace Engineering
Computer Science Engineering	Computer Science Engineering
Electronics & Communication Engineering	System & Signal Processing
Electronics & Communication Engineering	VLSI and Embedded Systems
Mechanical Engineering	Machine Design
Mechanical Engineering	Thermal Engineering

4.0 ATTENDANCE

The programs are offered on a unit basis with each subject being considered a unit.

4.1 A student shall be eligible to write University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

4.2 Condonation of shortage of attendance in aggregate up to 10% (65%andaboveandbelow75%) in each semester shall be granted by the College Academic Committee.

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

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

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

4.6 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfill sthe attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

4.7 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.

4.8 A student shall not be promoted to the next semester unless he satisfies the minimum academic requirements of the previous semester.

5.0 EVALUATION

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 Internal Evaluation and End Semester Examination.

For the theory subjects 70 marks shall be awarded based on the performance in the End Semester Examination and 30 marks shall be awarded based on the Internal Examination Evaluation. The internal evaluation consists of two mid-term examinations each covering descriptive paper 24 marks

which consists of six questions and answers any four questions, each carrying 6 marks a total duration of 2 hours. Average of the two mid-term examinations shall be taken as the final marks secured by each candidate. Six (6) marks are allocated for Assignments (as specified by the subject teacher concerned).The total marks secured by the student in mid-term examination and assignment is evaluated for 30 marks.

However, any student scoring internal marks less than 40% will be given a chance to write the internal exam once again after he/she re-registering for the concerned subject and paying stipulated fees as per the norms.

5.1 The end semesters examination will be conducted for 70marks with 5 questions consisting of two questions each (a) and (b), out of which the student has to answer either (a) or (b), not both and each question carries 14 marks.

5.2 For practical subjects, 70 marks shall be awarded based on the performance in the End Semester Examinations and 30 marks shall be awarded based on the day-to-day performance as Marks.

5.3 There shall be two seminar presentations during I year I semester and II semester respectively. For seminar, a student under Internal 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 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

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

5.5 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to reappear for the End semester Examination in that subject.

5.6 A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and so has failed in the end examination. In such a case, the candidate must re-register for the subject (s) and secure the required minimum attendance. The candidate's attendance in there- writing the end examination in those subject(s). In the registered subject (s) shall be calculated separately to decide upon his eligibility for even to the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled. In case the candidate secures less than the required attendance in any subject he shall not be permitted to write the End Examination in that subject. He shall re-register the subject when next offered.

5.7 Laboratory examination for M.Tech courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher and the second examiner shall be another Laboratory Teacher.

6.0 EVALUATIONOFPROJECT/DISSERTATIONWORK

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

6.2 A Project Review Committee (PRC) shall be constituted with Principal as Chairperson, Heads of all the Departments offering the M.Tech. programs and two other senior faculty members.

6.3 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.

6.4 After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the Departmental Academic Committee for approval. Only after obtaining the approval of the Departmental Academic Committee can the student initiate the Project work.

6.5 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Departmental Academic Committee. However, the Departmental Academic Committee 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.

6.6 A candidate shall submit his status report in a bound-form in two stages at least with a gap of 3 months between them.

6.7 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course 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 Principal through Head of the Department and make an oral presentation before the PRC.

6.8 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

6.9 The thesis shall be adjudicated by one examiner selected by the University. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

6.10 If the report of thesis not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

6.11 If there port of the examiner is favorable, Viva-Voce examination shall be conducted by aboard consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work as one of the following:

A Excellent
B Good
C Satisfactory
D Unsatisfactory

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

If the report of the Viva-Voce is unsatisfactory, the candidate shall retake the Viva-Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, he will not be eligible for the award of the degree.

7.0 AWARD OF DEGREE AND CLASS

In assessing the performance of the students in examinations, the usual approach is to award marks based on the examinations conducted at various stages (sessional, mid-term, end-semester etc.,) in a semester. As per UGC Autonomous guidelines, the following system is implemented in awarding the grades and CGPA under the Credit Based Semester System (CBCS).
Letter Grades and Grade Points:
The UGC recommends a 10-point grading system with the following letter grades as given below:

Grades	Points	Marks secured (%)
O (Outstanding)	10	≥ 85
A+(Excellent)	9	80 – 84
A(Very Good)	8	75 – 79
B+(Good)	7	70 – 74
B(Above Average)	6	65 – 69
C(Average)	5	60 – 64
P(Pass)	4	50 – 59
F(Fail)	0	<50
Ab(Absent)	0	-

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

Computation of SGPA and CGPA

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

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

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

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

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

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

Where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

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

8.0 WITHHOLDINGOFRESULTS

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

9.0 TRANSITORYREGULATIONS

Discontinued, detained, or failed candidates are eligible for admission to two earlier or equivalent subjects at a time as and when offered.

10. GENERAL

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

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

10.3 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council of the College is final.

10.4 The College may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Academic Council of the College/Affiliating University.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

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

		examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Using objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other

	instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-incharge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance i n that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining

		examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Academic Council of the College (or) affiliating University for further action towards suitable punishment.	

Malpractices identified by squad or special invigilators will entail punishment to the candidates as per the above guidelines..

M. Tech – (THERMAL ENGINEERING)

COURSE STRUCTURE

I Year I Semester

S.No.	Subject Code	SUBJECT	L	T/P/D	C	Max Marks	
						Int.	Ext.
1	R18D2101	Advanced Thermodynamics	3	-	3	30	70
2	R18D2102	Advanced Heat and Mass Transfer	3	-	3	30	70
3	R18D2103	Advanced Fluid Mechanics	3	-	3	30	70
4	R18D2104 R18D2105 R18D2106	**PROGRAM ELECTIVE-I** Cryogenic Engineering Solar Energy Technology Turbo Machines	3	-	3	30	70
5	R18D2107 R18D2108 R18D2109	**PROGRAM ELECTIVE-II** Advanced I.C. Engines Design of Heat Exchangers Energy and Environmental Engineering	3	-	3	30	70
6		**OPEN ELECTIVE –I**	3	-	3	30	70
7	R18D2181	Thermal Engineering Laboratory	-	3	2	30	70
8	R18DHS55	**Audit Course I** Disaster Management	2	-	-	50	-
Total			**20**	**3**	**20**	**260**	**490**

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

OPEN ELECTIVE I			
Subject Code	**Subject Name**	**Subject Code**	**Subject Name**
R18DME51	Non-Conventional Energy Sources	R18DCS51	Scripting Languages
R18DME52	Industrial Safety	R18DAE51	Mathematical Modeling Techniques
R18DME53	Operations Research	R18DEC51	Embedded Systems Programming
R18DHS51	Business Analytics		

I Year II Semester

S.No.	Subject Code	SUBJECT	L	T/P/D	C	Max Marks	
						Int.	Ext.
1	R18D2110	Fuels, Combustion and Environment	3	-	3	30	70
2	R18D2111	Computational Fluid Dynamics	3	-	3	30	70
3	R18D2112	Advanced Finite Element Analysis	3	-	3	30	70
4	 R18D2113 R18D2114 R18D2115	**PROGRAMELECTIVE – III** Energy Management Industrial Refrigeration Systems Jet Propulsion and Rocket Engines	3	-	3	30	70
5	 R18D2116 R18D2117 R18D2118	**PROGRAMELECTIVE- IV** Thermal and Nuclear Power Plants Thermal Measurements and Process Controls Refrigeration and Air-Conditioning	3	-	3	30	70
6		**OPEN ELECTIVE- II**	3	-	3	30	70
7	R18D2182	Computational Methods Laboratory	-	3	2	30	70
8	 R18DHS56	**Audit Course II** English for Research Paper Writing	2	-	-	50	
Total			**20**	**3**	**20**	**260**	**490**

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

OPEN ELECTIVE II			
Subject Code	Subject Name	Subject Code	Subject Name
R18DME54	Composite Materials	R18DCS52	Information Security
R18DME55	Waste to Energy	R18DAE52	Unmanned Air Vehicles
R18DME56	Industrial Management	R18DEC52	Research Methodology
R18DHS52	Cost Management of Engineering Projects		

IIYear I Semester

S.No.	Subject Code	SUBJECT	L	T/P/D	C	Max Marks	
						Int.	Ext.
1	R18D2183	Seminar-I	-	-	2	50	-
2	R18D2191	Mini Project	-	-	4	100	-
3	R18D2192	Project Review I	-	-	8	100	-
Total			**-**	**-**	**14**	**250**	**-**

II Year II Semester

S.No.	Subject Code	SUBJECT	L	T/P/D	C	Max Marks	
						Int.	Ext.
1	R18D2184	Seminar-II	-	-	2	50	-
2	R18D2193	Project Review - II	-	-	8	100	-
3	R18D2194	Project Viva-Voce	-	-	8	-	100
Total			**-**	**-**	**18**	**150**	**100**

SEMESTER-I
SYLLABUS

MALLAREDDY COLLEGE OF ENGINEERING AND TECHNOLOGY

M.Tech I Year – I Sem (Thermal Engineering)

L	T/P/D	C
3	-	3

(R18D2101) ADVANCED THERMODYNAMICS

Course Objectives:

- This course aims to provide a good platform to mechanical engineering students to understand, model and appreciate concept of dynamics involved in thermal energy transformation.
- To understand the nature and operating principles of systems involving energy flows.
- To describe and apply basic thermodynamic principles to analyze and predict performance of idealized forms of thermodynamic systems.
- To describe and assess benefits of improvements to thermodynamic systems.
- To relate idealized thermodynamic system models to corresponding real systems.

UNIT-I

Review of Thermodynamic Laws and Corollaries: Transient flow analysis, Second law thermodynamics, Entropy, Availability and unavailability, Thermodynamic potential. Maxwell relations, Specific heat relations, Mayer's relation. Evaluation of thermodynamic properties of working substance.

UNIT-II

P.V.T Surface: Equation of state. Real gas behavior, Vander Waal's equation, Generalization compressibility factor. Energy properties of real gases. Vapour pressure, Clausius, Clapeyro equation. Throttling, Joule. Thompson coefficient. Non reactive mixtures of perfect gases. Governing laws, Evaluation of properties, Psychometric mixture properties and psychometric chart, Air conditioning processes, cooling towers. Real gas mixture.

UNIT-III

Combustion: Combustion Reactions, Enthalpy of formation. Entropy of formation, Reference levels of tables. Energy of formation, Heat reaction, Adiabatic flame temperature generated product, Enthalpies, Equilibrium. Chemical equilibrium of ideal gased, Effect of non reacting gases equilibrium in multiple reactions, the vent hoff's equation. The chemical potential and phase equilibrium. The Gibbs phase rule.

UNIT-IV

Power Cycles: Review binary vapour cycle, co generation and combined cycles, Second law analysts of cycles. Refrigeration cycles. Thermodynamics off irreversible processes. Introduction, Phenomenological laws, Onsaga Reciprocity relation, Applicability of the Phenomenological relations, Heat flux and entropy production, Thermodynamic phenomena, Thermo electric circuits.

UNIT-V

Direct Energy Conversion Introduction: Fuel cells, Thermo electric energy, Thermo ionic power generation, Thermodynamic devices magneto hydrodynamic generations, Photovoltaic cells.

Course Outcomes:

- Provide in-depth knowledge on fundamental and applied thermodynamics and clear understanding of basic principles of work and energy conversion.
- To appreciate concepts learnt in fundamentals laws of thermodynamics from which learning ideas how to sustain in energy crisis.
- Understand the combustion phenomenon and its reaction using mathematical models.
- To identify and formulate power production based on the fundamentals laws of thermal engineering
- To apply the knowledge of mathematics, science and engineering fundamentals to model the energy conversion phenomenon.

TEXT BOOKS:

1. P.K. Nag, "Engineering Thermodynamics", 4 th Edition, Tata McGraw-Hill Education Private Limited, 2010.
2. S.S. Thipse, "Advanced Thermodynamics", Narosa Publishing House, New Delhi, 2013
3. Thermal Engineering by R.K.Rajput, Lakshmi Publications.

REFERENCE BOOKS:

1. Y.A. Cengel and M.A. Boles, "Thermodynamics – An Engineering Approach", 5 th Edition in SI Units, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.
2. C. Borganakke and R.E. Sonntag, "Fundamentals of Thermodynamics", 7 th Edition, Wiley India, Delhi, 2012.
3. Van P. Carey, "Statistical thermodynamics and micro scale thermo physics", Cambridge University Press, 1999

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(R18D2102) ADVANCED HEAT AND MASS TRANSFER

Course Objectives:

- To develop the ability to use the heat transfer modes.
- To analyze the thermal analysis and sizing of heat exchangers and to learn the heat transfer coefficient for compact heat exchange**s.**
- To understand the various types of flows and applying in empirical equations
- To understand and analyze boiling and condensation through geometrics
- Toachieveanunderstandingofthebasicconceptsofphasechangeprocesses

UNIT-I

Brief introduction to different modes of heat transfer: Conduction: General heat Conduction equation-initial and boundary conditions.

Transient heat conduction: Lumped system analysis-Heisler charts-semi infinite solid-use ofshape factors in conduction-2D transient heat conduction-product solutions.

UNIT-II

Finite difference methods for conduction: 1D & 2D steady state and simple transient heat conduction problems-implicit and explicit methods.

Forced Convection: 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.

UNIT-III

External flows: Flow over a flat plate: integral method for laminar heat transfer coefficient for different velocity and temperature profiles. Application of empirical relations to variation geometries for laminar and turbulent flows.

Internal flows: 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.

UNIT-IV

Free convection: Approximate analysis on laminar free convective heat transfer-bousisinesq approximation-different geometries-combined free and forced convection.

Boiling and condensation: Boiling curve-correlations-Nusselt's theory of film condensation on a vertical plate-assumptions & correlations of film condensation for different geometries.

UNIT-V

Radiation heat transfer: Radiant heat exchange in grey, non-grey bodies, with transmitting.

Reflecting and absorbing media, spherical surfaces, and gas radiation-radiation from flames.
Mass Transfer: Concepts of mass transfer-diffusion & convective mass transfer analogies-significance of non-dimensional numbers.

Course Outcomes:

- On successful completion of this course the student will be able to apply various correlations for heat transfer calculations.
- To present fundamentals of momentum, heat and mass transfer and to introduce general conservation equation for transport phenomena.
- To analyze empirical relations to variation geometries for laminar and turbulent flows.
- To understand radiation heat transfer in grey body and non-grey bodies.
- To understand analogy between momentum, heat and mass transfer.

TEXTBOOKS:

1. Principles of Heat Transfer/Frank Kreith/Cengage Learning
2. Elements of Heat Transfer/E. Radha Krishna/CRC Press/2012
3. Heat Transfer/RK Rajput/S.Chand

REFERENCE BOOKS:

1. Introduction to Heat Transfer/SK Som/PHI
2. Engineering Heat & Mass Transfer/Mahesh Rathore/Lakshmi Publications
3. Heat Transfer / Necati Ozisik / TMH

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(R18D2103) ADVANCED FLUID MECHANICS

Course Objectives:

- To understand the laws of fluid flow for ideal and viscous fluids.
- To represent the real solid shapes by suitable flow patterns and to analyze the same for aerodynamics performances.
- To understand the changes in properties incompressible flow and shock expansion.
- Too make the student understand the concepts of boundaries.
- To make the student capable to establish a relation between fluid flow and concepts of thermodynamics.

UNIT-I

In Viscid Flow of Incompressible Fluids: 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: Condition for irrotationality, circulation & vorticity Accelerations in Cartesystems normal and tangential accelerations, Euler's, Bernouli equations in 3D– Continuity and Momentum Equations

UNIT-II

Viscous Flow: 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.

UNIT-III

Boundary Layer Concepts: Prandtl's contribution to real fluid flows – Prandtl's boundary layertheory - 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.

UNIT-IV

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

UNIT –V

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

Course Outcomes:

- To apply knowledge of mathematics, science and engineering in compressible and incompressible fluid flows.
- To understand and analyse the concept of viscous fluids
- To derive the governing equations of fluid flow and applying them to simple flow problems.
- To understand turbulent flow and develop models using Moody's diagram
- Emphasizing the mathematical formulation of various flow problems

TEXT BOOKS

1. Fluid Mechanics and Machines/Modi and Seth/Standard Book House
2. Fluid Mechanics/Cohen and Kundu/Elsevier/5th edition
3. Fluid Mechanics/Potter/Cengage Learning

REFERENCE BOOK:

1. Fluid Mechanics and Machines/CP Kodandaraman/New Age Publications
2. A Text book of Fluid Mechanics/RK Rajput/S. Chand
3. Boundary Layer Theory/ Schlichting H /Springer Publications

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(R18D2104) CRYOGENIC ENGINEERING
(PROGRAM ELECTIVE-I)

Course Objectives:

- To provide an introductory knowledge of Cryogenic Engineering.
- To provide the fundamentals of cryogenics
- To understand the behavior of materials at low temperatures.
- To accustom with various methods of production of cryogenic fluids
- To develop skills for designing cryogenic systems including refrigeration, storage & transfer of cryogens, and instrumentation.

UNIT-I

Introduction to Cryogenic Systems: Mechanical Properties at low temperatures. Properties of Cryogenic Fluids.

Gas Liquefaction: Minimum work for liquefaction. Methods to protect low temperature, Liquefaction systems for gases other than, Neon, Hydrogen and Helium.

UNIT-II

Liquefaction Systems for Neon, Hydrogen and Helium: Components of Liquefaction systems. Heat exchangers. Compressors and Expanders, Expansion valve, Losses in real machines.

UNIT-III

Gas Separation and Purification Systems: Properties of mixtures, Principles of mixtures, Principles of gas separation, Air separation systems.

UNIT-IV

Cryogenic Refrigeration Systems: Working Medium, Solids, Liquids, Gases, Cryogenicfluid storage & transfer, Cryogenic storage systems, Insulation, Fluid transfer mechanisms, Cryostat, CryoCoolers

UNIT-V

Applications: Space technology, In-Flight air separation and collection of LOX, Gas industry,Biology, Medicine, Electronics.

Course Outcomes:

- Understand the structures of different cryogenic systems and the analytical method for cryogenic thermodynamic cycle, and cryogenic gases and liquids and their mixtures.
- Understand the principles cryogenics systems for Liquefaction Systems of nitrogen, neon and helium

- Remember the gas separation and purification systems
- Understand the cryogenic refrigeration systems for solid, liquid and gaseous fuels
- Evaluate material properties at cryogenic temperature and understand the applications

TEXTBOOKS:

1. Cryogenic Systems/ R.F.Barren/ Oxford University Press
2. Cryogenic Research and Applications: Marshal Sitting/ Von Nostrand/ Inc. New Jersey
3. Cryogenic Heat Transfer/ R.F.Baron

REFERENCE BOOKS:

1. Experimental Techniques in Low Temperature Physics- O.K. White, Oxford Press, 1968
2. Cryogenic Process Engineering/ K.D. Timmerhaus & TM Flynn/ Plenum Press, 1998
3. Hand Book of Cryogenic Engineering – J.G.Weisend –II, Taylor and Francis,

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(R18D2105) SOLAR ENERGY TECHNOLOGY
(PROGRAM ELECTIVE-I)

Course Objectives:

- To introduce the basic concepts and novel technologies in solar thermal systems
- Understanding basic characteristics of renewable sources of energy and technologies for their utilization
- To give review on thermal storage of energy
- To provide a balance between both frontier technology updates and existing solar thermal energy strategies, in both quantitative and qualitative way.
- To give review on cost and economics and regulatory rules related to utilization of renewable sources of energy

UNIT-I

Introduction – 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.

UNIT-II

Design of Solar Water Heating System and Layout: Power generation – solar central receiver system – Heliostats and Receiver – Heat transport system – solar distributed receiver system – Power cycles, working fluids and prime movers, concentration ratio.

UNIT-III

Thermal Energy Storage: Introduction – Need for – Methods of sensible heat storage usingsolids 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.

UNIT-IV

Direct Energy Conversion: solid-state principles – semiconductors – solar cells –performance – modular construction – applications - conversion efficiencies calculations.

UNIT-V

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

Course Outcomes:

- Define basic properties of solar energy renewable source of energy and technologies for their Utilization.
- Describe main elements of Solar water heating systems designed for utilization of renewable sources of energy.
- Discuss the aspects of thermal energy storage in relation to natural and human aspects of the environment.
- Undertake simple analysis of DEC principles and performance calculations.
- To understand and analyze the principle of economic analysis in solar photo voltaic application systems.

TEXTBOOKS:

1. Principles of solar engineering/ Kreith and Kerider/Taylor and Franscis/2nd edition.
2. Solar energy thermal processes/ Duffie and Beckman/John Wiley & Sons.
3. Solar energy: Principles of Thermal Collection and Storage/ Sukhatme/TMH/2nd . Edition.

REFERENCE BOOKS:

1. Solar energy/ Garg/TMH.
2. Solar energy/ Magal/Mc Graw Hill.
3. Solar Thermal Engineering Systems / Tiwari and Suneja/Narosa.

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(R18D2106) TURBO MACHINES
(PROGRAM ELECTIVE-I)

Course Objectives:

- Understand the fundamental concepts of turbo machines.
- Apply concepts of steam nozzles and turbines
- Understand the thermodynamic analysis of centrifugal compressors.
- Understand the axial flow compressors and evaluating their performances in theform of velocity triangles.
- Analyze energy transfer through graphical and analytical methods in axial flow gas turbines

UNIT-I

Fundamentals of Turbo Machines: Classifications, Applications, Thermodynamic analysis, isentropic flow. Energy transfer. Efficiencies, Static and Stagnation conditions, Continuity equations, Euler's flow through variable cross sectional areas, unsteady flow in turbo machines.

UNIT –II

Steam Nozzles: Convergent and Convergent-Divergent nozzles, Energy Balance, Effect of backpressure of analysis. Design of nozzles.

Steam Turbines: Impulse turbines, Compounding, Work done and Velocity triangle, Efficiencies, Constant reactions, Blading, Design of blade passages, Angle and height, Secondary flow. Leakage losses, Thermodynamic analysis of steam turbines.

UNIT-III

Gas Dynamics: Fundamental thermodynamic concepts, isentropic conditions, mach numbers and area, Velocity relations, Dynamic Pressure, Normal shock relation for perfect gas. Supersonic flow, oblique shock waves. Normal shock recoveries, detached shocks, Aerofoil theory.

Centrifugal Compressor: Types, Velocity triangles and efficiencies, Blade passage design, Diffuser and pressure recovery. Slip factor, Stanitz and Stodolas formula's, Effect of inlet mach numbers, Pre whirl, Performance.

UNIT-IV

Axial Flow Compressors: 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: Geometrical and terminology. Blade force, Efficiencies, Losses, Free end force, Vortex Blades.

UNIT-V

Axial Flow Gas Turbines: Work done. Velocity triangle and efficiencies, Thermodynamic flow analysis, Degree of reaction, Zweifels relation, Design cascade analysis, Soderberg, Hawthrone, Ainley, Correlations, Secondary flow, Free vortex blade, Blade angles for variable degree of reaction. Actuator disc, Theory, Stress in blades, Blade assembling, Material and cooling of blades, Performances, Matching of compressors and turbines, off design performance.

Course Outcomes:

- Able to derive the basic equations used for turbo machines.
- Will be able to understand the concept of velocity triangles used for performance evaluation of turbines.
- Analyze the geometric terminologies of axial flow compressors
- Identify and differentiate positive displacement machines and turbo machines
- Able to understand the concept of degree of reaction for axial flow compressors.

TEXTBOOKS:

1. Principles of Turbo Machines/DG Shepherd / Macmillan.
2. Fundamentals of Turbo machinery/William W Perg/John Wiley & Sons.
3. Basic Concepts in Turbo machinery by Grant Ingram.

REFERENCE BOOKS:

1. Element of Gas Dynamics/Yahya/TMH.
2. Principles of Jet Propulsion and Gas Turbine/NJ Zucrow/John Wiley.
3. Textbook Of Turbomachines Si Units by MS Govinde Gowda, AM Nagaraja.

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(R18D2107) ADVANCED I.C. ENGINES
(PROGRAM ELECTIVE-II)

Course Objectives:

- Analyze engine cycles and the factors responsible for making the cycle different from the ideal cycle.
- To familiarize with volumetric efficiency, turbulent motion, flow characteristics,
- Understand combustion phenomenon in SI engine and CI engines.
- Outline emission formation mechanism of IC engines, its effects and the legislation standards.
- Understand the latest developments in IC Engines and alternate fuels

UNIT-I

Introduction – 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.

UNIT -II

Gas Exchange Processes: Volumetric Efficiency – Flow through ports – Supercharging and Turbo charging.
Charge Motion: Mean velocity and Turbulent characteristics – Swirl, Squish – Pre-chamber Engine flows.

UNIT -III

Engine Combustion in SI 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 – Fuel
Spray Behavior – Ignition Delay – Mixing Formation and control, Common rail fuel injection system.

UNIT -IV

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

UNIT -V

Engine Heat Transfer: 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

Course Outcomes:

- To apply thermodynamics laws in engineering applications.
- To demonstrate thermodynamic analysis to IC engines and describe combustion phenomena in spark ignition and compression ignition engines.
- To apply the knowledge of operating characteristics of common internal combustion engines.
- Evaluate the methods of engine emission control techniques and implement viable alternate fuels.
- Ability and information to follow recent developments about the internal combustion engine technology

TEXTBOOKS:

1. I.C. Engines / V.Ganesan/TMH
2. I.C. Engines Fundamentals/Heywood/TMH
3. I.C. Engines/G.K. Pathak & DK Chevan/ Standerd Publications

REFERENCE BOOKS:

1. I.C. Engines /RK Rajput/Laxmi Publications
2. Computer Simulation of C.I. Engine Process/ V.Ganesan/University Pre
3. Advanced I.C Engines by Senthil.

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(R18D2108) DESIGNOF HEAT EXCHANGERS
(PROGRAM ELECTIVE-II)

Course Objectives:

- To understand the components and importance of heat exchangers used in industry.
- Familiarize with the thermal and stress analysis on various parts of the heat exchangers.
- To understand the heat transfer and design of double pipe heat exchangers.
- Familiarize with the sizing and rating of the heat exchangers for various applications.
- To know the parameters required for the design of condensers and cooling towers.

UNIT-I

Fundamentals of Heat Exchanger: Temperature distribution and its implications types–shell and tube heat exchangers–regenerators and recuperators–analysis of heat exchangers–LMTD and effectiveness method.

UNIT-II

Flow and Stress Analysis: Effectofturbulence–frictionfactor–pressureloss–stressintubes–header sheets and pressure vessels– thermal stresses, shear stresses- types of failures.

UNIT-III

Design Aspects: Heat transfer and pressure loss–flow configuration–effect of baffles–effect of deviations from ideality –design of double pipe-finned tube –shell and tube heat exchangers-simulation of heat exchangers.

UNIT–IV

Compact and Plate Heat Exchangers: Types – merits and demerits – design of compact heat exchangers, plate heat exchangers–performance influencing parameters– limitations

UNIT-V

Condensers and Cooling Towers: Design of surface and evaporative condensers–cooling tower–performance characteristics.

Course Outcomes:

- Abilitytodesigntheheatexchangerbasedontheinformationprovidedforaparticularapplication.
- To analyze the parameters which influence the flow, stress on heat exchangers.
- Ability to design different types of heat exchangers based on flow configuration and heat transfer.
- Analyze problems involved in heat transfer and simulation of heat exchangers.
- Able to design surface and evaporative condensers based on performance characteristics.

TEXT BOOKS:

1. Sadik Kakac and HongtanLiu, Heat Exchangers Selection, Rating and Thermal Design, CRC Press, 2002.
2. Fundamentals of Heat Exchanger Design by Ramesh K. Shah, Dusan P. Sekulic.
3. Plate Heat Exchangers: Design, Applications and Performance by Bengt Sundén, R. M.Manglik.

REFERENCE BOOKS:

1. Arthur. PFrass, Heat Exchanger Design, John Wiley & Sons, 1988
2. Taborek.T, Hewitt.G.F and Afgan.N, Heat Exchangers, Theory and Practice. McGraw-Hill Book.
3. Hewitt.G.F, Shires. G.L and Bott.T.R, Process Heat Transfer, CRC Press, 1994.

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(R18D2109) ENERGY AND ENVIRONMENTAL ENGINEERING (PROGRAM ELECTIVE-II)

Course Objectives:

- To understand Learn the principles of air and water pollution, effect of these pollutants on the environment.
- To know the methods available to control air pollution and water pollution.
- Familiarize with the sources of waste and energy generation from waste.
- Thorough knowledge on energy conservation act and its features.
- Familiarize with the waste heat recovery systems and its applications.

UNIT-I

Introduction to Pollution: Pollution of air, water, and soil; Effect of pollution on living systems

Air Pollution: Sources and classification of air pollutants, Effect of air pollution, Pollution from industries, Chemical reactions in a contaminated atmosphere, urban air pollution, Green house effect, Ozone layer depletion, Acid rain, Photo chemical smog, Meteorological aspects of air pollution.

Air Pollution Sampling and Measurement: Collection of gaseous and particulate pollutants, Analysis of air pollutants – Sulphur dioxide, Nitrogen oxides, Carbon monoxide, Oxidants and Ozone, Hydro carbons and Particulate matter

UNIT–II

Air Pollution Control Methods and Equipment: Cleaning of gaseous effluents, Particulate emission control, Control of specific gaseous pollutants SO2, NOx, Hydrocarbons, CO.

Water Pollution and Control: Types of water pollutants and their effects, Thermal pollution and effects, Water pollution laws and standards, Waste water sampling and analysis, Treatment of waste water (primary, secondary and tertiary treatment processes).

UNIT–III

Waste to Energy Conversion: Sources and classification of wastes, Energy generation from wastes - Biochemical vs. Thermo-chemical Conversion and their environment benefits, Introduction to Biochemical conversion (anaerobic digestion), Thermo-chemical conversion processes direct combustion, incineration, pyrolysis, gasification and liquefaction, Economics of thermo-chemical conversion, Industrial applications of incinerators and gasifiers, Briquetting; Utilization and advantages of briquetting.

UNIT–IV

Energy Conservation in Industry: Energy Conservation and its Importance, Energy Strategy for the Future, The Energy Conservation Act, 2001 and its Features, Energy conservation in Boilers, Steam Turbines and Cooling Towers.

UNIT–V

Waste Heat Recovery: Introduction, Classification and Application, Benefits of Waste Heat Recovery, Development of a Waste Heat Recovery System.

Course Outcomes:

- To analyze the gaseous pollutants such as nitrogen oxides, sulphur dioxide, carbon monoxide etc.
- Ability to justify the use of pollution control equipment and their design.
- Apply the knowledge about the operations of Waste to Energy Plants.
- Carry out Techno-economic feasibility for Waste to Energy Plants.
- To develop and implement waste heat recovery systems.

TEXT BOOKS:

1. "Environmental pollution control engineering" C. S. Rao/New age International . Pvt.Ltd
2. "Air pollution" M.N.Rao and M.V.N.Rao /Tata Mc Graw Hill
3. G.Masters: Introduction to Environmental Engineering and Science Prentice Hall of India Pvt Ltd, NewDelhi -2003.

REFERENCE BOOKS:

1. "Pollution control in process industries" S.P. Mahajan/ Tata Mc Graw Hill
2. "Energy Technology" S.Rao and B.B.Parulekar /Khanna publishers
3. H.S.Peavy, D.R..Rowe, G.Tchobanoglous (1985): Environmental Engineering McGraw- Hill BookCompany, NewYork.

OPEN ELECTIVE-I

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(R18DME51) NON CONVENTIONAL ENERGY SOURCES (OPEN ELECTIVE-I)

Course Objectives:

- To explain the concept of various forms of renewable energy.
- To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications.
- To impart the knowledge of basics of different non conventional types of power generation & power plants in detail.
- Understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are scarce in nature.
- Student learn different sources and conversion techniques for better society

UNIT-I

Introduction: Energy Scenario, Survey of energy resources. Classification and need for 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.

UNIT -II

Geothermal Energy: Structure of earth, Geothermal Regions, Hot springs. Hot Rocks, HotAquifers. Analytical methods to estimate thermal potential. Harnessing techniques, Electricity generating systems.

UNIT-III

Direct Energy Conversion: Nuclear Fusion, Fusion reaction, P-P cycle, Carbon cycle, Deuterium cycle, Condition for controlled fusion, Fuel cells and photovoltaic, Thermionic and Thermoelectric generation and MHD generator.

Hydrogen Gas as Fuel: Production methods, Properties, I.C. Engines applications, Utilization strategy, Performances.

UNIT-IV

Bioenergy: Biomass energy sources. Plant productivity, Biomass wastes, aerobic and anaerobic bioconversion processes, Raw material and properties of bio-gas, Bio-gas plant technology and status, the energetic and economics of biomass systems, Biomass gasification

UNIT-V

Wind Energy: Wind, Beaufort number, Characteristics, Wind energy conversion systems, Types, Betz model. Interference factor. Power coefficient, Torque coefficient and Thrust coefficient, Lift machines and Drag machines. Matching Electricity generation.

Energy from Oceans: 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.

Course Outcomes:

- Students get expertise in analyzing the environmental sources.
- Cost economics of using renewable energy sources compared to fossil fuel.
- Students get exposure on direct energy conversion systems.
- Student expertise the need and role of Non-Conventional Energy sources
- Recognize the need and ability to engage in lifelong learning for further developments in this field

TEXTBOOKS:

1. Non-conventional Energy Sources / GD Rai/Khanna publications.
2. Non-Conventional Energy Sources and Utilisation (Energy Engineering)/ R K Rajput / S.Chand.
3. Renewable Energy Sources /Twidell & Weir/Taylor and Francis/ 2nd special Indian edition .

REFERENCE BOOKS:

1. Renewable Energy Resources- Basic Principles and Applications/ G.N.Tiwari and M.K.Ghosal/ Narosa Publications.
2. Renewable Energy Resources/ John Twidell & Tony Weir/Taylor & Francis/2nd edition.
3. Non Conventional Energy / K.Mittal/ Wheeler.

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(R18DME52) INDUSTRIAL SAFETY
(OPEN ELECTIVE –I)

Course Objectives:

- Students will be able to recognize and evaluate occupational safety and health hazards in the workplace
- To explain the concept of various industrial safety methods.
- To outline division aspects measurements of safety performance.
- Able to analyze the effects of workplace exposures, injuries and illnesses, fatalities
- To determine appropriate hazard controls following the hierarchy of controls

UNIT-I:

Importance of Safety, health and environment. Health safety and environmental policy, fundamentals of safety, classification of accidents, Managements responsibility, objectives of safety management, National safety council, Employees state insurance act 1948, approaches to prevent accidents, principles of safety management, safety organization, safety auditing, maintenance of safety, measurements of safety performance, industrial noise and noise control, Industrial Psychology, Industrial accidents and prevention. Introduction to OSHAS 18001 AND OSHA.

UNIT II:

Process safety management (P.S.M) as per OSHA, legal aspects of safety, safety with respect to plant and machinery, the explosive act 1884, Petroleum act 1934, personal protective equipment, classification of hazards, protection of respiratory system, work permit system, hazards in refineries and process plants, safety in process plants, pollution in some typical process industry.

UNIT III:

Safe working practices, housekeeping, safe working environment, safety device and tools, precaution in use of ladders, safety instruction during crane operation, safety instruction for welding, burning and cutting and gas welding equipment, electrical safety, case studies, safety in use of electricity, electric shock phenomena, Occurrence of electric shock, medical analysis of electric shock and its effect, safety procedures in electric plants, installation of earthing system,

UNIT IV:

Safety in hazardous area, hazard in industrial zones, classification of industrial Enclosures for gases and vapors. Mechanical, Chemical, Environmental and Radiation hazards, Machine guards and safety devices, slings, load limits, lifting tackles and lifting equipment, hydrostatic test, Chemical hazards, industrial toxicology, toxic chemicals and its harmful effects on humans, factors influencing the effect

of toxic materials, Units of concentration, control measure, environmental hazards, devices for measuring radiation, safety analysis and risk analysis, risk management, First aid, Safety measures to avoid occupational diseases.

UNIT V

Factories act – 1948Stuatutory authorities – inspecting staff, health, safety, provisions relating to hazardous processes, welfare, working hours, employment of young persons – special provisions – penalties and procedures- Indian Boiler Act 1923, static and mobile pressure vessel rules (SMPV), motor vehicle rules, mines act 1952, workman compensation act, rules – electricity act and rules.

Course Outcome:

- Evaluate workplace to determine the existence of occupational safety and health hazards
- Identify relevant regulatory and national consensus standards along with best practices that are applicable
- Educate students about how to reduce work place hazards and to encourage the standard of Safety, Health & Environment programme , so as to aim 0% accidents and 100% safety in different industries in which Industrial Safety plays an important role.
- Select appropriate control methodologies based on the hierarchy of controls
- This has the blending mixture of both Learning and Skills.

Text Books:

1. Industrial safety management By: L.M. Deshmukh Publishers: Tata Mcgraw Hill ,New Delhi Year: 2006 Edition: First
2. The Factories Act 1948, Madras Book Agency, Chennai, 2000

References:

1. Industrial safety health and environment Management system By: R.K. Jain & Sunil S. Rao Publishers: Khanna Publishers Year: 2008 Edition: Second
2..The Indian boilers act 1923, Commercial Law Publishers (India) Pvt.Ltd., Allahabad.
3.. ”Accident prevention manual for industrial operations”, N.S.C.,Chicago, 1982.
4. Industrial Safety and Environment by Amit Gupta
5.“Safety in Industry” N.V. Krishnan Jaico Publishery House, 1996.

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(R18DME53) OPERATIONS RESEARCH
(OPEN ELECTIVE –I)

Course Objectives:

- To familiarize the students with the use of practice oriented mathematical applications for optimization functions in an organization.
- To familiarize the students with various tools of optimization, probability, statistics and simulation,
- To applicable in particular scenarios in industry for better management of various resources.
- To develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language.
- Understandable to the decision-making processes in Management Engineering.

UNIT–I

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

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

UNIT–II

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

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

UNIT–III

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

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

UNIT–IV

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

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

UNIT–V

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

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

Course Outcomes:

- Student will be able to illustrate the need to optimally utilize the resources in various types of industries.
- Apply and analyze mathematical optimization functions to various applications.
- Demonstrate cost effective strategies in various applications in industry.
- Student will be able to implement these Techniques in real Life.
- Student can use this mathematical software to solve the proposed models.

TEXT BOOKS:

1. Operations Research / S.D.Sharma-Kedarnath
2. Introduction to O.R/Hiller &Libermann (TMH).
3. Introduction to O.R /Taha/PHI

REFERENCE BOOKS:

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

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(R18DHS51) BUSINESS ANALYTICS
(OPEN ELECTIVE –I)

Course Objectives:

- To understand the importance of ever-increasing volume, variety and velocity of data in organization and application of data analytical tools for decision making.
- Students will demonstrate ethical reasoning skills, understand social, civic, and professional responsibilities and aspire to add value to society.
- Students will effectively communicate using business specific terminology in written and verbal form.
- Students will utilize interpersonal and leadership skills to be highly effective business managers and leaders.
- Students will have a strategic understanding of business analytics.

Unit-I: Introduction to Business Analytics: Importance, Scope, Evolution, Classification, and Application; Data Structure-Visualization of Data, Data Architecture, Measurement Scale; Decision Models-Classification, Structure of Decision Models; Data Structure and Data View-Understanding of data, exploring data using pivot tables.

Unit-II: Descriptive Analytics: Descriptive Statistical Measures–Population and samples, Measures of location, Measures of Dispersion, Measures of variability, measures of Association. Probability distribution and Data Modeling – Discrete Probability distribution, Continuous Probability distribution, Random sampling from Probability Distribution, Data Modeling and Distribution fitting.

Unit-III: Predictive Analytics: Karl Pearson Correlation Techniques -Multiple Correlation-Spearman's Rank correlation-Simple and Multiple regression-Regression by the method of least squares –Building good regression models –Regression with categorical independent variables --Linear Discriminant Analysis-One way and Two Way ANOVA

Unit-IV: Data Mining: Scope of Data Mining, Data Exploration and Reduction, Unsupervised learning –cluster analysis, Association rules, Supervised learning-Partition Data, Classification Accuracy, prediction Accuracy, k-nearest neighbors, Classification and regression trees, Logistics Regression.

Unit-V: Simulation: Random Number Generation, Monte Carlo Simulation, What if Analysis, Verification and Validation, Advantages and Disadvantages of Simulation, Risk Analysis, Decision Tree Analysis.

References:

- James Evans, Business Analytics, 2e, Pearson.
- Camm, Cochran, Fry, Ohlmann, Anderson, Sweeney, Williams Essential of Business Analytics, Cengage Learning.
- Thomas Eri, Wajid Khattack & Paul Buhler: Big Data Fundamentals, Concepts, drivers and Techniques by Prentice Hall of India, New Delhi.
- Akil Maheswari: Big Data, Upskill ahead by Tata McGraw Hill, New Delhi.
- Seema Acharya & Subhashini Chellappan: Big Data and Analytics, Wiley Publications, New Delhi.
- S. Christian Albright, Wayne L. Winston: Business Analytics: Data Analysis & Decision Making, Cengage Learning

CourseOutcomes:

- Students will be able to understand Importance of Analytics.
- Students will be able to understand Understanding the analytical tools.
- Students will be able to understand Application of Analytical tools to solve business problems.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Analyze and evaluate appropriate business strategies, practices, and theories that inform and guide organizations to ensure sustainability.

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(R18DCS51) SCRIPTING LANGUAGES
(OPEN ELECTIVE – I)

Course Objectives:

- Motivation for and applications of scripting.
- Difference between scripting languages and non- scripting languages.
- Types of scripting languages.
- Scripting languages such as PERL, PHP,TCL/TK, python and BASH.
- Creation of programs in the Linux environment.

UNIT I

Introduction to PERL and Scripting Scripts and Programs, Origin of Scripting , Scripting Today, Characteristics of Scripting Languages, Web Scripting, and the universe of Scripting Languages. PERL-Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines, advance per l - finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system, Creating Internet ware applications, Dirty Hands Internet Programming, security Issues.

UNIT II

PHP Basics- Features, Embedding PHP Code in your Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions.

UNIT III

Advanced PHP Programming Php and Web Forms, Files, PHP Authentication and Methodologies - Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World – Translating Websites- Updating Web sites Scripts, Creating the Localization Repository, Translating Files, text, Generate Binary Files, Set the desired language within your scripts, Localizing Dates, Numbers and Times.

UNIT IV

TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns, files, Advance TCL- eval, source, exec and up level commands, Name spaces, trapping errors, event driven programs, making applications internet aware, Nuts and Bolts Internet Programming, Security Issues, C Interface. Tk- Visual Tool Kits, Fundamental Concepts of Tk, Tk by example, Events and Binding , Perl-Tk.

UNIT V

Python Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling, Integrated Web Applications in Python – Building Small, Efficient Python Web Systems, Web Application Framework.

Course Outcomes:

- Ability to create and run scripts using PERL/TCl/Python/PHP in IC design flow.
- Be familiar with design issues of object-oriented and functional languages.
- Be familiar with language abstraction constructs of classes, interfaces, packages, and procedures.
- Be familiar with using functional languages.
- Ability to use Linux environment and write programs for automation of scripts in VLSI tool design flow.

TEXT BOOKS:

1. The World of Scripting Languages, David Barron, Wiley Publications.
2. Python Web Programming, Steve Holden and David Beazley, New Riders Publications.
3. Beginning PHP and MySQL, 3rd Edition, Jason Gilmore, Apress Publications (Dreamtech)

REFERENCE BOOKS:

1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Lee and B.Ware (Addison Wesley) Pearson Education.
2. Programming Python, M.Lutz, SPD.
3. PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning Publications.
4. PHP 5.1,I.Bayross and S.Shah, The X Team, SPD.
5. Core Python Programming, Chun, Pearson Education.
6. Guide to Programming with Python, M.Dawson, Cengage Learning.
7. Perl by Example, E.Quigley, Pearson Education.
8. Programming Perl, Larry Wall, T.Christiansen and J.Orwant, O'Reilly, SPD.
9. Tcl and the Tk Tool kit, Ousterhout, Pearson Education.
10. PHP and MySQL by Example, E.Quigley, Prentice Hall(Pearson).
11. Perl Power, J.P.Flynt, Cengage Learning.
12. PHP Programming solutions, V.Vaswani, TMH.

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(R18DAE51) MATHEMATICAL MODELING TECHNIQUES (OPEN ELECTIVE-I)

Course Objectives

- The objective is to emphasize the importance of mathematical modeling of diverse engineering problems.
- Specifically aerospace problems will be discoursed to understand the need for numerical techniques
- To introduce optimization techniques into numerical problems to reduce problem data.
- Identify a problem and choose an appropriate mathematical model.
- Solve the problem using the appropriate technology if necessary.

UNIT-I: **INTRODUCTION TO MODELING AND SINGULAR PERTURBATION METHODS**

Definition of a model, Procedure of modeling: problem identification, model formulation, reduction, analysis, Computation, model validation, Choosing the model, Singular Perturbations: Elementary boundary layer theory, Matched asymptotic expansions, Inner layers, nonlinear oscillations

UNIT-II: **VARIATIONAL PRINCIPLES AND RANDOM SYSTEMS**

Variational calculus: Euler's equation, Integrals and missing variables, Constraints and Lagrange multipliers, Variational problems: Optics-Fermat's principle, Analytical mechanics: Hamilton's principle, Symmetry: Noether's theorem, Rigid body motion, Random systems: Random variables, Stochastic processes, Monte Carlo method

UNIT-III: **FINITE DIFFERENCES: ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS**

ODE: Numerical approximations, Runge-Kutta methods, Beyond Runge-Kutta, PDE: Hyperbolic equations-waves, Parabolic equations-diffusion, Elliptic equations-boundary values

CELLULAR AUTOMATA AND LATTICE GASES

Lattice gases and fluids, Cellular automata and computing

UNIT- IV: **FUNCTION FITTING AND TRANSFORMS**

Function fitting: Model estimation, Least squares, Linear least squares: Singular value decomposition, Non-linear least squares: Levenberg-Marquardt method, Estimation, Fisher information, and Cramer-Rao inequality, Transforms: Orthogonal transforms, Fourier transforms, Wavelets, Principal components

FUNCTION FITTING ARCHITECTURES

Polynomials: Pade approximants, Splines, Orthogonal functions, Radial basis functions, Over-fitting, Neural networks: Back propagation, Regularization

UNIT-V: **OPTIMIZATION AND SEARCH**

Multidimensional search, Local minima, Simulated annealing, Genetic algorithms

FILTERING AND STATE ESTIMATION

Matched filters, Wiener filters, Kalman filters, Non-linearity and entrainment, Hidden Markov models

Course Outcomes:

- Student will be able to predict and develop a numerical framework to a problem of physical interest.
- Student will be able to choose different techniques to solve various problems of diverse engineering, more especially to aeronautics and aerospace.
- Student will also enable to choose better optimized solutions using different optimization techniques.
- Students will develop understanding of various mathematical concepts and modeling techniques required for successful application of mathematics.
- Student will be able to model data using the language and techniques of mathematics.

TEXT BOOK:

1. The Nature of Mathematical Modeling, Neil Gershenfeld, Cambridge University Press, 2006,ISBN 0-521-57095-6

REFERENCE BOOKS:

1. Mathematical Models in the Applied Sciences, A. C. Fowler, Cambridge University Press, 1997,ISBN 0-521-46140-5
2. A First Course in Mathematical Modeling, F. R. Giordano, M.D. Weir and W.P. Fox, 2003,Thomson, Brooks/Cole Publishers
3. Applied Numerical Modeling for Engineers, Donald De Cogan, Anne De Cogan, Oxford University Press, 1997

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(R18DEC51) EMBEDDED SYSTEMS PROGRAMMING (OPEN ELECTIVE –I)

Course Objectives

- To have knowledge about the basic programming of an embedded system.
- To provide in-depth knowledge about embedded processor, its hardware and software.
- To explain real time operating systems, inter-task communication and an embedded software development tool.
- To acquire knowledge about embedded processors and their applications.
- Test a real application of Embedded system on Board

Unit 1 - Embedded OS (Linux) Internals

Linux internals: Process Management, File Management, Memory Management, I/O Management. Overview of POSIX APIs, Threads – Creation, Cancellation, POSIX Threads Inter Process Communication - Semaphore, Pipes, FIFO, Shared Memory

Kernel: Structure, Kernel Module Programming Schedulers and types of scheduling.

Interfacing: Serial, Parallel Interrupt Handling Linux Device Drivers: Character, USB, Block & Network

Unit 2 – Open source RTOS

Basics of RTOS: Real-time concepts, Hard Real time and Soft Real-time, Differences between General Purpose OS & RTOS, Basic architecture of an RTOS, Scheduling Systems, Inter-process communication, Performance Matric in scheduling models, Interrupt management in RTOS environment, Memory management, File systems, I/O Systems, Advantage and disadvantage of RTOS.

Unit 3 – Open Source RTOS Issues

POSIX standards, RTOS Issues - Selecting a Real Time Operating System, RTOS comparative study. Converting a normal Linux kernel to real time kernel, Xenomai basics.

Overview of Open source RTOS for Embedded systems (Free RTOS/ Chibios-RT) and application development.

Unit 4 – VxWorks / Free RTOS

VxWorks/ Free RTOS Scheduling and Task Management - Realtime scheduling, Task Creation, Inter task Communication, Pipes, Semaphore, Message Queue, Signals, Sockets, Interrupts I/O Systems - General Architecture, Device Driver Studies, Driver Module explanation, Implementation of Device Driver for a peripheral

Unit 5 – Case study

Cross compilers, debugging Techniques, Creation of binaries & porting stages for Embedded Development board (Beagle Bone Black, Rpi or similar), Porting an Embedded OS/ RTOS to a target board ().Testing a real time application on the board

Course Outcomes

- Ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
- Ability to port an Embedded OS/ RTOS to a target board.
- Foster ability to understand the design concept of embedded systems.
- Ability to integrate hardware and software for embedded applications systems.
- Foster ability to understand the design concept of embedded systems.

TEXT BOOKS:

1. Essential Linux Device Drivers, Venkateswaran Sreekrishnan
2. Writing Linux Device Drivers: A Guide with Exercises, J. Cooperstein
3. Real Time Concepts for Embedded Systems – Qing Li, Elsevier

REFERENCES:

1. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw Hill
2. Embedded/Real Time Systems Concepts, Design and Programming Black Book, Prasad, KVK
3. Software Design for Real-Time Systems: Cooling, J E Proceedings of 17the IEEE Real-Time Systems Symposium December 4-6, 1996 Washington, DC: IEEE Computer Society
4. Real-time Systems – Jane Liu, PH 2000
5. Real-Time Systems Design and Analysis : An Engineer's Handbook: Laplante, Phillip A
6. Structured Development for Real - Time Systems V1 : Introduction and Tools: Ward, Paul T & Mellor, Stephen J
7. Structured Development for Real - Time Systems V2 : Essential Modeling Techniques: Ward, Paul T & Mellor, Stephen J
8. Structured Development for Real - Time Systems V3 : Implementation Modeling Techniques: Ward, Paul T & Mellor, Stephen J
9. Monitoring and Debugging of Distributed Real-Time Systems: TSAI, Jeffrey J P & Yang, J H
10. Embedded Software Primer: Simon, David E.
11. Embedded Systems Architecture Programming and Design: Raj Kamal, Tata McGraw Hill

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(R18D2181) THERMAL ENGINEERING LABORATORY

Course Objectives:

- To understand the working principles of I.C. engines.
- To learn the testing methods used to measure the performance parameters of an engine.
- To demonstrate and conduct experiments.
- Familiarize with the solar panel power systems.
- To understand the working principles of refrigeration systems.

LIST OF EXPERIMENTS:

1. Load test on four stroke single cylinder diesel engine using biodiesels
2. Measurement of Burning Velocity of premixed flame.
3. To study V-I characteristics of solar panel
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 vapor compression refrigeration system.
7. To estimate power generation from solar photovoltaic system.
8. Performance analysis of heat pipe.
9. To study the performance of solar flat plate collector.
10. A study on Evacuative tube concentrator.

Course Outcomes:

At the end of the course the learners will be able to

- Analyze the performance and exhaust emissions of an IC engine.
- Evaluate the performance of the Vapor compression and Air conditioning units.
- Analyze the flame propagation velocity of the gaseous fuels.
- Evaluate the performance of the solar flat plate collector and evacuated tube concentrator.
- To carry out the test on power generation and V-I characteristics of solar power systems.

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(R18DHS55) DISASTER MANAGEMENT
(AUDIT COURSE –I)

Course Objective:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Understand the four work objectives of the disaster manager.
- They Know the key personnel or specialists related to disaster management and associate them with the types of disasters and phases in which they are useful.
- To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
- To ensure skills and ability to design, implement and evaluate research on disasters.

Unit-I: **Introduction to Disaster Management:** Definition, Nature, Types and Magnitude. Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters

Unit-II: Consequences of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Pre-Disaster Management- Early Warning and Prediction Systems: Role of IT, RS, GIS, GPS and ICS

Unit-III: **Global Perspective (Natural Disasters):** History of Disasters And Types of Hazards: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides & Avalanches.

Unit-IV: Global Perspective (Man-Made Disasters): Study of Environmental Impacts Induced By Human Activity, Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit-V: Disaster Management and Planning: Post Disaster Management Planning: Management of Essential Supplies and Temporary Shelter Relief, Evacuation & other Logistic Management, Site Management, Medical Trauma and Stress Management, Integrated Developmental Planning For Disaster Management

Course Outcomes:

- Students will be able to affirm the usefulness of integrating management principles in disaster mitigation work.
- Students can distinguish between the different approaches needed to manage pre- during and post- disaster periods.
- Understanding foundations of hazards, disasters and associated natural/social phenomena.
- Familiarity with disaster management theory (cycle, phases).
- Capacity to manage the Public Health aspects of the disasters.

Reference Books:

- Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
- Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
- Central Water Commission, 1987, Flood Atlas of India, CWC, New Delhi.
- Central Water Commission, 1989, Manual of Flood Forecasting, New Delhi.
- Government of India, 1997, Vulnerability Atlas of India, New Delhi.
- Sahni, Pardeep Et.Al. (Eds.) 2002, Disaster Mitigation Experiences and Reflections. Prentice Hall of India, New Delhi.

SEMESTER-II
SYLLABUS

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(R18D2110) FUELS, COMBUSTION AND ENVIRONMENT

Course Objectives:

- Provide students with knowledge of fuel quantity and engine technology effects on emissions. Understand the combustion phenomena.
- Understand the concept of laminar and turbulent flame propagation. To give students the basic understanding of the thermodynamics of combustion process.
- To equip students with the knowledge of the important chemical reactions occurring in combustion engines their rates and control. .
- To study the flame structure of premixed and diffusion flames.
- Enabling them to know the use of different techniques for determination of thermal and transport properties of commercial fuels.

UNIT–I

Fuels: Detailed classification – Conventional and Unconventional Solid, Liquid, gaseous fuels and nuclear fuels – Origin of Coal – Analysis of coal. Coal – Carborisation, Gasification and liquefaction – Lignite: petroleum based fuels – problems associated with very low calorific value gases: Coal Gas – Blast Furnace Gas Alcohols and Biogas.

UNIT–II

Principles of Combustion: Chemical composition – Flue gas analysis – 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.

UNIT–III

Thermodynamics of Combustion: Enthalpy of formation – Heating value of fuel – Adiabatic flame Temperature – Equilibrium composition of gaseous mixtures.

UNIT–IV

Laminar and Turbulent Flames Propagation and Structure: 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 Fluidised Bed Systems.

UNIT–V

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

Course Outcomes:

- Extend their knowledge of fuels and engines to different situations of engineering context and professional practice.
- Understand about different methods to reduce air pollution The flame temperature of commercial fuels burning in the combustion chambers of internal combustion engines
- The rate of chemical reactions and emission characteristics of hydrocarbon fuels used in power plants and transportation sector.
- The burning velocity of premixed flames and important combustion characteristics of diffusion flames.
- Thermodynamic and transport properties of fuels at elevated pressures and temperatures prevalent in the combustion chambers of actual engines

TEXTBOOKS:

1. Combustion Fundamentals / Roger A strehlow / Mc Graw Hill
2. Fuels and combustion / Sharma and Chander Mohan/ Tata Mc Graw Hill
3. Combustion Engineering and Fuel Technology / Shaha A.K./ Oxford and IBH.

REFERENCE BOOKS:

1. Combustion / Sarkar / Mc. Graw Hill.
2. An Introduction to Combustion / Stephen R. Turns/ Mc. Graw Hill International . Edition.
3. Combustion Engineering / Gary L. Berman & Kenneth W. Ragland/ Mc. Graw Hill International Edition

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(R18D2111) COMPUTATIONAL FLUID DYNAMICS

Course Objectives:

- To develop finite difference and finite volume discredited forms of the CFD equations.
- To formulate explicit & implicit algorithms for solving the Euler Equations & Navier Stokes Equations.
- Equip students with the knowledge base essential for application of computational fluid dynamics to engineering flow problems.
- Provide the essential numerical background for solving the partial differential equations governing the fluid flow
- Develop students' skills of using a commercial software package

UNIT-I

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

Solution Methods: 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.

UNIT–II

Hyperbolic Equations: Explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations.

Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

UNIT–III

Formulations of Incompressible Viscous Flows: 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, example problems.

UNIT-IV

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

UNIT–V

Standard Variational Methods: Linear fluid flow problems, steady state problems, Transient problems.

Course Outcomes:

- Derive the basic governing equations applied for fluid flow problems.
- Apply the differential equations to fluid flow problems.
- Understand the concept of discretization.
- Solve simple algorithms for incompressible fluid flow.
- Understand solution of aerodynamic flows.
- Appraise & compare current CFD software.
  Simplify flow problems and solve them exactly

TEXTBOOKS:

1. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985
2. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
3. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications

REFERENCE BOOKS:

1. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
2. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities . Press.
3. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford . University Press/2nd Edition

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(R18D2112) ADVANCED FINITE ELEMENT ANALYSIS

Course Objectives:

- Gain a fundamental understanding of the finite element method for solving boundary value problems.
- Learn important concepts of variation form, minimum potential energy principles, and method of weighted residuals.
- Study one dimensional problems such as truss, beam, and frame members, two-dimensional problems such as plain stress and plain strain elasticity problems, torsion problem.
- Provide complements of Solid and Structural mechanics required for the FEA contents.
- Provide detailed understanding of using FEA to solve advanced structural and solid mechanics problems involving material nonlinearity.

UNIT-I

Introduction to FEM: Basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variation 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.

UNIT-II

1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.
Analysis of Trusses: Plane Trusses and Space Truss elements and problems.
Analysis of Beams: Hermite shape functions – stiffness matrix – Load vector – Problems.

UNIT-III

2-D Problems: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Iso parametric elements – quadrilateral element, shape functions – Numerical Integration.
Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements.
3-D Problems: Tetra hedran element – Jacobian matrix – Stiffness matrix.

UNIT-VI

Scalar Field Problems: 1-D Heat conduction-Slabs – fins - 2-D heat conduction problems – Introduction to Torsional problems.

UNIT-V

Dynamic Considerations And Dynamic Equations – consistent mass matrix – Eigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

Course Outcomes:

- Apply the concepts of minimum potential energy principles to solve structural mechanics problems.
- Compute Eigen values and eigenvectors of simple dynamic systems
- Obtain weak form from strong form and total potential, and recognize similarities . between such solutions, and those obtained by variational principles and principal of . virtual work.
- Able to demonstrate knowledge of the fundamental concepts of using FEA to model buckling of structures.
- Able to demonstrate knowledge of the fundamental concepts of the theory of plasticity.

TEXTBOOKS:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Finite Element Methods: Basic Concepts and applications, Alavala, PHI
3. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice – Hall

REFERENCE BOOKS:

1. Introduction to Fininte element analysis- S.Md.Jalaludeen,Anuradha Publications, . print-. 2012
2. A First Course in the Finite Element Method/Daryl L Logan/Cengage Learning/5th . Edition
3. Finite Element Method – Krishna Murthy / TMH

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(R18D2113) ENERGY MANAGEMENT
(PROGRAM Elective- III)

Course Objectives:

- To understand the principles associated with effective energy management and to apply these principles in the day-to-day life.
- To minimise energy costs / waste without affecting production & quality.
- To minimize environmental effects.
- To gain exposure to energy auditing.
- To understand the principles associated with effective energy management and to apply these principles in the day-to-day life.

UNIT-I

Introduction: 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 organizations. Initiating, Organizing and managing energy management programs

UNIT-II

Energy Audit: 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 constrains, Synthesis of alternative options and technical analysis of options. Process integration.

UNIT-III

Economic Analysis: Scope, Characterization of an investment project. Types of depreciation, Time value of money. Budget considerations, Risk analysis.

UNIT-IV

Methods of Evaluation of Projects: Payback, Annualized costs, Investor's rate of return,Present worth, Internal rate of return, Pros and cons of the common method of analysis, Replacement analysis.

UNIT-V

Alternative Energy Sources: Solar energy- Types of devices for solar energy collections, Thermal storage system, Control systems. Wind Energy, Availability, Wind Devices, Wind Characteristics, performance of turbines and systems.

Course Outcomes:

- Understanding of energy conservation and identification of energy conservation opportunities in various industrial processes

- Knowledge of various tools and components of energy auditing
- Understanding of energy conservation and identification of energy conservation opportunities in various industrial processes
- Will be able to analyse and estimate the costs involved in completion of a project.
- Gains knowledge about the importance of alternative energy sources in the present scenario.

TEXTBOOKS:

1. Energy Management Hand Book / W.C. Turner (Ed)
2. Energy Management Principles / CB Smith/ Pergamum Press
3. Energy Audits: A Workbook for Energy Management in Buildings by E-book by Tarik Al-Shemmeri

REFERENCE BOOKS:

1. Energy Management / W.R.Murthy and G.Mc.Kay / BS Publication
2. Management / H.Koontz and Cyrill Donnel / McGraw Hill
3. Energy Management Hand Book, BSR Publications.

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(R18D2114) INDUSTRIALREFRIGERATION SYSTEMS
(PROGRAM ELECTIVE- III)

Course Objectives:

- To provide concepts of Refrigeration systems in residential, commercial and industrial buildings.
- To impart knowledge of various compressors
- To educate about various system components and accessories of refrigeration systems like evaporators and condensers
- To learn about cycle analysis pertaining to Refrigeration systems.
- To learn about energy conservation and design cinderations

UNIT-I

Introduction: Introductiontoindustrialrefrigeration-differencefromconventionalsystem-applications–industrial and comfort air -conditioning-conditions for high COP.

UNIT-II

Compressors: Reciprocating and screw compressor: Multistage industrial applications, cylinder arrangement, cooling methods- oil injection and refrigeration injection, capacity regulations-Economizers.

UNIT-III

Evaporator sand Condensers: Types of Evaporators, Liquid circulation: Mechanical pumping and gas pumping-advantage and disadvantage of liquid re-circulation-circulation ratio-top feed and bottom feed refrigerant-Net Positive Suction Head(NPSH)-two pumping vessel system-suction risers– design –piping loses. Different Industrial Condensers arrangement, Evaporators-Types and arrangement, liquid circulation, type of feed, refrigerant tipping design, functional aspects. Lubricating oil: types-physical properties, types of circulation and oil separator.

UNIT-IV

Vessels in Industrial Refrigeration: High pressure receiver, flash tank, liquid and vapour separator, separation enhancers, low pressure receivers, surge drum, surge line accumulator, thermosyphon receiver and oil pots.

UNIT-V

Energy Conservation and Design Considerations- Source of losses, energy efficient components, and heat reclaim thermal storage, ice builder and ice harvester.

Insulation: critical thickness, insulation cost and energy cost, vapour barriers, construction methods of refrigerated spaces.

Course Outcome:

- To enable students to demonstrate and apply knowledge of design, select components for, and prepare design documents for industrial Refrigeration systems.
- Analyze performance of compressors in refrigeration system
- Study the working principles of evaporators and condensers of refrigeration system.
- Study the vessels that used in Industrial refrigeration systems
- Evaluate energy conservation and design methods in air conditioning system

TEXTBOOKS:

1. WilbertF.Stoecker, Industrial Refrigeration HandBook,McGraw-Hill,1998.
2. ASHRAEHandBook: Fundamentals,1997.
3. ASHRAEHandBook: Refrigeration,1998.

REFERENCE BOOKS:

1. ASHRAEHandBook: HVAC SystemsandEquipment,1996.
2. TransportpropertiesofSUVARefrigerants, Du-PontChemicals,1993.
3. Refrigeration and Air Conditioning Technology by Bill Whitman, Bill Johnson, John Tomczyk &Eugene Silberstein.

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(R18D2115) JET PROPULSION AND ROCKET ENGINES (PROGRAMELECTIVE-III)

Course Objectives:

- Develop an understanding of how air-breathing engines and chemical rockets produce thrust.
- Analyze the characteristics of the nozzle.
- Working knowledge of the basic operation and design requirements of propulsion turbo machinery components (inlets, compressors, combustors, turbines, afterburners, and nozzles).
- Carry out performance analysis rockets.
- To study the Ramjet Engine propulsion system

UNIT-I

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

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

UNIT-II

Principles of Jet Propulsion and Rocket Engines : 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: 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.

UNIT-III

Aero Thermo Chemistry of the Combustion Products: 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: 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.

UNIT-IV

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: 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. Un cooled engines, injectors – various types, injection patterns, injector characteristics, and atomization and drop size distribution, propellant tank design.

UNIT-V

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.

Course Outcomes:

- Analyze the thrust in air-breathing engines and rockets.
- Characterize the performance and operating/design constraints for inlets, compressors, combustors, turbines and nozzles
- Calculate energy release, e.g., adiabatic flame temperatures, and equilibrium composition of gases at known temperature and pressure
- Analyze the thermodynamic performance of simple chemical and electrical rocket cycles and compute relevant performance parameters
- An understanding of Ramjet and Integral Ramjet Propulsion System.

TEXTBOOKS:

1. Mechanics and Dynamics of Propulsion/ Hill and Peterson/John Wiley & Sons.
2. Rocket propulsion elements/Sutton/John Wiley & Sons/8th Edition.
3. Gas Turbines/Ganesan /TMH.

REFERENCE BOOKS:

1. Gas Turbines & Propulsive Systems/Khajuria & Dubey/Dhanpat Rai & Sons.
2. Rocket propulsion/Bevere.
3. Jet propulsion /Nicholas Cumpsty.

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(R18D2116) THERMAL AND NUCLEAR POWER PLANTS
(PROGRAM ELECTIVE-IV)

Course Objectives:

- Provide awareness about resources of energies available in India for Power Production by Thermal and Nuclear Processes.
- Understand and know the requirements for a Thermal Power Plant and Nuclear Power Plant, from sources to consumption and economics of power plants.
- Study and learn the processes and cycles followed in Thermal Power Plants and nuclear power plants and components used in the power plants.
- Gain the knowledge on steam power plants, steam generators and gas turbine power plants, their analyses on fuel and fluidized bed combustion, ash handling systems.
- Understanding the power plant instrumentation

UNIT–I

Introduction: Sources of energy, Type of Power plants. Direct energy conversion system, Energy sources in India, Recent developments in power generation, Combustion of coal, Volumetric analysis, Gravimetric analysis. Fuel gas analysis.

Steam Power Plant: Introduction. General layout of steam power plant, Modern coal. Fired Steam, Steam power plant. Power plant cycle, Fuel Handling, Combustion equipment, Ash handling, Dust collectors.

Steam Generators: Types, Accessories. Feed water heaters, Performance of boiling, Water treatment, Cooling towers, and Steam turbines. Compounding of turbines, Steam condensers, Jet and surface condensers.

UNIT-II

Gas Turbine Power Plant: Cogeneration. Combined cycle power plant, Analysis, Waste heat recovery, IGCC power plant, Fluidized bed, Combustion, Advantages, and Disadvantages.

UNIT-III

Nuclear Power Plant: Nuclear physics, Nuclear Reactor, Classification, Types of reactors, Site selection. Method of enriching uranium. Application of nuclear power plant. Nuclear Power Plant Safety: Bi-Product of nuclear power generation, Economics of nuclear power plant, Nuclear power plant in India, Future of nuclear power.

UNIT-IV

Economics of Power Generation: Factors affecting the economics, Loading factors, Utilization factor, Performance and operating characteristics of power plant, Point economic load sharing, Depreciation. Energy rate, Criteria for optimum loading. Specific economic energy problem.

UNIT-V

Power Plant Instrumentations: Classification, Pressure measuring instrument, Temperature measurement and Flow Measurement, Analysis of combustion gases, Pollution types, Methods of control.

Course Outcomes:

- Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.
- Gain the knowledge about resources of energies available in India for Power Production by Thermal and Nuclear Processes.
- Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts
- Analyze the processes and cycles followed in Thermal Power Plants and nuclear power plants and components used in the power plants and identify the losses to get better efficiency.
- Describe the working principle and basic components of measuring instruments of power plant and pollution control methods involved with it.

TEXTBOOKS:

1. Power Plant Engineering / P.K.Nag/ TMH.
2. Power Plant Engineering / R.K.Rajput / Lakshmi Publications.
3. Power Plant Engineering, by Samsher Gautam, First Edition.

REFERENCE BOOKS:

1. Power Plant Engineering / P.C.Sharma / Kotearia Publications.
2. Power Plant Technology / Wakil.
3. Power Plant Engineering by A.K. Raja, Amit Prakash Srivastava,Manish Dwivedi.

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(R18D2117) THERMAL MEASUREMENTS AND PROCESS CONTROLS (PROGRAM ELECTIVE-IV)

Course Objectives:

- Educate the student with operating principles and function of measuring instruments used in Engineering and process industries
- Make the student conversant with various working principles of instruments
- Understand and analyze the behavioral characteristics of instruments
- Make the student learn about calibration procedure the instrument
- Educate the student about the fundamental aspects of control systems and their use in the context of industry applications

UNIT-I

General Concepts: 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.

UNIT-II

Measurement of Flow: 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.

UNIT-III

Temperature Measurement: Different principles of Temperature Measurement, use ofbimetallic thermometers – Mercury thermometers, Vapor Pressure thermometers, Thermo positive elements, thermocouples in series & parallel, pyrometry, measurement of heat flux, calibration of temperature measuring instruments and design of temperature measuring instruments.

UNIT-IV

Level Measurement: 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.

UNIT-V

Process Control: 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, transient regulations.

Course Outcomes:

- Making the student conversant with different working principles of various instruments
- Making the student to learn in the transduction of the signals
- Student can be able to analyze the behavior of an instrument in the measurement process
- Be able to analyze and design an instrumentation system, dealing with the concepts of dynamic range, signal noise ratio, and error budget
- Build, program, calibrate and use a microprocessor-based instrumentation system

TEXTBOOKS:

1. Measurement System, Application & Design – E.O. Doeblin.
2. Mechanical and Industrial Measurements – R.K. Jain – Khanna Publishers.
3. Applied Thermal Engineering, Design. Processes. Equipment. Economics by T.S. Zhao

REFERENCE BOOKS:

1. Mechanical Measurements – Buck & Beckwith – Pearson.
2. Control Systems, Principles & Design, 2nd Edition – M. Gopal – TMH.
3. Thermal processing quality and Principles by George Awuah, Hosahalli S . Ramaswamy, AEconomides.

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(R18D2118) REFRIGERATION AND AIR CONDITIONING (PROGRAM ELECTIVE-IV)

Course Objectives:

- Learning the fundamental principles and different methods of refrigeration and air conditioning.
- Study of various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.
- Comparative study of different refrigerants with respect to properties, applications and environmental issues.
- Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
- Study of the various air conditioning operating principles, and cooling load estimation

UNIT–I

Vapour Compression Refrigeration: Performance of Complete vapor compression system.

Components of Vapor Compression System: The condensing unit – Evaporators – Expansion valve – Refrigerants – Properties – ODP & GWP - Load balancing of vapor compression Unit.

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

UNIT–II

Production of Low Temperature: 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.

UNIT–III

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

Steam Jet refrigeration system: Representation on T-s and h-s diagrams – limitations and applications.

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

UNIT–IV

Air Conditioning: Psychometric properties and processes – Construction of Psychometric 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.

UNIT–V

Air Conditioning Systems: All Fresh air, Re-circulated air with and without bypass, withreheat 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.

Course Outcomes:

- Illustrate the fundamental principles and applications of refrigeration and air conditioning system
- Obtain cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems
- Present the properties, applications and environmental issues of different refrigerants
- Calculate cooling load for air conditioning systems used for various applications
- Operate and analyze the refrigeration and air conditioning systems.

Use P-h, T-S and Psychrometric charts to solve refrigeration and Air conditioning design

TEXTBOOKS:

1. Refrigeration & Air Conditioning /C.P. Arora/TMH.
2. Refrigeration & Air Conditioning /Arora & Domkundwar/ Dhanpat Rai.
3. Refrigeration and Air Conditioning /Manohar Prasad.

REFERENCE BOOKS:

1. Principles of Refrigeration/ Dossat /Pearson.
2. Refrigeration and Air Conditioning /Ananthanarayana /TMH.
3. Refrigeration and Air Conditioning /Jordan& Preister /Prentice Hall.

OPEN ELECTIVE-II

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(R18DME54) COMPOSITE MATERIALS
(OPEN ELECTIVE –II)

Course Objectives:

- To be familiar with classification and characteristics of composite material and their applications.
- To gain the knowledge about manufacturing methods of composites.
- To know the testing methods related to composite materials.
- To understand and analyze problems on macro mechanical behavior of laminate
- Understanding of failure theories and methods of joining

UNIT-I

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

UNIT-II

Manufacturing methods: Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical. Measurement of interface strength.

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Course Outcomes:

- To provide knowledge on characteristics of composites.
- To get knowledge on manufacturing and testing methods and mechanical behavior of composites.
- To get the exposure mechanical properties of different materials.
- Ability to analyze problems on macro mechanical behavior of laminate and failure and joining theories involved in.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Stuart M Lee, J. Ian Gray, Miltz, (1989), Reference Book for Composites Technology, CRC press
2. Frank L Matthews and R D Rawlings, (2006), Composite Materials: Engineering and Science, Taylor and Francis.
3. D. Hull and T.W. Clyne, (1996), Introduction to Composite Materials, Cambridge University Press
4. Analysis and Performance of Fiber Composites by Bhagwan D. Agarwal
5. Mechanics of Composite Materials by Autar K. Kaw

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(R18DME55) WASTE TO ENERGY
(OPEN ELECTIVE –II)

Prerequisite: Renewable Energy Sources, Physics, Environmental Studies

Course Objectives:

- To classify solid waste sources
- To identify methods of solid waste disposal
- To study various energy generation methods
- To analyse biogas production methods and recycling of e-waste
- To understand Ewaste and its hazards

UNIT- I :Solid Waste Sources Solid Waste Sources, types, composition, Properties, Global warming, Municipal Solid Waste: Physical, chemical and biological properties , Waste Collection and, Transfer stations, Waste minimization and recycling of municipal waste, Segregation of waste, Size Reduction , Managing Waste. Status of technologies for generation of Energy from Waste Treatment and Disposal Aerobic composting, incineration, Furnace type and design, Medical waste /Pharmaceutical waste treatment Technologies, incineration, Environmental impacts, Measures to mitigate environmental effects due to incineration.

UNIT – II: Land Fill method of Solid waste disposal Land fill classification, Types, methods and Sitting consideration, Layout and preliminary design of landfills: Composition, characteristics, generation, Movement and control of landfill leach ate and gases, Environmental monitoring system for land fill gases.

UNIT – III: Energy Generation from Waste Bio-chemical Conversion: Sources of energy generation, anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, Industrial waste, agro residues, Anaerobic Digestion.

UNIT – IV: Biogas production, Land fill gas generation and utilization, Thermo-chemical conversion: Sources of energy generation, Gasification of waste using Gasifiers, Briquetting, Utilization and advantages of briquetting, Environmental benefits of Bio-chemical and Thermo- chemical conversion.

UNIT – V: E-waste: e-waste in the global context – Growth of Electrical and Electronics Industry in India – Environmental concerns and health hazards – Recycling e-waste: a thriving economy of the unorganized sector – Global trade in hazardous waste – impact of hazardous e-waste in India. Management of e-waste: e-waste legislation, Government regulations on e-waste management – International experience – need for stringent health safeguards and environmental protection laws of India.

Course Outcomes: Up on the completion of the subject, the student will be able to

- Apply the knowledge about the operations of Waste to Energy Plants.
- Analyse the various aspects of Waste to Energy Management Systems.
- Carry out Techno-economic feasibility for Waste to Energy Plants.
- Apply the knowledge in planning and operations of Waste to Energy plants.
- Understand e-waste management and disposals.

TEXT BOOKS:

1. Nicholas P. Cheremisinoff. Handbook of Solid Waste Management and Waste Minimization Technologies. An Imprint of Elsevier, New Delhi (2003).
2. P. Aarne Vesilind, William A. Worrell and Debra R. Reinhart. Solid Waste Engineering. Thomson Asia Pte Ltd. Singapore (2002)
3. M. Dutta , B. P. Parida, B. K. Guha and T. R. Surkrishnan. Industrial Solid Waste Management and Landfilling practice. Narosa Publishing House, New Delhi (1999).
4. “E-waste in India: Research unit, Rajya Sabha Secretariat, New Delhi, June 2011”
5. Amalendu Bagchi. Design, construction and Monitoring of Landfills. John Wiley and Sons. New York. (1994)
6. M. L. Davis and D. A. Cornwell. Introduction to environmental engineering. Mc Graw Hill International Edition, Singapore (2008)
7. C. S. Rao. Environmental Pollution Control Engineering. Wiley Eastern Ltd. New Delhi (1995)
8. S. K. Agarwal. Industrial Environment Assessment and Strategy. APH Publishing Corporation. New Delhi (!996)
9. Sofer, Samir S. (ed.), Zaborsky, R. (ed.), “Biomass Conversion Processes for Energy and Fuels”, New York, Plenum Press, 1981
10. Hagerty, D.Joseph; Pavoni, Joseph L; Heer, John E., “Solid Waste Management”, New York, Van Nostrand, 1973
11. George Tchobanoglous, Hilary Theisen and Samuel Vigil Prsl: Tchobanoglous, George Theisen, Hillary Vigil, Samuel, “Integrated Solid Waste management: Engineering Principles and Management issues”, New York, McGraw Hill, 1993.

REFERENCES:

- C Parker and T Roberts (Ed), Energy from Waste – An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985

- KL Shah, Basics of Solid and Hazardous Waste Management Technology, Prentice Hall, 2000 3. M Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House, 1997
- G Rich et.al, Hazardous Waste Management Technology, Podvan Publishers, 1987
- AD Bhide, BB Sundaresan, Solid Waste Management in Developing Countries, INSDOC, New Delhi,1983 FUEL CELL AND

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(R18DME56) INDUSTRIAL MANAGEMENT
(OPEN ELECTIVE-II)

Course Objectives:

- This course is intended to familiarize the students with the framework for the managers and leaders
- The student able to understanding and making decisions relating to issues related organizational structure, production operations, marketing
- The student learns about Human resource Management, product management and strategy.
- The student will be able to learn the concepts of PERT&CPM.
- This course will help in preparing variable control charts, and R charts, attributes control charts, p charts and c charts.

UNIT- I

Concepts of Management and Organisation - Functions of Management - Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs - Systems Approach to Management.

UNIT –II

Designing Organisational Structures : Basic concepts related to Organisation - Departmentation and Decentralisation, Types of mechanistic and organic structures of organisation (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization, Virtual Organisation, Cellular Organisation, team structure, boundary less organization, inverted pyramid structure, lean and flat organization structure) and their merits, demerits and suitability.

UNIT –III

Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant- Matrix approach. Plant Layout - definition, objectives, types of production, types of plant layout - various data analyzing forms-travel chart.

Work study - Definition, objectives, method study - definition, objectives, steps involved- various types of associated charts-difference between micro motion and memo motion studies. Work measurement- definition, time study, steps involved-equipment, different methods of performance

rating- allowances, standard time calculation. Work Sampling - definition, steps involved, standard time calculations, differences with time study.

UNIT –IV

Materials Management-Objectives, Inventory - functions, types, associated costs, inventory classification techniques-ABC and VED analysis. Inventory Control Systems-Continuous review system-periodical review system. Stores Management and Stores Records. Purchase management, duties of purchase of manager, associated forms. Introduction to PERT / CPM : Project management, network modeling-probabilistic model, various types of activity times estimation-programme evaluation review techniques- Critical Path-probability of completing the project, deterministic model, critical path method (CPM)-critical path calculation-crashing of simple of networks.

UNIT –V

Inspection and quality control, types of inspections - Statistical Quality Control-techniques-variables and attributes-assignable and non assignable causes- variable control charts, and R charts, attributes control charts, p charts and c charts. Acceptance sampling plan- single sampling and double sampling plans-OC curves. Introduction to TQM-Quality Circles, ISO 9000 series procedures. Introduction to Human Resource Management, Functions of HRM, Job Evaluation, different types of evaluation methods. Job description, Merit Rating.- difference with job evaluation, different methods of merit ratings, wage incentives, different types of wage incentive schemes. Marketing, marketing vs selling, marketing mix, product lifecycle.

Course Outcomes:

- Plan an organizational structure for a given context in the organization carry out production operations through Work study and carry out production operations through Work study.
- Understand the markets, customers and competition better and price the given products appropriately and ensure quality for a given product or service.
- Student will be capable of rating the performance of project.
- Plan and control the HR function better and plan, schedule and control projectthrough PERT and CPM,evolve a strategy for a business or service organization.
- Capable of inspecting the quality of production and control the quality.

TEXT BOOKS:

1. Amrine, Manufacturing Organization and Management, Pearson, 2nd Edition, 2004.
2. Industrial Engineering and Management O.P. Khanna Dhanpat Rai.
3. A.R.Aryasri, Management Science , Tata McGraw-Hill, 2002.

REFERENCE BOOKS:

1. Panner Selvam, Production and Operations Management, PHI, 2004.
2. Dr. C. Nadha Muni Reddy and Dr. K. Vijaya Kumar Reddy, Reliability Engineering & Quality Engineering, Galgotia Publications, Pvt., Limited.
3. Phillip Kotler, Marketing Management, Pearson, 2004.

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(R18DHS52) COST MANAGEMENT OF ENGINEERING PROJECTS (OPEN ELECTIVE –II)

Course Objective:

- Project Cost management is concerned with the process of planning and controlling the budget of a project or business.
- The Cost Management course addresses activities such as planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.
- To make student be capable of taking the decisions in different situations.
- To make student capable of solving Problems on Material and Labor variances.
- To make student capable to perform Audit.

Unit-I:

Introduction to Project Cost Management: Concept of project cost management - objectives and scope- Elements of project costs: functional classification and ascertainment of cost (material, labour and overhead costs) –Preparation of a cost sheet for an engineering project

Unit-II:

Method of Project Costing: Single Output/ Unit Costing: Activity Based Costing - Job Costing - Batch Costing - Contract Costing - Process/ Operation Costing

Unit-III:

Marginal Cost: Marginal Costing – Nature and Scope- Applications - Break even charts and Point, Decision Making (all types with full problems) Differential Cost Analysis, Advantages and Disadvantages of Marginal Costing.

Unit-IV:

Project Budgetary Control: Objectives of Project Budgetary control - Functional Project Budgets - Master Budgets - Key Factor Problems on Production Budgets and Flexible Budgets. Standard Costing- Comparison with Budgetary control, analysis of Variances, Simple Problems on Material and Labor variances only.

Unit-V: Project Cost Audit & Reporting to Management: Objectives and advantages of Project Cost Audit – Project Cost Audit report - Management Audit - Objectives and Scope. Reporting to Management – Purpose of reporting- Requisites of a good report, Classifications of Report, Segment reporting.

Course Outcome:

- The student is able to understand the detailed cost concepts, cost structure and elements of costs of manufacturing and service organizations.
- The student is capable of establishing the method of project costing.
- To learn the reporting system of the organization for effective decision making, planning, evaluation and control.
- Student will be able to control the budget for the project.
- Understands the importance of objectives and advantages of project cost audit.

Reference Books

- Project Estimating and Cost Management, Project Management Essential Library, Berrett-Koehler Publishers (October 1, 2001)
- Project Management Accounting,: Budgeting, Tracking, and Reporting Costs and Profitability, Wiley; 2 edition (June 28, 2011) by Kevin R. Callahan, Gary S. Stetz , Lynne M. Brooks
- Cost and Management Accounting 2014, by S.P. Jain & K.L. Narang
- Cost and Management Accounting, New Age International by M.E. Thukaram Rao
- Advanced Cost & Management Accounting – Problems & Solutions, Prentice Hall of India (P) Ltd. by V.K. Saxena & C.D. Vashist
- Studies in Cost Management, Sultan Chand & Sons by S.N. Maheshwari

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(R18DCS52) INFORMATION SECURITY
(OPEN ELECTIVE – II)

Course Objectives:

- Explain the objectives of information security
- Explain the importance and application of each of confidentiality, integrity, authentication and availability
- Understand various cryptographic algorithms.
- Understand the basic categories of threats to computers and networks
- Describe public-key cryptosystem.

UNIT I

A model for Internetwork security, Conventional Encryption Principles & Algorithms (DES, AES, RC4, Blowfish), Block Cipher Modes of Operation, Location of Encryption Devices, Key Distribution.

Public key cryptography principles, public key cryptography algorithms (RSA, Diffie-Hellman, ECC), public Key Distribution.

UNIT II

Approaches of Message Authentication, Secure Hash Functions (SHA-512, MD5) and HMAC, Digital Signatures, Kerberos, X.509 Directory Authentication Service, Email Security: Pretty Good Privacy (PGP)

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT III

Web Security: Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET). Firewalls: Firewall Design principles, Trusted Systems, Intrusion Detection Systems

UNIT IV

Auditing For Security: Introduction, Basic Terms Related to Audits, Security audits, The Need for Security Audits in Organization, Organizational Roles and Responsibilities for Security Audit, Auditors Responsibility In Security Audits, Types Of Security Audits.

UNIT V

Auditing For Security: Approaches to Audits, Technology Based Audits Vulnerability Scanning And Penetration Testing, Resistance to Security Audits, Phase in security audit, Security audit Engagement Costs and other aspects, Budgeting for security audits, Selecting external Security Consultants, Key Success factors for security audits.

Course Outcomes:

- Ability to identify information system requirements for both of them such as client and server.
- Ability to understand the current legal issues towards information security.
- Able to understand the importance of web security.
- Student gains knowledge of Organizational Roles and Responsibilities for Security Audit.
- Understands the Key Success factors for security audits.

TEXT BOOKS:

1. Cryptography and Network Security by William Stallings, Fourth Edition, Pearson Education 2007.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education, 2008.
3. Cryptography & Network Security by Behrouz A. Forouzan, TMH 2007.
4. Information Systems Security by Nina Godbole, WILEY 2008.

REFERENCE BOOKS:

1. Information Security by Mark Stamp, Wiley – INDIA, 2006.
2. Fundamentals of Computer Security, Springer.
3. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY 2006.
5. Modern Cryptography by Wenbo Mao, Pearson Education 2007.
6. Principles of Information Security, Whitman, Thomson.

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(R18DAE52) UNMANNED AIR VEHICLES
(OPEN ELECTIVE –II)

Course Objectives:

- To make the student understand the roles of unmanned aircraft.
- Acquire the knowledge of various disciplines contributing to the design, development and deployment of UAVs
- To make student understand how to avoid Mid-air Collision (MAC).
- The student will be able to understand the concepts of ground testing.
- Develop and deploy the UAV systems

UNIT-I: INTRODUCTION TO UNMANNED AIRCRAFT SYSTEMS

Applications of UAS, categories of UAV systems, roles of unmanned aircraft, composition of UAV system.

UNIT-II: DESIGN OF UAV SYSTEMS-I

Introduction to design and selection of the systems-conceptual phase, preliminary design, detailed design; Aerodynamics and airframe configurations-Lift-induced Drag, Parasitic Drag, Rotary-wing Aerodynamics, Response to Air Turbulence, Airframe Configurations; Medium-range, Tactical Aircraft, Characteristics of Aircraft Types-Long-endurance, Long-range Role Aircraft, Medium-range, Tactical Aircraft, Close-range/Battlefield Aircraft, MUAV Types, MAV and NAV Types, UCAV, Novel Hybrid Aircraft Configurations, Aspects of Airframe Design: Scale Effects, Packaging Density, Aerodynamics, Structures and Mechanisms, Selection of power- plants, Modular Construction, Ancillary Equipment, Design for Stealth: Acoustic Signature, Visual Signature, Thermal Signature, Radio/Radar Signature, Payload Types: Non-dispensable and dispensable payloads.

UNIT-III: DESIGN OF UAV SYSTEMS-II

Communications-Communication Media, Radio Communication, Mid-air Collision (MAC) Avoidance, Communications Data Rate and Bandwidth Usage, Antenna Type; Control and Stability: HTOL Aircraft, Convertible Rotor Aircraft, Payload Control, Sensors, Autonomy; Navigation: NAVSTAR Global Positioning System (GPS), TACAN, LORAN C, Inertial Navigation, Radio Tracking, Way-point Navigation; Launch and Recovery.

Design for Reliability: Determination of the Required Level of Reliability, Achieving Reliability, Reliability Data Presentation, Multiplexed Systems, Reliability by Design, Design for Ease of Maintenance; Design for Manufacture and Development

UNIT-IV: THE DEVELOPMENT OF UAV SYSTEMS

System Development and Certification-System Development, Certification, Establishing Reliability; System Ground Testing: UAV Component Testing, UAV Sub- assembly and Sub-system Testing, Testing Complete UAV, Control Station Testing, Catapult Launch System Tests, Documentation; System In- flight Testing: Test Sites, Preparation for In-flight Testing, In- flight Testing, System certification.

UNIT-V: DEPLOYMENT AND FUTURE OF UAV SYSTEMS

Operational trials and full certification; UAV System Deployment- Network-centric Operations (NCO), Teaming with Manned and Other Unmanned System; Naval, arm and air force roles, civilian, paramilitary and commercial roles.

Course Outcomes:

- The student gains knowledge about composition of UAV system.
- The student will be able to understand the design concepts of UAVs
- The student will be able to understand the electronic instrumentation associated with the UAVs
- The student acquires knowledge about sub assembly and subsystem testing.
- The student attains knowledge about Network-centric Operations (NCO).

Text Books:

1. Reg Austin, Wiley, “Unmanned Aircraft Systems, UAVS Design and Deployment”, 2nd Edition, 2010.

Reference Books:

1. Richard K. Barnhart, Stephen B. Hottman, Douglas M. Marshall, Eric Shappee, (eds.), “Introduction to Unmanned Aircraft Systems”, CRC Press, 2012.
2. Valavanis, Kimon P., Vachtsevanos, George J. “Handbook of Unmanned Aerial Vehicles” AIAA series, 3rd Edition, 2004.

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(R18DEC52) RESEARCH METHODOLOGY
(OPEN ELECTIVE – II)

Course Objectives

- Demonstrate the ability to choose methods appropriate to research aims and objectives
- Identify appropriate research topics
- Prepare a project proposal (to undertake a project) • organize and conduct research (advanced project) in a more appropriate manner
- Write a research report and thesis
- Write a research proposal (grants)

UNIT - I

Introduction: Research objective and motivation, Types of research, Research approaches, Significance, Research method vs. methodology, Research process.

UNIT - II

Formulating a research problem: Literature review, Formulation of objectives, Establishing Operational definitions, Identifying variables, constructing hypotheses.

UNIT - III

Research design and Data Collection: Need and Characteristics, Types of research design, Principles of Experimental research design, Method of data collection, Ethical issues in collecting data.

UNIT - IV

Sampling and Analysis of data: Need of Sampling, Sampling distributions, Central limit theorem, Estimation: mean and variance, Selection of sample size Statistics in research, Measures of Central tendency, Dispersion, asymmetry and relationships, Correlation and Regression analysis, Displaying data

UNIT - V

Hypothesis Testing: Procedure, Hypothesis testing for difference in mean, variance limitations, Chi-square test, Analysis of variance (ANOVA), Basic principles and techniques of writing a Research Proposal

Text Books:

1. R. C. Kothari, Research Methodology: Methods and Techniques, 2nd edition, New Age International Publisher, 2009

2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005

Course Outcomes:

- Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling.
- Construct a coherent research proposal that includes an abstract, introduction, literature review, research questions, ethical considerations, and methodology
- Have basic knowledge on qualitative research techniques
- Have adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis
- Have basic awareness of data analysis-and hypothesis testing procedures

References:

1. Trochim, William M. The Research Methods Knowledge Base, 2nd Edition. Internet WWW page, at URL: <http://www.socialresearchmethods.net/kb/>

2. (Electronic Version): StatSoft, Inc. (2012). Electronic Statistics Textbook. Tulsa, OK: StatSoft. WEB: http://www.statsoft.com/textbook/.(Printed Version): Hill, T. & Lewicki, P. (2007). STATISTICS: Methods and Applications. StatSoft, Tulsa, OK.

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(R18D2182) COMPUTATIONAL METHODS LABORATARY

Course Objectives:

- To build the strong foundation in Mathematics of students needed for the field of electronics and Telecommunication Engineering
- To provide students with mathematics fundamentals necessary to formulate, solve and analyses complex engineering problems.
- To prepare student to apply reasoning informed by the contextual knowledge to engineering practice.
- To prepare students to work as part of teams on multi-disciplinary projects.
- Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.

LIST OF EXPERIMENTS:

1. Solution for the one dimensional wave equations using explicit method of lax using finite difference method (code development)
2. Solution for the one dimensional heat conduction equation using explicit method using finite difference method (code development)
3. Numerical simulation of Flat plate boundary layer using FEM software
4. Numerical simulation of Laminar flow through pipe using FEM software
5. Numerical simulation of Flow past cylinder using FEM software
6. Numerical simulation of flow through nozzle using FEM software
7. Numerical simulation of combustion using FEM software
8. Simulation of Compressible flow in convergent divergent nozzle.
9. Simulation of compressible flow in a compressor.
10. Six degrees of freedom simulation F-16 model.

Note: Any Ten Experiments can be conducted.

Equipment Needed:

1. **Computers**: Core 2 duo processor with 1 GB RAM
2. **Soft wares:** Matlab or scilab and Ansys

Course Outcomes:

- Students will demonstrate basic knowledge of Laplace Transform., Vector differentiation and differentiation Integration.
- Students will demonstrate an ability to identify and Model the problems of the field of Electronics and Telecommunication and solve it.
- Students will be able to apply the application of Mathematics in Telecommunication Engineering

- Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.

Perform vector differentiation and integration, analyze the vector fields and apply to Electro-Magnetic fields

Reference Books:

1. MATLAB an Introduction with Applications Fifth Edition AMOS GILAT by WILEY Publications
2. Programming in SCI lab by VINU V DAS New Age International Publications
3. ANSYS FLUENT and CFX Tutorials

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(R18DHS56) ENGLISH FOR RESEARCH PAPER WRITING (AUDIT COURSE –II)

Course Objectives:

- To enable the students to use linguistic structures to form well-organized texts in research contexts.
- To improve the quality of a composition by using appropriate cohesive devices.
- To enhance the mechanics of writing skills using correct grammar and vocabulary.
- To equip learners with the strategies of error – free writing.
- To get complete knowledge to write the research paper.

INTRODUCTION

Writing a research paper is a significant part of any academia. It is a substantial piece of academic writing in which the author does independent investigation into a topic and writes a description of the findings of that study. Research studies are important because these contribute to a scholar's knowledge and also provides solutions to the latest challenges. Writing forces one to think about what he believes and what he wants to communicate. Since good writing skills allow a learner to communicate his message with clarity, an extensive exposure on techniques of writing research paper proves to be an immense value to the students .

SYLLABUS

Unit 1 - Sentence Formation
Word order, Structuring paragraphs, Breaking up long sentences

Unit 2 - Cohesive devices
Types of cohesive devices - Anaphoric reference, Cataphoric reference, Exophoric reference
Tense agreement

Unit 3 – Academic Vocabulary
Hedging, Transitions – Additive, Adversative, Causal, Sequential

Unit 4– Grammar for Research Papers
Active & Passive, Punctuation, Articles

Unit 5 – Academic writing

Removing redundancy, Avoiding ambiguity, Paraphrasing, Sample Abstracts for practice, Sample videos

* Exercises apart from the text book shall also be referred for classroom tasks.

REFERENCE BOOKS:

1. English for Writing Research Papers. Adrian Wallwork, edition II, Springer, 2016.
2. Handbook of Technical Writing. James H. Shelton, McGraw Hill, 1994
3. Writing the Research Paper, a handbook. 8th edition, Anthony C. Winkler, Jo Ray Metherell, Wadsworth, 2012

Course Outcomes:

Students will be able to:

- Write in a clear, coherent, and direct style appropriate for academic research
- Draft coherent and unified paragraphs with adequate supporting details.
- Develop the strategy to use lexical terms effectively.
- Adopt appropriate syntactic and semantic techniques
- Demonstrate analytical and inferencing skills.
- Comprehend and employ the various forms of scholarly composition.

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(R18D2183) SEMINAR-I

Course Objectives:

- Understand the diverse field in Mechanical Engineering
- Understand the themes of this seminar
- Identify, understand and discuss current
- Understand the history of Mechanical research
- Identifies real-world issues

Course Outcomes:

- Learn and integrate
- Think and Create
- Communicate
- Clarify Purpose and Perspective
- Practice and use multiple thinking strategies to examine real- world issues

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(R18D2191) MINI PROJECT

Course Objectives:

- To be able to apply some of the techniques/principles you have been taught
- To carry out budget and time planning for the project.
- To inculcate implementation skills by basics of design using an appropriate analysis tool.
- To follow correct simulation practices
- To do effective methodology in the mini project

Course Outcomes:

- Demonstrate a through and systematic understanding of project contents.
- Understand methodologies and professional way of documentation and communication.
- Know the key stages in development of the project.
- Extend or use the idea in mini project.
- Create new ideas with the help of fundamentals of Mechanical Engineering

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(R18D2192) PROJECT REVIEW-I

Course Objectives:

- To provide an opportunity to work in group on a topic / problem / experimentation.
- To encourage creative thinking process.
- To provide an opportunity to analyze and discuss the results to draw conclusions.
- To acquire and apply fundamental principles of planning and carrying out the work plan project through observations, discussions and decision making process.
- To acquire the knowledge to publishing papers in peer reviewed journals/conference proceedings

Course Outcomes:

- Identify methods and materials to carry out experiments/develop code.
- Reorganize the procedures with a concern for society, environment and ethics.
- Analyze and discuss the results to draw valid conclusions.
- Prepare a report as per recommended format and defend the work.
- Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.

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(R18D2184) SEMINAR-II

Course Objectives:

- Understand the diverse field in Mechanical Engineering
- Understand the themes of this seminar
- Identify, understand and discuss current
- Understand the history of Mechanical research
- Identifies real-world issues

Course Outcomes:

- Learn and integrate
- Think and Create
- Communicate
- Clarify Purpose and Perspective
- Practice and use multiple thinking strategies to examine real- world issues

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L	T/P/D	C
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(R18D2193) PROJECT REVIEW-II

Course Objectives:

- To provide an opportunity to work in group on a topic / problem / experimentation.
- To encourage creative thinking process.
- To provide an opportunity to analyze and discuss the results to draw conclusions.
- To acquire and apply fundamental principles of planning and carrying out the work plan project through observations, discussions and decision making process.
- To acquire the knowledge to publishing papers in peer reviewed journals/conference proceedings

Course Outcomes:

- Identify methods and materials to carry out experiments/develop code.
- Reorganize the procedures with a concern for society, environment and ethics.
- Analyse and discuss the results to draw valid conclusions.
- Prepare a report as per recommended format and defend the work.
- Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.

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(R18D2194) PROJECT VIVA- VOCE

Course Objectives:

- Student understand the project and should give the clear explanation about the project
- To provide the foundation of good programming skills by discussing key issues to the design of project.
- To be able to apply some of the techniques/principles students have been taught.
- To enable the students to attend placements and be better performers in their future.
- To familiarize with the various techniques.

Course Outcomes:

- Understand the data requirements and collect data relevant to their research.
- Analyze data and interpret results.
- Develop research design for their topic of research.
- Follow the process related activity and testing techniques to work as team member.
- Implement different system calls for various file handling operations.

SEMESTER-I

COURSE COVERAGE SUMMARY

SUB: ADVANCED THERMODYNAMICS

UNITS	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
1 (Basic TD laws)	1,2,3	PK Nag	Basics and Applied Thermodynamics	Tata Mcgraw Hill	New
2 (PVT Surface)	3,15	Mahesh M Rathore	Thermal Engineering	Tata Mcgraw Hill	2nd
3 (Combustion)	17	Mahesh M Rathore	Thermal Engineering	Tata Mcgraw Hill	2nd
4 (Power Cycles)	7 & 8	Holman	Thermodynamics	Tata Mcgraw Hill	sixth
5 (Energy conversion)	6	B. Mazumdar	A Text book of Energy Technology	Tata Mcgraw Hill	New

SUB: ADVANCED HEAT & MASS TRANSFER

UNITS	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
1 (Modes of heat tranfer)	1	PK nag	Heat Transfer	TMH	New
2 (Finite Difference Methods)	3	Frank kreith	Principles of Heat Transfer	Cengage learning	7th
3 (External flows)	7,8	R.K.Rajput	Heat Transfer	SChand	Revised
4 (Free Convection)	8	R.K.Rajput	Heat Transfer	SChand	Revised
5 (Radiation Heat Transfer)	11,12	R.K.Rajput	Heat Transfer	SChand	Revised

SUB: ADVANCED FLUID MECHANICS

UNITS	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
1 (INVISCID FLOW OF INCOMPRESSIBLE FLUIDS)	9,10	Modi and Seth RK Rajput	Fluid Mechanics and Machines A Text book of Fluid Mechanics	Standard Book House S. Chand	New
2 (Viscous Flow)	5,6	Cohen and Kundu	Fluid Mechanics	Elsevier	5th
3 (Boundary Layer Concepts)	3,4	Schlichting H	Boundary Layer Theory	Springer Publications	New
4 (Introduction to Turbulent Flow)	7 & 8	William S Janna	Fluid Mechanics	CRC Press	sixth
5 (Compressible Fluid Flow)	1,2,5,6	Shapiro.	Dynamics & Theory and Dynamics of Compressible Fluid Flow	Tata Mcgraw Hill	New

SUB: SOLAR ENERGY TECHNOLOGY

UNITS	CHAPTER NO'S IN TEXT BOOKCOVERD	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
Unit-I Introduction	1&2	Sukhatme	Principles of Thermal Collection and Storage	TMH	2nd
Unit-II Design of Solar Water Heating System and Layout	3&4	Sukhatme	Principles of Thermal Collection and Storage	TMH	2nd
Unit-III Thermal Energy Storage	5&6	Sukhatme	Principles of Thermal Collection and Storage	TMH	2nd
Unit-IV Direct Energy Conversion	7&8	Sukhatme	Principles of Thermal Collection and Storage	TMH	2nd

Unit-V Economics:	9	Sukhatme	Principles of Thermal Collection and Storage	TMH	2nd

SUB: ADVANCED I.C. ENGINES

UNITS	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
Unit-I Introduction	1&2	V.Ganesan	I.C. Engines	TMH	4th
Unit-II Gas Exchange Processes:	3&4	V.Ganesan	I.C. Engines	TMH	4th
Unit-III Engine Combustion in SI Engines:	5&6	V.Ganesan	I.C. Engines	TMH	4th
Unit-IV Pollutant Formation and Control:	7&8	V.Ganesan	I.C. Engines	TMH	4th
Unit-V Engine Heat Transfer:	9	V.Ganesan	I.C. Engines	TMH	4th

SUB: NON CONVENIONAL ENERGY RESOURCES

UNITS	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
1 (Introduction Solar Energy)	2,3	John twidell&Tony Weir	Renewable Energy Resources	Taylor&Francis	New
2 (PVT Surface)	14	John twidell&Tony Weir	Renewable Energy Resources	Taylor&Francis	New
3 (Combustion)	17	G.N.Tiwari & M.K.Ghoshal	Renewable Energy Resources	Narosa publications	New
4 (Power Cycles)	10	John twidell&Tony Weir	Renewable Energy Resources	Taylor&Francis	New
5 (Energy conversion)	7&8,11,12 &13	John twidell&Tony Weir	Renewable Energy Resources	Taylor&Francis	New

SEMESTER-II

COURSE COVERAGE SUMMARY

SUB: FUELS, COMBUSTION AND ENVIRONMENT

UNITS	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
1 (Fuels)	1,2	Roger A Strehlow	Combustion Fundamentals	Mcgraw Hill	2nd
2 (Principles of Combustion)	3,4,5	Sharma and Chander Mohan	Fuels and Combustion	Tata Mcgraw Hill	New
3 (Thermodynamicsof Combustion)	7 & 8	Roger A Strehlow	Combustion Fundamentals	Mcgraw Hill	2nd
4 (Laminar and Turbulent Flames)	10, 11	Roger A Strehlow	Combustion Fundamentals	Mcgraw Hill	2nd
5 (Environmental Considerations)	12,13	Roger A Strehlow	Combustion Fundamentals	Mcgraw Hill	2nd

SUB: COMPUTATIONAL FLUID DYNAMICS (CFD)

UNITS	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
1 Finite Difference Methods &Equations Solution methos	 Ch-1 & 2 Ch-5 & 6	 Suhas V. Patnakar John . D. Anderson	 Computational Fluid Flow & Finite Difference Methods Computational Fluid Dynamics	 Hema Shava Publishers Corporation Mc Graw Hill	 2 nd 1 st
2 Stability Analysis, Burger equations: Explicit & Implicit methods	Ch-4 & 5	Suhas V. Patnakar	Numerical Heat Transfer and Fluid flow	Hema Shava Publishers & Mc Graw Hill	2 nd
3 Incompressible Fluid Flows	Ch -8 & 9	Tapan K.SenGupta	Fundamentals of CFD	Universities Press	1 st
4 Finite Volume method	Ch- 9 & 10	T. J. Chung	Computational Fluid Dynamics	Universities Press	2002 Edition
5 Standard Variational Methods	Ch- 11 & 12	Frank Choriton	Text Book of CFD	CBS Publishers	1985 Edition

SUB: ADVANCED FINITE ELEMENT ANALYSIS (AFEA)

UNITS	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
I-unit introduction to fem	ch-1	singiresu s. rao	the finite element method in engineering	elsevier	5th edition
II-unit 1-d structural problems analysis of trusses anlysis of beams	ch-1,2,3,4,9	singiresu s. rao	the finite element method in engineering	elsevier	5th edition
III-unit 2-d problems 3-d problems	ch-15,16	singiresu s. rao	the finite element method in engineering	elsevier	5th edition
IV-unit scalar field problems	ch-7	singiresu s. rao	the finite element method in engineering	elsevier	5th edition
V-unit dynamic problems	ch-12	singiresu s. rao	the finite element method in engineering	elsevier	5th edition

SUB: INDUSTRIAL REFRIGERATION SYSTEM

UNIT	CHAPTER NO'S IN TEXT BOOK COVRED	AUTHOR	TEXT BOOK TITLE	PUBLISHERS	EDITION
1 (Introduction)	1,2	C.P.Arora	Refrigeration&Airconditioning	DhanapathraiPublications	New
2 (Compressors)	3,15	S.C.Aurora	Refrigeration and Air Conditioning	S.C.Publications	2nd
3 (EvaporatorsandCondensers)	5,6	Refrigeration and Air Conditioning Technology	Refrigeration and Air Conditioning Technology	Tata Mcgraw Hill	2nd
4 (VesselsinIndustrial Refrigeration)	7 & 8	WilbertF.Stoecker	Industrial Refrigeration HandBook	Tata Mcgraw Hill	1998
5 (EnergyConservationand DesignConsiderations)	6	Manohara Prasad	A Text book Refrigeration and Air Conditioning	Tata Mcgraw Hill	New

SUB: THERMAL NUCLEAR POWER PLANT

Units	Chapter No's In Text Book Covered	Author	Text Book Title	Publishers	Edition
UNIT-I General Concepts, Measurement of pressure	1&2	R.K. Jain	Mechanical and Industrial Measurements	Khanna Publishers	2000
UNIT-II Measurement of Flow	3	R.K. Jain	Mechanical and Industrial Measurements	Khanna Publishers	2000
UNIT-III Temperature Measurement	4&5	R.K. Jain	Mechanical and Industrial Measurements	Khanna Publishers	2000
UNIT-IV Level Measurement, Measurement of density	4	E.O. Doeblin	Measurement System, Application & Design	Tata megrahil	2005
UNIT-V Process Control	5&6	E.O. Doeblin	Measurement System, Application & Design	Tata megrahil	2005

SUB: INDUSTRIAL MANAGEMENT

Units	Chapter No's In Text Book Covred	Author	Text Book Title	Publishers	Edition
Unit-I Concepts of Management and Organisation	1&2	Panner Selvam	Production and Operations Management	PHI	2004
Unit-II Designing Organisational Structures	3&4	Panner Selvam	Production and Operations Management	PHI	2004
Unit-III Plant location, definition, factors affecting the plant location	5&6	Panner Selvam	Production and Operations Management	PHI	2004
Unit-IV Materials Management-Objectives, Inventory	7&8	Panner Selvam	Production and Operations Management	PHI	2004
Unit-V Inspection and quality control, types of inspections	9	Panner Selvam	Production and Operations Management	PHI	2004

SEMESTER-I

PREVIOUS QUESTION PAPERS

R17

Code No: R17D2101

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I-Year - I Semester Supplementary Examinations, June 2019

Advanced Thermodynamics
(TE)

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

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SECTION-I

1 (a) Give the statements of second law of thermodynamics and show that they are equivalent **[7M]**

(b) A 50 Kg copper block initially at 140^0C is dropped into an insulated tank that contains 90 L of water at 10^0C. determine the final equilibrium temperature and the total entropy change for this process **[7M]**

OR

2 Define availability and explain availability in chemical reactions with examples **[14M]**

SECTION-II

3 Derive a relation for the joule-Thomson coefficient and the inversion temperature for a gas whose equation of state is $(P+a/v^2)\ v= RT$ **[14M]**

OR

4 A rigid tank that contains 2 Kg of N_2 at 25^0C and 550 KPa is connected to another rigid tank that contains 4 Kg of O_2 at 25^0C and 150 KPa. The valve connecting the two tanks is opened, and the two gases are allowed to mix. If the final mixture temperature is 25^0C, determine the volume of each tank and final mixture pressure. **[14M]**

SECTION-III

5 (a)	Describe the Vant Hoff's equilibrium box and derive its equations	**[10M]**
(b)	A mixture of methane and oxygen in the proper ratio for complete combustion and at 25^0C and 1 atm, reacts in a constant volume calorimeter bomb. Heat is transfers until the products of combustion are at 400K. Determine the heat transfer per mole of methane.	**[4M]**

OR

6	An internal combustion engine burns liquid octane and uses 150% theoretical air. The air and fuel enter at 25^0C, and the products leaves the engine exhaust ports at 900K. In the engine 80% of the carbon burns to CO_2 and the remainder burns to CO. The heat transfer from this engine is just equal to the work done by the engine	**[14M]**

SECTION-IV

7	Explain the working principal of ideal vapour compression refrigeration cycle with neat sketch	**[14M]**

OR

8 (a)	Explain the working principal of binary vapour cycle with neat sketch	**[7M]**
(b)	Explain about thermodynamic phenomena	**[7M]**

SECTION-V

9 (a)	Describe an MHD closed cycle system with neat sketch	**[7M]**
(b)	Explain about Thompson and Peltier effects	**[7M]**

OR

10 (a)	Explain about photovoltaic cell	**[7M]**
(b)	What is thermionic emission effect? How space charge effect is minimized	**[7M]**

***

Code No: R17D2101 **R17**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - I Semester Supplementary Examinations, July/Aug 2018

Advanced Thermodynamics

(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

******

Section I

1. a) What are the different laws of thermodynamics? Explain them with the properties developed based on these laws. (7M)

b) Air at 15 ^{o}C is to be heated to 40 ^{o}C by mixing it in steady flow with a quantity of air at 90 ^{o}C. Assume that the mixing process is adiabatic neglecting changes in kinetic and potential energy; calculate the ratio of mass flow of air initially at 90 ^{o}C to that initially at 15 ^{o}C. Calculate also the effectiveness of the heating process, if the atmospheric temperature is 15 ^{o}C. (7M)

(OR)

2. a) Find the expression for T*ds* in terms of *dT* and *dp* (6M)

b) Derive the following relations i)$(\frac{\partial T}{\partial p})_s = (\ T\ v\beta/C_p)$ ii)$(\frac{\partial T}{\partial v})_s = (\ T\ \beta/C_v\ K)$ (8M)

Section II

3. a) What is a p-v-T surface? Draw a portion of a surface. (4M)

b) One kg of air at a pressure of 8 bar and a temperature of 100^{o}C undergoes a reversible polytropic process following the law $pv^{1.2}$ = Constant. If the final pressure is 1.8 bar, determine i) the final specific volume, temperature and increase in entropy; ii) the work done and the heat transfer. Assume R= 0.287 kJ/kgK and $\boldsymbol{\gamma}$= 1.4 (10M)

(OR)

4. a) One kg of CO_2 has a volume of 1m^3 at 100 ^{o}C. Compute the pressure by i) Vander Waal's equation, ii) perfect gas equation. (8M) b) Write short notes on by pass factor of a heating/ cooling coil (6M)

Section III

5.a)Derive relations for internal energy and enthalpy of reaction (7M)

b) The following results were obtained in a trail on a boiler fitted with an economizer.

	Co_2	Co	O_2	N_2
Analysis of gas entering the economizer	8.3	0	11.4	80.3
Analysis of gas leaving the economizer	7.9	0	11.5	80.6

i) Determine the air leakage into the economizer, if the carbon content of the fuel is 80 percent. ii) Determine the reduction in temperature of the gas due to air leakage if atmospheric temperature is 20

^{o}C and flue gas temperature is 410 ^{o} C. Ash collected from the ash pan is 15 percent by weight of the fuel fired. Take C_p for air =1.005 kJ/kgK, and C_p for flue gas= 1.05kJ/kgK (7M).

(OR)

6. a) A fuel $C_{10}H_{22}$ is burnt using a air fuel ratio of 13:1 by weight. Determine the complete volumetric analysis of the products of combustion, assuming that the whole amount of hydrogen burns to form water vapor and there is neither any free oxygen nor any free carbon. The carbon burns to Co_2 and Co. air contains 77% nitrogen and 23% oxygen by weight. (7M)

b)Derive relations for internal energy and enthalpy of reaction (7M)

Section IV

7). a) Clearly explain the Braton cycle with regeneration with Temperature – entropy diagram. (7M)

b) Can regeneration cycle be used at high pressure ratios? Justify your answer. (7M)

(OR)

8) a. Explain the importance of Onsaga relations in evaluating the irrevesibilities for coupled flows (7M)

b) What are phenomenological laws? Explain their applications. (7M)

Section V

9). a) What is a fuel cell? Explain its working principle. (6M)

b) What is direct energy conversion system? Write its advantages, limitations and applications by comparing with the conventional energy system. (8M)

(OR)

10). a) Describe an MHD closed cycle system with neat sketch (7M)

b) Explain about thermo electric circuits (7M)

****

Code No: R17D2101

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - I Semester Regular Examinations, Jan/Feb 2018

Advanced Thermodynamics

(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14marks.

*****

Section I

1. a) Derive the first and second Tds equations. From them derive the expression for difference in specific heat capacities. (7)

b) Draw the P-V diagram for an ideal gas and derive the equation for work done and prove that $\frac{(\gamma-1)}{\frac{(\gamma P2)}{(P2-P1)}+\frac{(V1)}{(V2-V1)}}$ (7)

OR

2. a) Explain the inequality of Clausius. (7)

b) Two kg of air at 500 kPa, 80 ^{o}C expands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of surroundings which is at 100 kPa, 5 ^{o}C. For this process determine i) maximum work, ii) irreversibility, iii) change in availability. Assume various thermal constants. (7)

Section II

3. a) One kg of air at a pressure of 8 bar and a temperature of 100 ^{o}C undergoes a reversible polytropic process following the law $pv^{1.2}$ = Constant. If the final pressure is 1.8 bar, determine i) the final specific volume, temperature and increase in entropy; ii) the work done and the heat transfer. Assume R= 0.287 kJ/kgK and **γ**= 1.4 (8)

b) Solve the same problem assuming that the process to be irreversible and adiabatic between end states. (6)

OR

4. a) Prove that the molar analysis is identical with the volumetrical analysis, and both are equal to the ratio of the partial pressure to the total pressure. (6)

b) A vessel contains at 1 bar and 20 ^{o}C a mixture of one mole of Co_2 and 4 moles of air. Calculate for the mixture i)the masses of Co_2, O_2 and N_2 and total mass. ii) the percentage carbon content by mass; iii) the apparent molecular weight and the gas constant for the mixture; iv) the specific volume of the mixture. (8)

Section III

5). a)Write the combustion equation for carbon in both mass and volume (7)

b) One kg of ethane C_2H_6 is burned with 90 % of theoretical air. Assuming complete combustion of hydrogen in the fuel determine the volumetric analysis of the dry products of the combustion. (7)

OR

6. a) Describe the Vant Hoff's equilibrium box and derive its equations (10)
b) Briefly explain the process of combustion. (4)

Section IV

7). a) Explain about the working of Binary vapor cycle with a neat sketch. (7)
b) Explain the working of combined cycle power plant with its advantages. (7)

OR

8) a) Explain the importance of Onsaga relations in evaluating the irrevesibilities for coupled flows (7)
b) What are phenomenological laws? Explain their applications. (7)

Section V

9).a) Describe an MHD open cycle system with neat sketch (7)
b). Explain about photovoltaic cell (7)

OR

10). a) What is thermionic emission effect? How space charge effect is minimized? (7)

b) Explain about Thompson and Peltier effects (7)

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M. Tech –I Semester Regular/ Supply Examinations, February, 2016

ADVANCED THERMODYNAMICS

(Thermal Engineering)

Time: 3 HoursMax Marks: 70

Section-I

1. a) Explain about , Availability, unavailability and Exergy.(7M)
   b) Derive Mayer relation and explain the conclusions drawn from this relation.(7M)

OR

2. What are different laws of thermodynamics? Explain them along with the properties developed based on these laws.

Section-II

3. a) Discuss about availability balance of a closed system.
   b) 8 kg of air at 650 K and 5.5 bar pressure is enclosed in a closed system. If the atmosphere temperature and pressure are 300 K and 1 bar respectively, determine :
   (i) The availability if the system goes through the ideal work producing process.
   (ii) The availability and effectiveness if the air is cooled at constant pressure to atmospheric temperature without bringing it to complete dead state. Take C_v = 0.718 kJ/kg K, C_p= 1.005 kJ/kg K.

OR

4. a) What is Joule - Thompson coefficient? Explain why it is zero for ideal gas.

   b) Derive the P-V-T relations of ideal gas and discuss about Daltons law of partial pressures and avogadro's law of additive volumes.

Section-III

5. Saturated air leaving the cooling section of an air-conditioning system at 14^0C at a rate of 50 m^3/min is mixed adiabatically with the outside air at 32^0C and 60 percent relative humidity at a rate of 20 m^3/min. Assuming that the mixing process occurs at a pressure of 1 atm, determine the specific humidity, the relative humidity, the dry-bulb temperature, and the volume flow rate of the mixture.

OR

6. Explain the following psychrometric processes.
   i) Cooling and dehumidification, ii) Sensible heating and cooling.

Section-IV

7. a) What is enthalpy of formation? How does it differ from the enthalpy of combustion?
   b) Discuss about Gibbs phase rule. Explain why the Gibbs function remain constant during phase transition.

OR

8. a) Explain about Phenomenological laws and discuss about its applicability.
   b) Explain about second law analysis of an actual cycle.

Section-V

9. a) What do you understand by NHD? With a neat sketch explain the working of MHD and write its advantages.
   b) Explain the working principle of Photovoltaic cells. Write its advantages and disadvantages.

OR

10. Explain the following i) Thermo ionic conversion system. Ii) Generalized compressibility factor iii) Adiabatic flame temperature.

M. Tech –I Semester Regular/ Supply Examinations, February, 2016

ADVANCED THERMODYNAMICS

(Thermal Engineering)

Time: 3 Hours **Max Marks: 70**

Section-I

1. What is non flow availability function? Is it a property? Explain.

OR

2. The expansion of a perfect gas is so controlled that the pressure changes according to the law p = *a*V+*b*, where *a* and *b* are constants and V is the volume. The mass of gas is 0.68kg and the initial and final pressures are 7bar and 2.1bar and the corresponding values are 0.084m^3 and 0.28m^3. The characteristic gas constant is 0.26kJ/K and γ =1.39. Find a) Change in entropy per kg during the expansion b) the maximum value of internal energy per kg reckoned from 0^0C. c) The heat added up to the point of maximum internal energy d) heat rejected during the rest of operations e) the net heat added or removed during the process.

Section-II

3. Explain the equation of state for real gases and suggest a suitable method for calculation of constants in the Vanderwaals equation. Describe briefly generalized compressibility charts along with its importance.

OR

4. Determine the pressure of saturated steam at 40^0C if at 35^0C the pressure is 5.628kPa, the enthalpy of vaporization is 2418.6kJ/kg and the specific volume is 25.22$m^{3/}$/kg the enthalpy of vaporization is essentially constant over this temperature range.

Section-III

5. 10m^3/min of dry air at 32^0C is mixed with a steam of hydrogen at 127^0C to form a mixed steam at 47^0C and 1 bar. The mixing occurs adiabatically and at steady state; determine a) the mass flow rates of dry air and hydrogen, in kg/min b) mole fraction of dry air and hydrogen in existing mixture.

OR

6. a) Deduce a relationship between enthalpy of combustion and internal energy of combustion. b) Explain briefly about enthalpy of formation.

Section-IV

7. a) Discuss the importance of Onsagar relations in evaluating the irreversibilities for coupled flows.
   b) Write notes on Vont Hoff's Equilibrium Equation.

OR

8. Explain the procedure for second law analysis of power cycle. Describe the second law analysis of Rankine power cycle.

Section-V

9. Describe the working of combined cycle power generation with diagrams.

OR

10. a) What is fuel cell? Explain its working principle.
    b)Discuss briefly about Seebeck, Thompson and Peltier effects.

M. Tech –I Semester Regular/ Supply Examinations, February, 2016

ADVANCED THERMODYNAMICS

(Thermal Engineering)

Time: 3 Hours **Max Marks: 70**

Section-I

1. a) Derive Tds equation from Maxwell's relations.
   b) A fluid undergoes a reversible adiabatic compression from0.5 MP. 0.2 m^3 to 0.05 m^3 according to the law, $pv^{1.3}$ = constant. Determine the change in enthalpy, internal energy and entropy, and the heat transfer and work transfer during the process.

OR

2. A closed system contains air at a pressure of 1 bar, temperature 300K, and volume 0.018m^3 This system undergoes a thermodynamic cycle consisting of the following three processes in series: i) constant volume heat addition till pressure becomes 5 bar, ii) constant pressure cooling, and iii) isothermal heating to initial state. Represent the cycle on T-S and p-V plots and evaluate the change in entropy for each process take Cp=0.718kJ/kgK, and R=0.287kJ/kgK

Section-II

3. A) Write down the Vaan der Waals equation of state. How does it differ from the ideal gas equation of state?
   B) Why does the enthalpy of an air-vapor mixture remain constant during an adiabatic saturation process?

OR

4. 120m^3 of air per minute at 35^{0}C DBT and 50% RH is cooled to 20^{0}C by passing through a cooling coil. Determine the following: i) Relative humidity of out coming air and its wet bulb temperature ii) capacity of cooling coil in tons of refrigeration iii) amount of water vapour removed per hour.

Section-III

5. Water at 90^{0}C flowing at the rate of 2 kg/s mixes adiabatically with another stream of water at 30^{0}C flowing at the rate of I kg/s. Estimate the entropy generation rate and the rate of exergy loss due to mixing. Take atmospheric temperature = 300K.

OR

6. Explain briefly Gibbs Phase rule. What is adiabatic flame temperature. Write short notes on chemical equilibrium.

Section-IV

7. Explain briefly about the different cogeneration cycles with neat sketches.

OR

8. Discuss briefly about the applicability of the Phenomenological relations

Section-V

9. Explain the working of Hydrogen fuel cell with neat sketch and list out the advantages and disadvantages.

OR

10. a) Describe with a neat sketch about magneto hydrodynamic generator.
    b) Derive the expression for power and efficiency of thermionic generator

R18

Code No: R18D2102

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I-Year - I Semester Supplementary Examinations, June 2019

Advanced Heat and Mass Transfer
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

***

SECTION-I

1 Derive the general heat conduction equation in spherical coordinate system. State the assumptions made. **[14M]**

OR

2 A long Aluminum cylinder which may be treated as an infinite cylinder has 50 mm diameter and is initially at a temperature of 250^0C is suddenly exposed to a convection environment at 80^0C with convection heat transfer coefficient of 600 W/m^2 ^{0}C. Calculate the temperature in the cylinder at a radius of 12.5 mm after one minute. Also estimate the heat lost per unit length from the cylinder during this one minute time. **[14M]**

SECTION-II

3 Describe the procedure of implicit and explicit methods used in numerical solution for heat conduction problems. **[14M]**

OR

4 (a) Define heat transfer coefficient. On what factors does its value depend upon? **[4M]**
(b) Describe the steps involved in determining the heat transfer coefficient using

dimensional analysis using Buckingham PI theorem.

[10M]

SECTION-III

5 Using the solution of Integral-Momentum equation and energy equation, derive an expression for heat transfer coefficient for the laminar flow of a fluid with a velocity of U_∞ at T_∞ over a flat plate whose wall temperature is maintained at T_w. . Assume cubic polynomial for velocity and temperature profiles and the plate is heated from the leading edge. **[14M]**

OR

6 Engine oil at 40^0C enters a 15 mm diameter 3 m long tube. The tube wall is maintained at constant temperature of 70^0C. The velocity of engine oil is 0.3 m/s. Estimate the heat transfer rate to oil and its exit temperature. Consider forced convection only. **[14M]**

SECTION-IV

7 (a) Define Grashoff number and explain its significance in natural convection. **[4M]**

(b) A large vertical steel plate is maintained at 80^0C and exposed to atmospheric air at 20^0C. The plate has a height of 5 m and width of 9 m. Calculate the natural convection heat loss from the plate to the atmospheric air. **[10M]**

OR

8 (a) Sketch and explain the different regimes of boiling curve. **[10M]**

(b) Define critical heat flux. Explain its usefulness and significance **[4M]**

SECTION-V

9 A 10 m long pipe carrying steam with 15 cm outer diameter runs in a large room and is exposed to ambient air at 25^0C. The outer surface temperature of the pie is at 500^0C. Calculate the loss of heat due to radiation from the pipe. Take the length of the pipe is 10 m. Take the emissivity of the pipe as 0.85. What would be the radiation heat loss if the pipe is enclosed in a 40 cm brick conduit of emissivity 0.93? **[14M]**

OR

10 (a) State and explain Fick's law of diffusion. **[4M]**

(b) Give the definition and significance of each of the following non-dimensional numbers used in Mass Transfer calculations.

(i) Sherwood Number

(ii) Stanton Number
(iii) Schmidt Number
(iv) Lewis Number
(v) Peclet Number

[10M]

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Code No: R17D2102

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - I Semester Supplementary Examinations, July/Aug 2018

Advanced Heat and Mass Transfer

(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

******

Section I

1). Derive the general heat conduction equation in cylindrical coordinates.(14M)

OR

2).What are the assumptions in lumped analysis? (4M)

b) A large slab of aluminum at a uniform temperature of 200^{o}C suddenly has its surface temperature lowered to 70^{o}C. What is the total heat removed from the slab per unit surface area when the temperature at a depth 4 cm has dropped to 120^{o}C. (10M)

Section II

3). Prove the following equations

i) Displacement thickness = $\int_0^{\delta}\left(1-\frac{u}{U}\right)dy$ (7M)

ii) ii) Momentum thickness= $\int_0^{\delta}\left[\left(1-\frac{u}{U}\right)\left(\frac{u}{U}\right)\right]dy$(7M)

OR

4). If the velocity distribution in the boundary layer of a flat plate is given by an expression $\frac{u}{U}=$ sin $(\frac{\pi}{2})(\frac{y}{\delta})$ then find the expression for boundary layer thickness.(14M)

Section III

5) a)The aero plane flies with a speed of 450 kmph at a height where the surrounding air has a temperature of 1^{o}C and pressure of 65 cm of Hg. The aero plane wing is idealized as a flat plate 6m long, 1.2m wide is maintained at 19^{o}C. If the flow is made parallel to the 1.2m width calculates i) heat lost from the wing ii) drag force on the wing. Take the properties of air as k = 0.02511 w/m ^{o}C, ν = 14.16X10^{-6} m^{2}/sec, Pr = 0.705 (7M)

b) From Reynold's analogy prove that

$$\frac{hx}{\rho cp.U}=\left(\frac{Cfx}{2}\right) \qquad (7M)$$

OR

6). a) Define Nusselt's number, Reynold's number and Prondtl number. (6M)

b)Air at 20^{o}C flows over a 800 mm long plate at a velocity of 45 m/sec. if the surface of the plate is maintained at 300^{o}C, determine:i) The heat transfer from the entire plate length to air taking into consideration both laminar and turbulent portions of the boundary layer
ii) The percentage error if the boundary layer is assumed to be of turbulent nature from the very leading edge of the plate.Assume unit width of the plate and critical Reynold's number as 5X10^{5}
(8M)

Section IV

7). a) What is burnout point? (4M)
b) A vertical tube of 60mm outside diameter and 1.2m long is exposed to steam at atmospheric pressure. The outer surface of the tube is maintained at a temperature of 50^{o}C by circulating cool water through the tube. Calculate the following, i) the rate of heat transfer to the coolant, and ii) the rate of condensation of steam. (10M)

OR

8).A hot plate 1m X 0.5m at 130^{o}C is kept vertically in stir air at 20 ^{o}C. find i) heat transfer coefficient ii) initial rate of cooling the plate in ^{o}C /minute, iii) time required for cooling plate from 180^{o}C if the heat transfer is due to convection only. Mass of the plate is 20 kg and Cp equal to 400J/Kg K. Assume 0.5 m side is vertical and the heat transfer coefficient calculated in i) above remains constant and convection takes place from both the sides of the plate. (14M)

Section V

9).a) Explain the concept of a black body. (7M)
b) Determine the heat loss by radiation per meter length of 80mm diameter pipe at 300^{o}C, if i)located in a large room with a red brick walls at a temperature of 27^{o}C; ii) enclosed in a 160mm red brick conduit at a temperature of 27 ^{o}C. Take ε (pipe) = 0.79 and ε (brick conduit) =0.93. (7M)

OR

10).a) Explain the term mass transfer and give the applications of mass transfer. (7M)
b) The radiation shape factor of the circular surface of the thin hollow cylinder of 10 cm diameter and 10 cm length is 0.1716. What is the shape factor of the curved surface of the cylinder with respect to itself? (7M)

Code No: R17D2102

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - I Semester Regular Examinations, Jan/Feb 2018

Advanced Heat and Mass Transfer

(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14marks.

****

Section -I

1. Prove that 2- dimensional conduction equation in Cartesian coordinates for the homogeneous material, steady state conditions, without heat generation is given by Laplace equation $\nabla^2 t = 0$ where ∇^2 represents Laplacian operator. (14)

OR

2). a) A 60mm thick mild steel plate (α=0.00122m^2/sec) is initially at a temperature of 30^{o}C. It is suddenly exposed on one side to a fluid which causes the surface temperature to increase to and remain at 110^{o}C. Determine: i) the maximum time that the slab is treated as a semi-infinite body: ii) the temperature at the center of the slab 1.5 minutes after the change in surface temperature. (7)

b) Explain the importance of Heisler charts in solving the transient conduction problems? (7)

Section II

3). Derive the energy equation for thermal boundary layer in Cartesian coordinates . (14)

OR

4). Air at 20^{o}C and 1.03 bar flows over a flat plate 50 cm X 30 cm maintained at 60^{o}C at a speed of 4 m/sec. Assuming that the flow is parallel to 30 cm side, find

i) Mass flowing through the boundary.
ii) Thickness of the boundary layer at the trailing edge
iii) Heat transfer from the plate per hour
iv) Drag force exerted on the plate (14)

Section -III

5).aGive the relationship between hydrodynamic boundary layer and thermal boundary layer when i) Pr< 1 and ii) Pr=1 (4)

b) A refrigerator truck is moving on a highway at 90kmph in a desert area where ambient air temperature is 50^{o}C. The body of the truck may be considered as a rectangular box measuring 10m (length) X4 m (width) X3 m (height). Assume that the boundary layer of the four walls is turbulent, the heat transfer takes place only from the four surfaces and the wall surface of the truck is maintained at 10^{o}C. Neglecting heat transfer from the front and back and assuming the flow to be parallel to 10m long side. Calculate the following i) the heat loss from the four surfaces ii) the tonnage of refrigeration, iii) the power required to overcome the resistance acting on the four surfaces. (10)

OR

6).a) In the straight tube of 60mm diameter, water is flowing at a velocity of 1 m/sec. the tube surface temperature is maintained at 70^{o}C and the flowing water is heated from the inlet temperature 15 ^{o}C to an outlet temperature of 45^{o}C. Taking the physical properties of water at its mean bulk temperature, calculate the following. i) The heat transfer coefficient from the tube surface to the water, ii) The heat transferred, and iii) the length of the tube. (7)

b) Define the terms boundary layer thickness, displacement thickness, momentum thickness and energy thickness. (7)

Section IV

7). a) Differentiate between the mechanism of film wise and drop wise condensation (4)

b) A vertical plate 350 mm high and 420 mm wide, at 40^{o}C, is exposed to saturated steam at 1 atmospheric pressure. Calculate the following i) the film thickness the bottom of the plate, ii) The maximum velocity at the bottom of the plate iii) the total heat flux to the plate assumes vapor density is small compared to that of condensate.(10)

OR

8). a)A vertical plate 180 mm X 180 mm and at 50^{o}C exposed to atmosphere at 10^{o}C. Compare the free convection heat transfer from this plate with that which would result due to forced convection over the plate at a velocity is equal to twice the maximum velocity which would occur in free convection boundary layer. (7)

b) Explain the heat transfer phenomenon by natural convection over a vertical tube (7)

Section V

9). a) A thin copper sphere with its internal surface highly oxidized, has a diameter of 20 cm. how small a hole must be made in the sphere to make an opening that will have an absorptivity of 0.9? (7)

b) State the Fick's law of diffusion and what the limitations are. (7)

OR

10). a) Derive the expression for a shape factor in case of a radiation exchange between two surfaces. (7)

b) Determine the rate of heat loss by radiation from a steel tube of outside diameter 70mm and 3m long at a temperature of 227^{o}C, if the tube is located within a square brick conduit of 0.3m side and at 27^{o}C. Take ε (steel) = 0.79 and ε(brick)= 0.93. (7)

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Code No: 5121B **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech I Semester Examinations, August - 2016

ADVANCED HEAT AND MASS TRANSFER

(Thermal Engineering)

Time: 3hrs **Max.Marks:60**

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 20 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 8 marks and may have a, b, c as sub questions.

PART - A

5 × 4 Marks = 20

1.a) What is meant by lumped-capacity analysis? [4]

b) What is a grid independence test? [4]

c) Explain Local Skin friction coefficient formula. [4]

d) Why do bubbles form on the heating surface? [4]

e) What is visible light? [4]

PART-B

5 × 8 Marks = 40

2.a) Define thermal conductivity, thermal resistance and thermal conductance.

b)A steel pipe is carrying steam at a pressure of 30 bar Its outside diameter is 90 mm and is lagged with a layer of material45 mm thick(K = 0.05 W/mK). The ambient temperature is 20^0 C and the surface of the lagging has a heat transfer coefficient of 8.4 W/m-K. Neglecting resistance due to pipe material and due to steam film on the inside of steam pipe find the thickness of lagging (K = 0.07 W/m-K) which must be added to reduce the steam condensation rate by 50 per cent if the surface coefficient remains unchanged.

3.a) Discuss the concept of transient heat conduction in semi infinite solids.

b)A long cylindrical bar (K = 21.5 W/mK; α = 0.019 m^2/hr) of radius 80 mm comes out of oven at 830^0 C throughout and is cooled by quenching it in a large bath of 40^0 C coolant. If h = 180 W/m^2K, calculate the time taken by the shaft centre to reach 120^0 C, the surface

temperature of the shaft when its centre temperature is 124^0 C and the temperature

gradient at the outside surface at the same instant of time. [4+4]

4.A 2 cm thick granite slab [k=2 W/m ^{0}C, $\alpha=1\times10^{-6}$ m^2/s] is initially at a uniform temperature of 200^0. Keeping one of the surfaces of the slab as insulated, the other surface is suddenly lowered to 0^{0}C and then maintained at that temperature. Develop an explicit

finite difference scheme for determining temperature distribution in the slab as a function of position and time as well as the heat flux at the boundary surface. [8]

OR

5.a) What is the difference between local and average convection heat-transfer coefficients?

b)Calculate the Darcy friction factor and pressure drop per unit length when air at

atmospheric pressure at 30^{0}C flows through a 2 cm square tube with a mass flow rate of

0.7 kg/min. Assume that the flow is fully developed. [4+4]

6.A flat plate solar collector has a cover plate at 45^{0}C exposed to ambient air at 25^0 C in parallel flow over the plate with free stream velocity of 8 km/h. a) Compute the heat-loss

rate from the plate, b) If the plate is installed 2 m from the leading edge of a roof and flush

with the roof surface, calculate the rate of heat loss. Properties of air at 35^0 C are

k = 0.02625 W/m^{0}C, $v=16.55\times10^{-6}$ m^2/s, Pr=0.7268. [4+4]

OR

7.Oil is heated from 22^0 C to 56^0 C by passing through a tube of 4 cm diameter. Find out the

length of the tube required, for an oil flow rate of 60 Kg/min, if the surface temperature of the tube wall is maintained at 100^0 C. Assume the following properties of oil at the mean bulk temperature: ρ=895 Kg/m^3, k=0.151 W/m K, $v=0.40\times10^{-6}$ m^2/s, Cp=2.177 Kj/kg K.[8]

8.a) What is natural convection? How is it different from forced convection? In which mode of heat transfer will the convection heat-transfer coefficient usually be higher, and why?

b)Thin vertical plates, 10 cm long, initially at 60^{0}C are suspended in a water bath maintained

at 20^{0}C. What minimum spacing would prevent interference between their free convection

boundary layers? [4+4]

OR

9.a) Explain briefly the condensation mechanism.

b)Water at atmospheric pressure is to be boiled in polished copper pan. The diameter of the pan is 350 mm and is kept at 1150C. Calculate the following:

(i)Power of the burner;

(ii)Rate of evaporation in kg/h;

(iii) Critical heat flux for these conditions. [4+4]

10.a) What benefit can be derived from a radiation shield and reradiating surface?.

b)Determine the rate of heat loss by radiation from a steel tube of outside diameter of 70mm and 3m long at a temperature of 2270C, if the tube is located within a square brick

conduit of 0.3 m side and at 270C. Take Emissivity (Steel) = 0.79 and

Emissivity (brick) =0.93.

OR

11.a) List some industrial and day-to-day applications of mass transfer.

b) Dry air at 1 atm and 400C flows with a velocity of 0.5 m/s across a wet-bulb thermometer.

What would be the reading on the thermometer? [4+4]

R09

Code No: D9101

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.TECH II - SEMESTER EXAMINATIONS, APRIL/MAY 2012

ADVANCED HEAT AND MASS TRANSFER

(HEATING VENTILATION AND AIR CONDITIONING)

Time: 3hours **Max. Marks: 60**

Answer any five questions

All questions carry equal marks

- - -

1.a) What is critical thickness of insulation and derive the same for cylinder and sphere?

b)A steel tube of length 20 cm with internal and external diameters of 10 and 12 cm is quenched from 5000C to 300C in a large reservoir of water at 100C. Below 1000C the heat transfer coefficient is 1.5 kW/m2K. Above 1000C it is less owing to a film of vapour being producing at the surface, and an effective mean value between 5000C and 1000C is 0.5 kW/mK. The density of steel is 7800 kg/m3 and the specific heat is 0.47 kJ/kg K. Neglecting the internal thermal resistance of the steel tube, determine the quenching time.

2

Explain the importance of Heisier charts in solving the transient heat conduction problems.

3.A slab of Aluminum 10 cm thick is originally at a temperature of 5000C. It is suddenly immersed in a liquid at 10000 C resulting it a heat transfer coefficient of 1200 W/m2k. Determine the temperature at the centerline and the surface 1 min after the immersion. Also the total thermal energy removal per unit area slab during this period. The properties of aluminum for the given condition are: $\alpha = 8.4 \times 10{-}5m2/s$,

K=215 W/mK, ρ = 2700 kg/m3, Cp= 0.9 kJ/kg. Explain the terms 'hydrodynamic boundary layer' and 'thermal boundary layer', how

are these thickness related to Prandtl number.

Compute the coefficient of heat transfer from a vertical plate of height 2 m to the surrounding still air at 20oC when the plate is maintained at 100oC. Use the following relation NuL = 0.15(GrLPrL)n (Pr/Prs)0.25, Where all fluid properties except Prs (Pr at surface) are taken at the ambient temperature.

4.a) What is the criterion for transition from laminar to turbulent boundary layer in free convection on a vertical plate?

b)Estimate power required to maintain a vertical heater surface at 1300C in ambient air at 200C. The plate is 15 cm high and 10 cm wide. Consider equivalent radiation heat transfer coefficient as 8.5 W/m2K.

5.a) Show that the Nusselt Number for the constant wall heat flux in the tube for the fully developed flow is 4.17.

b)How to evaluate the heat transfer due radiation between the plates by the incorporation of radiation shields?

6.a) Estimate the power required to boil water in a copper pan 0.35 m in diameter. The pan is maintained at 1200C by electric heater. What is the evaporation rate and also estimate the critical flux.

b)Explain the phenomena of flow boiling through the tube along with boiling curve.

7.a) Prove that intensity of radiation is given by Ib = Eb/∏.

b)State and explain Kirchoff's identity? What are the conditions under which it is applicable?

c)A person standing 10m from a point heat source is subjected to a radiation intensity of 200×106 J/hr m2. How far should he stand from the heat source to feel and intensity of half the previous value?

8.a) Derive the Roshenhow equation for the estimation heat transfer coefficient during evaporation.

b)Explain the physical significance of the mass transfer coefficients and describe the analogy between heat transfer and mass transfer.

R18

Code No: R18D2103

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I-Year - I Semester Supplementary Examinations, June 2019

Advanced Fluid Mechanics
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

**

SECTION-I

1 Explain Lagrangian and Eulerian Method for Fluid flow **[14M]**

OR

2 a) Derive Bernoulli's equation for fluid flow and mention its applications **[14M]**
b) Discuss on stream function

SECTION-II

3 Discuss the importance of Navier-stoke's equations **[14M]**

OR

4 Explain in detail Hagen Poisoulle flow. **[14M]**

SECTION-III

5 Explain Von-Karman momentum integral equation for laminar boundary layer **[14M]**

OR

6 Discuss on separation of boundary layer and velocity distribution within a boundary layer **[14M]**

SECTION-IV

7 Explain (a) Turbulent boundary layer equations **[14M]**

(b) Turbulent boundary layer conditions

OR

8 Explain skin friction coefficient for boundary layers on a flat plate **[14M]**

SECTION-V

9 (a) Explain Equations of momentum, Bernoulli's and Euler's for compressible flow **[14M]**
(b) What is the mach number and its application

OR

10 (a) Discuss Mach Cone and Mach angle for compressible flow **[14M]**
(b) Air enters a converging – diverging nozzle with negligible velocity at an absolute pressure of 1MPa and a temperature of 60^0C. If the flow is isentropic and the exit temperature is -11^0C. What is the Mach Number at the exit.

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Code No: R17D2103

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - I Semester Supplementary Examinations, July/Aug 2018

Advanced Fluid Mechanics

(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

SECTION-I

Q. No. 1 Explain the following [14M]
(i) Path lines (ii) Stream line (iii) Streak lines (iv) Stream tubes

OR

Q. No. 2 a) What are the limitations of the Bernoulli's equation? [7M]
b) Explain the terms Circulation and Vorticity. [7M]

SECTION-II

Q. No. 3Two parallel plates kept 100mm apart have laminar flow of oil between them with a maximum velocity of 1.5 m/s. calculate:
(i). The discharge per metre width
(ii). The shear stress at the plates
(iii). The difference between in pressure between two points 20m apart,
(iv). The velocity gradient at the plates and
(v). The velocity at 20mm from the plate.[14M]

OR

Q. No. 4 Derive an expression for shear stress of flow of viscous fluid between two parallel plates. Assume one plate is moving and other is at rest. [14M]

SECTION-III

Q. No. 5 Derive the Von Karman momentum equation for boundary layer. [14M]

OR

Q. No.6Find out the boundary layer thickness, shear stress, local coefficient of drag and coefficient of drag for the following velocity profile. [14M]
$u/U=2(y/\delta)-(y/\delta)^2$

SECTION-IV

Q. No. 7 A smooth brass pipe 75mm in diameter and 900m long carries water at the rate of 7 litres per second. If the kinematic viscosity of water is 0.0195 stokes, calculate the loss of head, wall shearing stress, centre line velocity, shear stress and velocity at 25mm from the centre line and the thickness of the laminar sublayer. Take density=1000kg/m^3. [14M]

OR

Q. No. 8 Derive an expression for the lift produced on a rotating cylinder placed in a uniform flow field such that the axis of the cylinder is perpendicular to the direction of flow. [14M]

SECTION-V

Q. No. 9a) What is Mach number? Why is this parameter so important for the study of flow of compressible fluids? [4M]

b) Derive Rankine Line Equation and Rankine-Hugoniot equations and express in terms of Mach number. [10M]

OR

Q. No. 10a) Derive an equations for acoustic velocity for Mach number. [7M]

b) Explain Mach angle, Mach cone, and stagnation state. [7M]

Code No: R17D2103

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - I Semester Regular Examinations, Jan/Feb 2018

Advanced Fluid Mechanics

(TE)

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14marks.

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Section-I

Q. No. 1 a) Differentiate between the Eulerian and Lagrangian methods of representing fluid flow.[7M]
b) Derive Euler's equation of motion. [7M]

OR

Q. No. 2 What are the types of fluid flows? Explain them in detail. [14M]

Section-II

Q. No. 3 a) Derive the Navier-stokes equations of motion. [10M]
b) What are the important applications of Navier-Stokes Equation? [4M]

OR

Q. No. 4 A lubricating oil of viscosity 1 poise and specific gravity 0.9 is pumped through a 30mm diameter pipe. If the pressure drop per metre length of pipe is 20kN/m^2, determine:
(i). The mass flow rate in kg/min
(ii). The shear stress at the pipe wall
(iii). The Reynolds number of flow, and
(iv). The power required per 50m length of the pipe to maintain the flow. [14M]

Section-III

Q. No. 5a) What is boundary layer? Explain Prandtl's boundary layertheory. [6M]
b) What are the characteristics of boundary layer? [8M]

OR

Q. No.6 Explain creeping flow around a sphere. [14M]

Section-IV

Q. No. 7 If mixing length l is given by $l = \frac{k(\frac{dv}{dy})}{(\frac{d^2v}{dy^2})}$ and$\tau = \tau_0 \ (1 - \frac{y}{R})$, derive the expression for velocity distribution for a fully developed turbulent flow in a circular pipe of radius R. [14M]

OR

Q. No. 8Explain what is meant by separation of boundary layer? Describe with sketches the methods to control separation. [14M]

Section-V

Q. No. 9Derive the Bernoulli's equation for the following [14M]
(i). Isothermal process
(ii). Adiabatic process

OR

Q. No. 10For a normal shock wave in air Mach number is 2. If the atmosphere pressure and air density are 26.5kN/m^2 and 0.413 kg/m^3 respectively, determine the flow conditions before and after the shock wave. Take γ=1.4. [14M]

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Code No: R17D2105

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
M.Tech I Year - I Semester Regular Examinations, Jan/Feb 2018
Solar Energy Technology
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14marks.

****

Section-I

Q. No. 1 a) Define Solar Constant 5M
b) Explain working principle of typical liquid collector 9M

OR

Q. No. 2 a) What are the reasons for variation in solar radiation reaching the earth 5M
b) Define Beam radiation and Diffuse radiation 9M

Section-II

Q. No. 3 a) What are the working fluids used for heat transfer in solar power plants? 6M
b) Write advantages of concentrating collectors over flat plate collectors 8M

OR

Q. No. 4 a) Explain solar central receiver system 8M
b) Write merits and demerits of working fluids used in solar power plants for heat transfer 6M

Section-III

Q. No. 5 a) Explain packed bed exchanger storage system 7M
b) Write advantages of active and passive heating systems 7M

OR

Q. No.6 a) Explain latent heat storage system 7M
b) Explain porous absorber plat based air heaters 7M

Section-IV

Q. No. 7 a) Briefly discuss about semi conductors. 8M
b) Explain Photovoltaic Effect 6M

OR

Q. No. 8 a) Calculate the fill factor for a solar cell which has the following parameters: 8M
V_{oc} = 0.2V; I_{sc} =5.5mA; V_{max} =0.125V; I_{max} =3mA
b) Write limitation to Cell Efficiency 6M

Section-V

Q. No. 9. a . Explain the cost based analysis of water heating system 7M
b. Briefly discuss about economic analysis 7M

OR

Q. No. 10 . The cost of a air-circulating collector is INR 35,000. During its useful life of 20 years, besides other routine maintenance costs of INR 300 each year, replacement of the wooden duct in the 10th year is expected to cost INR 4000. Determine the equivalent annual cost of the system for an interest rate of 10%. 14M

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R18

Code No: R18D2105

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I-Year - I Semester Supplementary Examinations, June 2019

Solar Energy Technology
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

***

SECTION-I

1	a)Explain potential of solar energy in energy technology b) Mention the types of solar collectors	**[14M]**
	OR	
2	a) Discuss on orientation and tracking for solar collectors b) List out the advantages of solar energy	**[14M]**

SECTION-II

3	Explain solar central receiver system and its applications.	**[14M]**
	OR	
4	Explain Heat transport system and its advantages	**[14M]**

SECTION-III

5	Discuss on methods of sensible heat storage using solids and liquids	**[14M]**

OR

6	Explain terms (a) Air heaters (b) Solar dryers	**[14M]**

SECTION-IV

7	Discuss on (a) Solid state principles in direct energy conversion (b) semiconductors	**[14M]**

OR

8	Explain the construction and working principle of solar cells and mention its applications	**[14M]**

SECTION-V

9	Discuss on Discounted cash flow and life cycle costs	**[14M]**

OR

10	Explain cost based analysis of water heating system	**[14M]**

****

Code No: R17D2105

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
M.Tech I Year - I Semester Supplementary Examinations, July/Aug 2018
Solar Energy Technology
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

SECTION-I

Q. No. 1 a) Define Solar Constant. Estimate the average solar radiation on tilted surfaces. 5M
b) Explain basic instruments employed for solar radiation measurement 9M

OR

Q. No. 2 a) Explain the working principles of flat plate collector with a neat sketch 5M
b) Write types of concentrating collectors and explain the line focusing Collector 9M

SECTION-II

Q. No. 3 a) Explain Rankine cycle 8M
b) Explain about concentration ratio? 6M

OR

Q. No. 4 a) Explain solar central receiver system 8M
b) Discuss about prime movers 6M

SECTION-III

Q. No. 5 a) Write factors influencing optimum capacity of energy storage system 7M
b) Explain packed bed exchanger storage system 7M

OR

Q. No.6 a) Write types of energy storage systems 7M
b) Explain solar refrigeration system with a neat sktech. 7M

SECTION-IV

Q. No. 7 a) Calculate the fill factor for a solar cell which has the following parameters: 8M
V_{oc} = 0.2V; I_{sc} =5.5mA; V_{max} =0.125V; I_{max} =3mA
b) Explain Photovoltaic Effect 6M

OR

Q. No. 8 a) Calculate the maximum power and cell efficiency of the cell at an intensity of 8M
200Wm^2, given V_{oc}=0.24 V, I_{sc}=9mA, V_{max}=0.14V and I_{max} = 6mA, Area of Collector= 4cm^2.
b) Write limitation to Cell Efficiency 6M

SECTION-V

Q. No. 9. A PV system for water pumping costs INR 10,000 to purchase and install on the field of a farmer. It is expected to save INR 1200 worth of diesel annually to the farmer and its annual maintenance cost is estimated at INR 100. Calculate the NPV of the investment on the PV system if the useful life of the system is 30 years and the interest rate is 8%. 14M

OR

Q. No. 10. Briefly discuss about (a) photovoltaic applications (b) economic analysis (7*2= 14M)

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Code No: R17D2107

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
M.Tech I Year - I Semester Regular Examinations, Jan/Feb 2018
Advanced IC Engines
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14marks.

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Section-I

1 a) write the classification of Internal combustion engines [4 M]
b) what are the factors affecting the fuel –air cycle explain [10 M]

OR

2 a) explain the effect of the following on combustion.
I. Imperfect mixing of fuel and air
II. Progressive burning
III. Burning time loss [5+5+4 M]

Section-II

3 a) Explain the working of Turbo charging and Write the advantages and disadvantages of turbo charging over super charging? [8 M]
b) Define volumetric efficiency and explain how it can be improved? [6 M]

OR

4 a) Define squish and Explain the role of pre chamber in complete combustion [7 M]
b) Explain the flow patterns used in petrol engines . [7 M]

Section-III

5 a) Explain the stages of combustion in the SI engine. [5 M]
b) Explain about common rail ignition system with neat sketch. [9 M]

OR

6 a) What is meant by delay period? Describe it, indicating its importance. [7 M]
b) Describe the mechanisms of combustion of fuel spray injected in swirl air [7M]

Section-IV

7)what are the effects of following variables on CI engine exhaust emissions? [5+4+5 M]
I. Injection timing
II. Type of fuel
III. Intake air charge dilution

OR

8 a) what are the poisoning the catalyst of a convertor? How can it be reduced [7 M]
b) How is NO_x formed in the exhaust of IC engines? what are the variables that affect the NO_x emissions [7 M]

Section-V

9 a) define convective mode of heat transfer. Discuss the role of convective heat transfer in ic engines [7 M]
b) Explain the working of hydrogen as fuel in IC engine in terms of emission reduction [7 M]

OR

10 a) Explain the working of HCCI engine with the help of line diagram [8 M]
b) Explain working of lean burning engines [6 M]

Code No: R17D2107

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
M.Tech I Year - I Semester Supplementary Examinations, July/Aug 2018
Advanced IC Engines
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

SECTION-I

1 a) Distinguish between ideal engine cycles and real cycles [7 M]
b) What are the design and operating parameters of C.I. Engines? Explain? [7 M]

OR

2 a) Explain the models used for predicting thermodynamic properties of fuel mixtures of IC engines. [7 M]
b) Write the differences between actual and air standard cycles [7 M]

SECTION-II

3 a) Explain the working of Supercharging and Write the advantages and disadvantages of super charging over turbo charging?[7 M]
b) How variation in volumetric efficiency of an engine affects overall efficiency of an engine. Explain? [7 M]

OR

4 a) Define swirl?. Explain the role of swirl in complete combustion [7 M]
b) Describe the flow patterns required for downstream of inlet port of a diesel engine. [7 M]

SECTION-III

5 a) Write the classifications of IC Engines in detail [8M]
b) Explain the losses in IC engines during combustion process [6 M]

OR

6 Explain the effect of the following on CI Engine combustion and efficiency [5+5+4 M]
I. Spray behavior
II. Ignition delay
III. Mixing formation

SECTION-IV

7 a) How NO and NOx are measured explain any one analyzer with neat sketch? [7 M]
b) Name different types of catalytic convertors and explain working of 3 way catalytic convertor? [7 M]

OR

8 a) what are the main constituents of particulates from SI and CI engine explain the difference between particulates and soot? [7 M]
b) Explain the working of flame ionization detector to measure unburned HC from engine emissions? [7 M]

SECTION-V

9 a) what are the design and operating variables which may decrease the formation of HC in the exhaust of SI engine? Briefly explain them. [7 M]
b) Explain the methods to adopt for maximum heat utilization in an IC engine [7 M]

OR

10 a) Explain the working of rotary engine with the help of line diagram [7 M]
b) What are the modifications to be done in IC engine to suit for Bio fuels, Explain [7 M]

****

R18

Code No: R18D2107

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I-Year - I Semester Supplementary Examinations, June 2019

Advanced I.C. Engines
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

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SECTION-I

1 (a) What are the important IC engine design parameters? Describe each of the parameters briefly. **[7M]**

(b) Compare Fuel-air cycles and Actual cycles of SI engine. **[7M]**

OR

2 Describe in detail the steps involved in computer modeling of SI engines. **[14M]**

SECTION-II

3 What is meant by super charging? Describe the methods of super charging of IC engines. How is it different from turbocharging? **[14M]**

OR

4 (a) Describe the significance of swirl in IC engine cylinder charge motion. Explain how inlet port geometry can be used to generate swirling motion. **[7M]**

(b) Explain the function of pre-chamber in diesel engines. Describe the charge motion in a pre-combustion chamber of diesel engine. **[7M]**

SECTION-III

5 Discuss In detail various factors that affect detonation in SI engines. Suggest methods to control detonation in SI engines. **[14M]**

OR

6 (a) Discuss the important fuel spray characteristics in diesel engines. **[7M]**
(b) Explain the working of Common Rail Direct Injection system in Diesel engines **[7M]**

SECTION-IV

7 (a) Describe the emissions from CI engine and their impact on environment. **[7M]**
(b) Discuss the factors that affect the formation levels of NO_x in diesel engines and how it can be controlled. **[7M]**

OR

8 What is a catalytic converter? With a neat sketch explain the constructional details and the controlling mechanism of various pollutants in a catalytic converter. **[14M]**

SECTION-V

9 (a) Discuss the suitability of LPG and CNG as a fuel in SI engine. **[7M]**
(b) Describe the fuel supply system used in CNG fitted engine with a sketch. **[7M]**

OR

10 (a) What are bio-fuels? Give some examples. Discuss their significance in the current economic scenario. **[7M]**
(b) What are the challenges in the adaptability of biofuels? Discuss the need for modification of CI engines for the suitability of biofuels. **[7M]**

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Code No: R17DME51

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
M.Tech I Year - I Semester Regular Examinations, Jan/Feb 2018
Non Conventional Energy Sources
(MD& TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14marks.

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SECTION – I

1. What are the important performance indices of a solar collector? Based on what features the performance of a solar collector can be evaluated. (14M)

(OR)

2. a) Derive the expression for total radiation on inclined surface. Show that a horizontal surface receives no- ground reflected radiation. (7M)
b) Define solar constant. What is its standard value? (7M)

SECTION – II

3. a) Explain the analysis of energy content and its extraction for a hot dry rock type Geothermal resource. (7M)
b) Explain the difference between a Geothermal power plant and thermal power plant. (7M)

(OR)

4. a) How can geothermal energy be utilized for electricity generation. (7M)
b) What do you mean by dry steam, Wet steam and hot water geothermal systems? (7M)

SECTION – III

5. a) Mention the applications of fuel cells and explain any one application. (7M)
b) Derive an expression for emf, free energy, potential, power output and efficiency of a fuel cell. (7M)

(OR)

6. a) How does a fuel cell generate heat? (7M)
b) How fuel cells is the future option for our energy needs. Justify your answer. (7M)

SECTION – IV

7. a) State various routes of Biomass energy conversion to energy. (7M)
b) Write short notes on Materials for Biogas. (7M)

(OR)

8. What are biomass conversion technologies? Draw a schematic diagram to explain various conversion technologies and products. (14M)

SECTION – V

9. a) Derive an expression for power extracted from wind. Write short notes on Betz criterion. (7M)
b) Write a technical note on selection of generator for WECS. (7M)

(OR)

10. a) Explain about single basin arrangement in tidal power generation. (7M)
b) Describe the concepts of converting wave energy in to electrical energy. (7M)

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R17

Code No: R17DME51

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
M.Tech I Year - I Semester Supplementary Examinations, July/Aug 2018
Non Conventional Energy Sources
(MD & TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

SECTION – I

1 a) Write about the availability energy consumption pattern and growth rate in India.(7M)
b) What are the prospects of renewable energy sources in India? (7M)

(OR)

2 Write short notes on different types of solar energy collectors with neat diagrams. (14M)

SECTION – II

3 Explain with neat sketches, the operation of geothermal power plants. (14M)

(OR)

4a) Discuss the energy analysis of a hot aquifer type Geothermal resource. (7M)
b) List the various types of Geothermal resources. (7M)

SECTION – III

5What is fuel cell? Describe the principle of working of H_2-O_2 cell. Give also limitations. (14M)

(OR)

6 Write short notes on
a) Molten carbonate fuel cells (MCFC) (4M)
b) Solid oxide fuel cells (SOFC) (4M)
c) Methanol fuel cells (3M)
d) Phosphoric acid fuel cells (3M)

SECTION – IV

7a) What are the factors which affect the generation of Biogas? (7M)
b) Explain the production of Biogas. (7M)

(OR)

8.With a neat sketch explain fixed dome type and movable drum type plant. (14M)

SECTION – V

9.Derive the expression for power extracted from wind considering Betz model of a wind turbine. What is the maximum theoretical power that can be extracted and under what condition. (14M)

(OR)

10a) State the basic principle of tidal energy production and write major components of tidal power plant. (7M)
b) What are the advantages and limitations of wave energy conversion? (7M)

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R18

Code No: R18DME51

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I-Year - I Semester Supplementary Examinations, June 2019

Non Conventional Energy Sources

(MD, TE, VLSI&ES & ASP)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

*****

SECTION-I

Q.No. 1 Explain with neat sketch the potential of Renewable energy sources in India. [14M]

OR

Q.No. 2 a) Explain with a neat sketch, the working of solar PV-Power generation. [9M]

b) Write short note on solar still. [5M]

SECTION-II

Q.No.3 Explain with a neat sketch, working of geo thermal power plant for power generation. [14M]

OR

Q.No. 4 a) What are the environmental impacts of geothermal energy? [7M]

b) What are the merits and demerits of geothermal energy? [7M]

SECTION-III

Q.No. 5 a) Explain with a neat sketch about nuclear fusion. [7M]

b) Explain with a neat sketch about nuclear fission. [7M]

OR

Q.No. 6 a) What are the advantages and dis-advantages of the usages of Hydrogen gas as IC Engine fuel? [7M]

b) What are the properties of Hydrogen gas? [7M]

SECTION-IV

Q.No.7 Explain with neat sketch the working of KVIC (Khadi Village Industries Commission) Bio-gas plant. [14M]

OR

Q.No. 8 With a neat sketch explain about fixed dome of movable drum type Bio-gas plant. [14M]

SECTION-V

Q.No. 9 Explain with neat sketches the various types of wind energy turbines.[14M]

OR

Q.No.10 a) What are the Advantages and limitations of wave energy conversion.[7M]

b) State the basic principle of tidal energy production. [7M]

SEMESTER-II

PREVIOUS QUESTION PAPERS

R18

Code No: R18D2110

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Semester Regular Examinations, June-2019
Fuels, Combustion and Environment
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

***

SECTION-I

1 What are the different kinds of fuels used in an Internal Combustion engines? **[14M]**

OR

2 Explain Conventional and Unconventional liquid and gaseous fuels. **[14M]**

SECTION-II

3 Explain the various factors that influence on the combustion. **[14M]**

OR

4 Explain Combustion stoichiometry and reaction order of combustion. **[14M]**

SECTION-III

5 Explain heating value of fuel and adiabatic flame temperature. **[14M]**

OR

6	Explain Equilibrium composition of gaseous mixtures.	**[14M]**

SECTION-IV

7	What are the factors affecting the burning velocity of combustion of fuel?	**[14M]**

OR

8	Explain Flame stability and burning velocity of fuels.	**[14M]**

SECTION-V

9	What is air pollution? What happens to pollutant in the atmosphere?	**[14M]**

OR

10	Explain different methods of Emission control.	**[14M]**

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Code No: R17D2110

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
M.Tech I Year - II Semester Regular Examinations, July/Aug 2018
Fuels, Combustion and Environment
(TE)

R17

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

Section-I

1. a) Do you think that, Nuclear Fuels are necessary for India? Discuss about it. (7M)
   b) Why storage and handling of liquid fuels is difficult when compared with solid fuels Explain. (7M)
   .

OR

2. a) Explain the production of biogas with the help of reactions. (7M)
   b) What are the factors affecting the production of biogas? (7M)

Section-II

3. a) What is meant by "dew point of products"? Explain. (7M)
   b) Explain the general Oxidation phenomenon in a combustion process. (7M)

OR

4. a) Briefly explain about the combustion stoichiometry . (7M)
   b) Explain about Zeroth, first, Second and Third Order Reactions. (7M)

Section-III

5. a) Explain the enthalpy formation in combustion process with a neat diagram. (7M)
   b) What is the role of adiabatic flame temperature in thermodynamic combustion process? (7M)

OR

6. a) What do you understand by combustion thermodynamics? Explain. (7M)
   b) Explain about various theories of combustion? (7M)

Section-IV

7. a) Explain about various theories for laminar flame propagation. (7M)
   b) What are the various factors affecting the laminar flame velocity? Explain. (7M)

OR

8. a) Explain the turbulent flame propagation and factors affecting turbulent flame velocity. (7M)
   b) Explain the term Flame Stability. What is its effect on combustion process? (7M)

Section-V

9. What are the effects of air pollution on environment? Explain. (14M)

OR

10. a) Explain about environmental pollution caused by main pollutants. (7M)
    b) Explain about various measures taken to control the air pollution? (7M)

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Code: 13D11105

M.Tech I Semester Supplementary Examinations September/October 2015

FUELS & COMBUSTION TECHNOLOGY

(Thermal Science & Energy Systems)

(For students admitted in 2013 & 2014 only)

Time: 3 hours Max. Marks: 60

Answer any FIVE questions

All questions carry equal marks

*****

1 (a) Discuss the different factors that are responsible for the efficient production of biogas.
(b) Explain with the help of biological reactions the production of biogas.

2 (a) What do you understand by the word "Briquetting of solid fuels"?
(b) What is coal carbonization? Explain in detail the coal preparation method.

3 (a) Explain the procedure for storage and handling of liquid fuels.
(b) What are the important petroleum products? List out the various applications of the petroleum products.

4 (a) H_2 is considered as a most promising fuel for air-craft. Comment.
(b) Discuss the different methods to be used to supply H_2 if it used in petrol engines.

5 (a) Discuss in detail the different theories of combustion.
(b) What do you understand by combustion thermodynamics? Discuss.

6 The gas analysis of a diesel engine exhaust carried out by Orsat apparatus is CO_2 = 7.5%, O_2 = 9.4%, CO = 1%. Determine:
(a) A : F ratio used (by mass)
(b) The mass analysis of the fuel
Air contains 21% of O_2 and 79% of N_2 by volume and air molecular weight = 29. Assume fuel is purely hydro – carbon.

7 (a) List the different types of furnaces. Explain in detail batch & continues furnaces with a neat sketch.
(b) List out the advantages and disadvantages of ceramic coating to furnaces.

8 With a neat sketch explain the following in detail:
(a) Open hearth furnace and kilns.
(b) Pot & crucible furnaces.

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M. Tech. II Semester Regular Examinations

FUELS, COMBUSTION AND ENVIRONMENT

Thermal Engineering

MODEL PAPER -I

Time : 3 Hours Max. Marks: 60

Answer any FIVE Questions
All Questions Carry Equal Marks

1. a. Explain about Conventional and Unconventional Solid fuels.
   b. Discuss in detail about gaseous fuels?
2. a. What do you understand by "dew point of products"?
   b. Explain in detail about General oxidation behavior of HC's.
3. a. What is Enthalpy of formation?
   b. Discuss about Adiabatic flame Temperature in combustion analysis.
4. a. What do you understand by the word "Turbulent Flame" .
   b. What are the factors affecting the burning velocity.
5. What are the effects of Air pollution on Environment? Explain.
6. With a neat sketch explain in detail about Fluidized Bed Systems.
7. What do you understand by Equilibrium composition of gaseous mixtures? Explain.
8. What do you understand by complex reactions and chain reactions? Explain.

M. Tech. II Semester Regular Examinations

FUELS, COMBUSTION AND ENVIRONMENT

Thermal Engineering

MODEL PAPER –II

Time : 3 Hours Max. Marks: 60

Answer any FIVE Questions

All Questions Carry Equal Marks

1. a .Briefly explain any two solid fuels and what is its effect on calorific value?
   b. Analyze different types of coal tests.
2. a. Explain fractional distillation and reforming process.
   b. Explain coal gasification process.
3. a. What do you understand by higher heating value and lower heating value of a fuel?
   b. Explain 2nd order of kinetic reactions with examples.
4. Determine the adiabatic flame temperature when liquid Octane [C_8H_{18}] at 25^oC is burned with 300% theoretical air at 25^0C in a steady flow process.
5. a. What do you understand by flame stability?
   b .Draw a neat characteristic stability diagram and explain its salient points.
6. a. Explain the structure of turbulent flame propagation.
   b. What are the factors affecting on turbulent flame propagation?
7. What do you understand by air pollution? Briefly discuss the major sources for emissions and their means for control.
8. Write short notes on the following :
   a. Bio gas
   b .Adiabatic flame temperature
   c. Fluidized bed system

R18

Code No: R18D2111

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Semester Regular Examinations, June-2019
Computational Fluid Dynamics
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

***

SECTION-I

1 Distinguish between Finite Difference Method, Finite Volume Method and Finite Element Method. **[14M]**

OR

2 Formulate the finite difference scheme for $(\partial^2 u/\partial x^2)_{i,j}$ and $\frac{\partial^2 u}{\partial x \partial y}$ **[14M]**

SECTION-II

3 Explain the Euler's FTBS approximation (First order upwind scheme) for the first order wave equation. **[14M]**

OR

4 Write Burgers' equation in different forms. Explain their application in fluid dynamics. **[14M]**

SECTION-III

5 (a) Distinguish between compressible flow and incompressible flow. **[4M]**
(b) Enunciate the **SIMPLE** pressure correction method in solving incompressible flow fields. **[10M]**

OR

6	(a) Classify the various compressible flow computational schemes for solving Euler's equation (b) Illustrate any one type of computational scheme with combined space-time discretisation (Lax-Wendroff's scheme) to solve compressible flows.	**[4M]** **[10M]**

SECTION-IV

7	Enunciate the cell centred average scheme via finite difference method for a 2-D fluid flow problem.	**[14M]**

OR

8	Formulate the Cell Centred control volume procedure for 3-D Euler equation via FDM using fractional step scheme	**[14M]**

SECTION-V

9	Explain in detail the Conjugate Gradient Method (CGM) used in the solution by FEM.	**[14M]**

OR

10	State steady state problem analysis and Explain it with any example.	**[14M]**

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Code No: R17D2111

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Regular Examinations, July/Aug 2018

Computational Fluid Dynamics

(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

******

Section-I

1. a) Explain in detail the similarities, differences, advantages and disadvantages between finite difference methods, finite volume methods and finite element methods used for solving fluid flow problems. **(7M)**

b) What is CFD? Justify CFD is an advanced research tool. Compare it with any testing equipment.**(7M)**

OR

2. a) What are the different types of boundary conditions encountered in solving fluid flow problems? **(4M)**

b) Write a short note on eigen value method. **(10M)**

Section-II

3. a) Explain Lax Wendroff scheme in detail for solving hyperbolic equation.**(7M)**

b) Write the Burger's equation. What types of problems are governed by Burger's equation? **(7M)**

OR

4. Describe Von Neumann stability analysis for non linear hyperbolic equation.**(14M)**

Section-III

5. a) Explain Primitive Variable formulations of Incompressible Navier – Stokes Equations.**(7M)**

b) Derive the compressible potential equation from 2D Navier Stokes equations. (7M)

OR

6. a) Explain Vorticity - Stream Function formulations of Incompressible Navier – Stokes Equations. **(7M)**

b) For what types of flows are compressible potential equation is generally used? **(7M)**

Section-IV

7. a) Explain cell – centered scheme of finite volume method in detail. **(7M)**

b) Explain Two – dimensional heat conduction equation using Interior Triangle scheme**.(7M)**

OR

8. a) Explain Nodal point scheme of finite volume method in detail. **(7M)**
   b) Explain the Flux Vector Splitting scheme by using Boundary Triangle Method. **(7M)**

Section-V

9. Solve FVM for steady one dimensional convection and diffusion problem.(**14M)**

OR

10. a) Explain generalized Galerkin method for formulating finite element equations for unsteady flow problems.**(8M)**

    b) Explain the meaning of the term "residual" in variational methods. **(6M)**

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Code No: R18D2112

R18

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Semester Regular Examinations, June-2019
Advanced Finite Element Analysis
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

***

SECTION-I

1 a) Derive the relations between stress-strain, strain-displacement relations and equilibrium equations for 3-dimentional system. **[7M]**

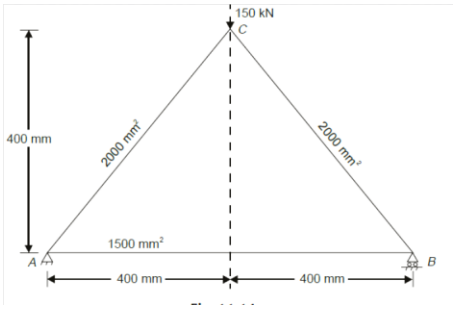
b) Explain the plane stress and plane strain problem with examples. **[7M]**

OR

2 Derive the expression for stiffness and total load vector using minimum potential energy. **[14M]**

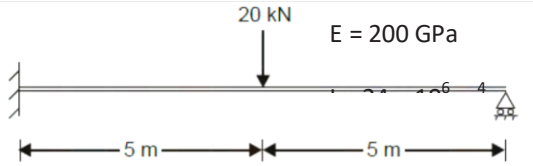
SECTION-II

3 For the three – bar truss shown in Fig. Determine the nodal displacements, stress in each member and reactions at supports. Find the support reactions also. Take modulus of elasticity as 200 GPa. **[14M]**



OR

4 A beam of length 10 m, fixed at one end and supported by a roller at the other end carries a 20 kN concentrated load at the centre of the span. Determine: i) Deflection under load, ii) Shear force and bending moment at mid span, iii) Reactions at support. **[14M]**



SECTION-III

5 Derive the Jacobian of transformation matrix and strain-displacement matrix for a constant strain triangle element. **[14M]**

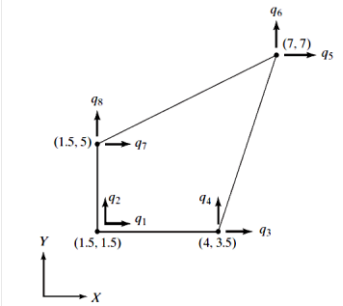
OR

6 A long thick-walled cylindrical pressure vessel of inner radius 0.75 m and outer radius 1.0 m is subjected to an internal pressure of 5 MPa. Considering an axial length of 0.2 m, determine the radial displacement of the inner surface of the pressure vessel. Take E = 207 GPa and v = 0.3. Assume that the outer surface of the pressure vessel is constrained from any displacement. Use two triangular ring elements. **[14M]**

SECTION-IV

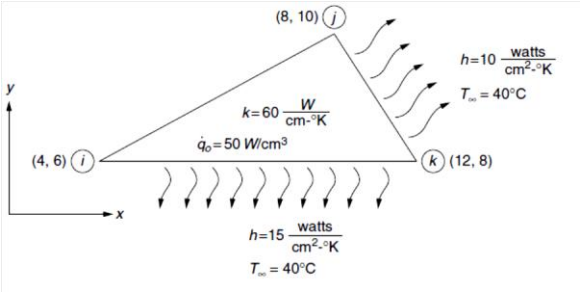
7 a) Derive the shape functions for Eight-Node Quadrilateral element. **[6M]**

b) Fig shows a four-node quadrilateral. The element displacement vector q is given as q = [1, 0, 0.15, 0, 0.2, 0.35, 0, 0.08]^T. find The x, y -coordinates of a point P whose location in the master element is given by $\xi = 1$ and $\eta = 1$. **[8M]**



OR

8 Compute the element matrices and vectors for the element shown in Fig. when the edges jk and ki experience convection heat loss. **[14M]**

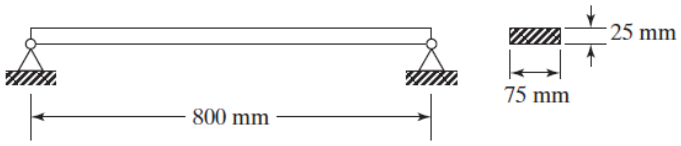


SECTION-V

9 Derive the element mass matrix for bar, truss, Constant strain triangle and beam element. **[14M]**

OR

10 Determine all natural frequencies of the simply supported beam shown in Fig. **[14M]**



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Code No: R17D2112 **R17**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Regular Examinations, July/Aug 2018

Advanced Finite Elemental Analysis

(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

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SECTION-I

1 a What is the difference between Finite element methods and analytical methods 5M

b Explain about , Glerkin's Method and Rayleigh-Ritz method 4M

c Draw a typical three dimensional element and derive the equations of equilibrium of a three dimensional stress system 5M

OR

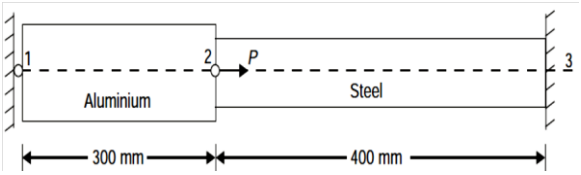
2 a Explain the terms plane stress and plane strain with examples 4M

b Explain about one-dimensional Heat transfer in FEM 5M

c Derive stiffness matrix of beam element. 5M

SECTION-II

3 a Determine the nodal displacements at node 2, stresses in each material and support reactions in the bar shown in Fig. due to applied force P=400×10^3 N and temperature rise of 30^0 C. 7M



A_{al} = 2400 mm^2 A_s= 1200 mm^2

l_{al}= 300 mm l_{al}= 200 mm

$E_{al}=0.7\times10^5$ N/mm^2 $E_s=2\times10^5$ N/mm^2

b Derive the transformation matrix for truss element 4M

c What is Hermite shape functions 3M

OR

4 a Derive the stiffness matrix and load vector for quadratic bar element 10M

b Explain the term Shape Functions. Why polynomial terms are preferred for shape functions in finite element method? 4M

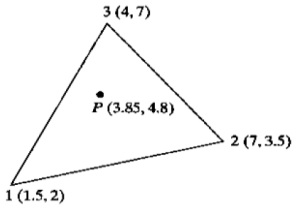
SECTION-III

5 a What is Constant strain triangle (CST), (ii) Linear strain triangle (LST) and (iii) Quadratic strain triangles (QST). 6M

b Using one point and one point Guass quadrature, evaluate the integral 4M

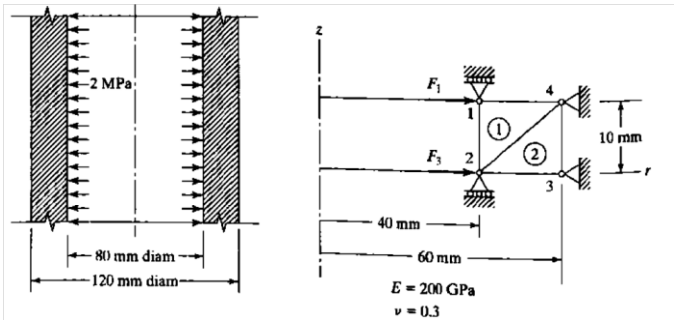
$$I=\int_{-1}^{1}\int_{-1}^{1}(r^2s^3+rs^4)\mathrm{d}r\mathrm{d}s$$

c Evaluate shape functions at the interior point of a triangular element as shown in Fig, 4M



OR

6 a Find the displacements at inner radius for a long cylinder shown in Fig. using two elements on the 10 mm length. 10M

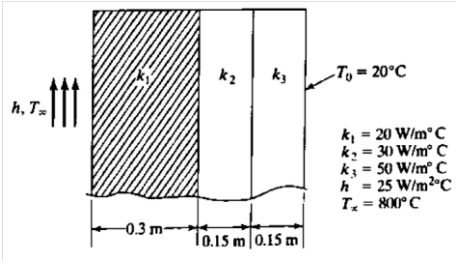


b Write the shape functions for Tetrahedran element 4M

SECTION-IV

7 a In the heat transfer analysis of a one-dimensional fin, the fin is modeled with quadratic finite elements. For an interior element, the nodes 1, 2, and 3 are located at x = 12 cm, 15 cm, and 18 cm with the nodal temperatures as 80°C, 75°C, and 68°C, respectively. Determine the shape functions of the element and the temperature gradient (dT/dx) in the element. 7M

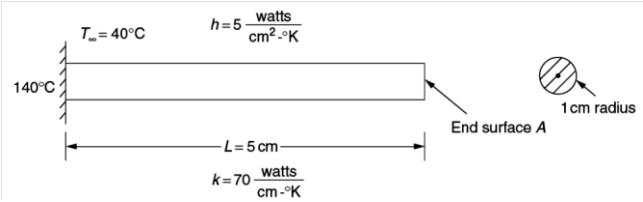
b A composite wall as sown in Fig. determine the temperature distribution in the wall. $T_\alpha = 800^0$ C and h= 25 W/m^2.^{0}C. 7M



OR

8 a Heat is generated in a large plate (k=0.8 W/m ^{0}C) at the rate of 4000 W/m^3. The plate is 25 cm thick. The outside surface of the plate is expected to ambient air at 30^0 C with a convective heat transfer coefficient of 20 W/m^2. Determine the temperature distribution in the wall. 7M

b Using one finite element, find the temperature distribution in the one-dimensional fin shown in Fig. 7M

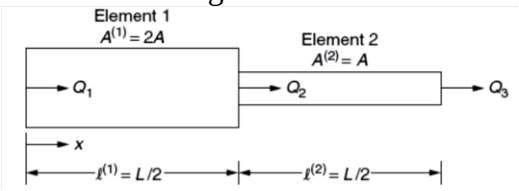


SECTION-V

9	a	Derive the mass matrix for one dimensional bar and CST element	10M
	b	Find the natural frequency of vibration of a fixed-free bar in axial motion based on a one-element model using consistent mass matrix	4M

OR

10		Find the natural frequencies and mode shapes of longitudinal vibration of the unconstrained stepped bar shown in Fig.	14M



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Code No: **R15D1504**

R15

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - I Semester supplementary Examinations, Jan/Feb 2018

Advanced Finite Element Analysis

(MD)

Roll No										

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks

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SECTION - I

1.(a) What is the FEM and what are the applications of FEM. Also write the advantages and disadvantages of FEM.. (10M)

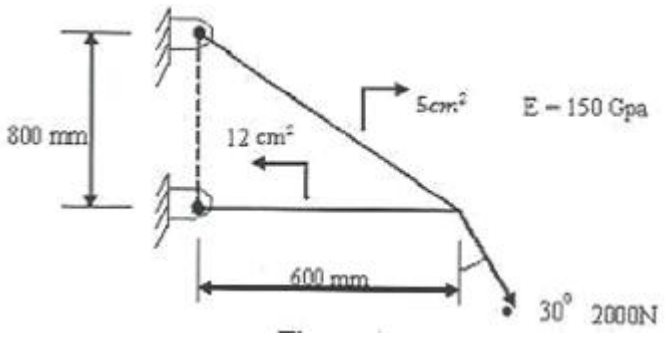
(b) List out the various properties of stiffness matrix. (5M)

(Or)

2.Discuss convergence requirements in finite element formulation. Derive the shape function for 3-noded truss element by Lagrangian interpolating function. (15M)

SECTION – II

3.Calculate the nodal displacement, stresses and support reactions for the truss shown in figure. (15M)



(Or)

4.(a) Differentiate among Bar element, Truss element and Beam element indicating D.O.F and geometry characteristics for determining stiffness matrix. (10M)

(b) Describe EFA Hermite shape functions. (5M)

SECTION – III

5. (a) Derive the stiffness matrix [K] and the load vector for the two dimensional six nodded triangular element, also determine nodal displacements of triangular element, strain and stress of an element.(10M)

(b) Differentiate between CST and LST with respect to the triangular element.(5M)

(Or)

6. Determine the element equations for the plane stress element shown in Fig.1. The element has a 20 N/cm^2 load acting perpendicular to side jk and is subjected to a 15ºC temperature rise.Thickness of the element = 2 cm; E = 6 × 10$_6$ N/cm^2 α = 7 × 10–6 cm/cm ºC; μ = 0.25 (15M)

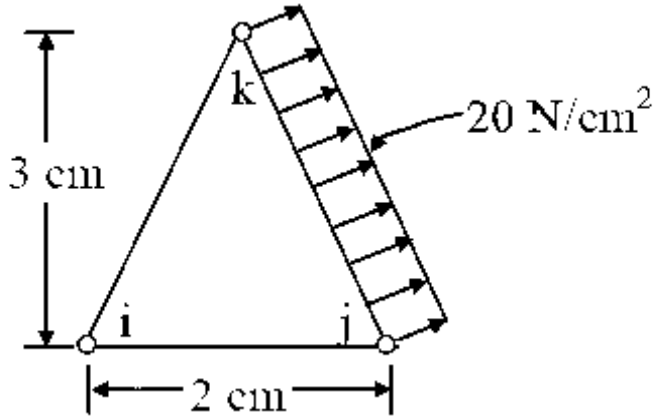


Fig.1

SECTION – IV

7. Consider a brick wall of thickness 0.3 m , k=0.7 W/m K . The inner surface is at 280^0 C and the outer surface is exposed to cold air at -150^0 C. The heat transfer coefficient associated with the outside surface is 40W/m^2 K. Determine the steady state temperature distribution within the wall and also the heat flux through the wall. Use two elements and obtain the solution.(15M)

(Or)

8. For the two dimensional body as shown figure 2, determine the temperature distribution. The left and right ends have constant temperatures of 200^{0}C and 100^{0}C respectively. Take k=5 W/cm^{0}C. The body is insulated along the top and bottom.(15M)

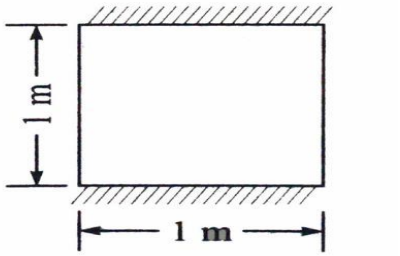


Fig.2

SECTION – V

9. (a) Distinguish between consistent mass matrix and Lumped mass matrix.(5M)

(b) Consider axial vibration of the steel bar shown in Fig.3, (i) develop the global stiffnessand mass matrices and (ii) determine the natural frequencies and mode shapes usingthe characteristic polynomial technique.(10M)

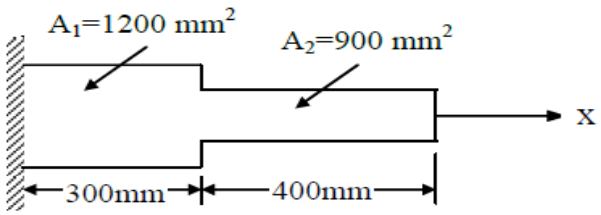


Fig.3

(Or)

10. Evaluate eigen values and eigen vectors for a cantilever beam of length 1 m, supported at the other end. Take E = 200GPa, I = 40×10^{-10} m^4, A = 2×10^{-4} m^2 and weight density = 7850 kg/m^3. Use one element method. (15M)

****

Code No: R15D1504 **R15**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - I Semester supplementary Examinations, August 2017

Advanced Finite Element Analysis

(MD)

Roll No										

Time: 3 hours **Max. Marks: 75**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 15 marks.

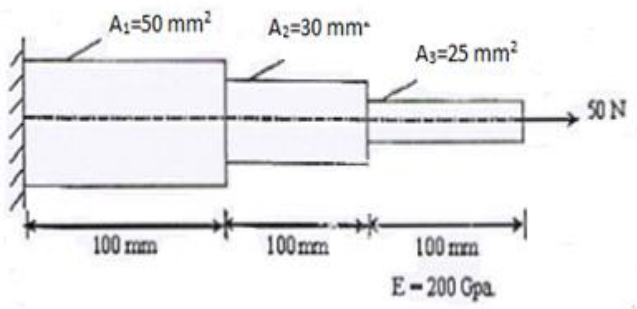
****

SECTION-I

1. a. List the advantages and disadvantages of FEM over other traditional variation methods.
   b. Derive the finite element equation using the potential energy approach.

(OR)

2. a.Use finite element method to calculate displacement and stresses of the bar as shown in figure.1.



   b. List and briefly describe the general steps of the finite element method.

SECTION-II

3. a) Differentiate between planar frame element and space frame element.
   b) Calculate the nodal displacement, stresses and support reactions for the truss shown in figure Assume the missed data

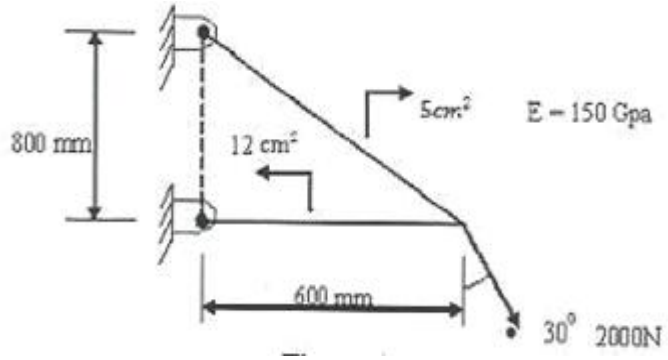


Figure.1

(OR)

4. For a beam and loading shown in Figure.2, determine the slopes at 2 and 3 and the vertical deflection at the mid point of the distributed load.

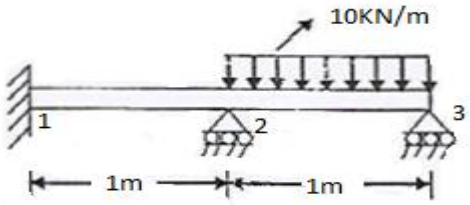


Figure.2

SECTION-III

5. a. Derive the stiffness matrix of an axisymmetric element using potential approach.
   b. Compute the finite element equation for the LST element as shown in Figure.3

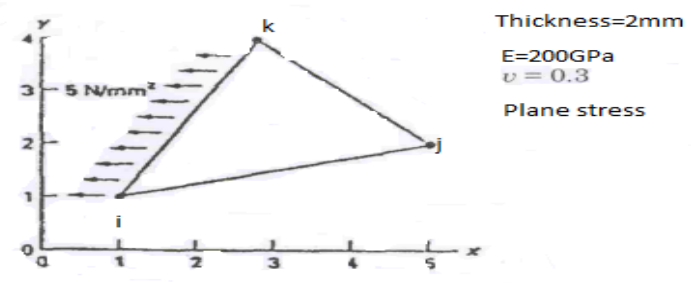


Figure.3

(OR)

6. a. What are the non-zero strain and stress components of axisymmetric element? Explain.

   b. The nodal coordinates of the triangular element shown in figure 4 At the interior point P the x coordinate is 3.3 and the shape function at the node 1 is N_1 is 0.3 Determine the shape functions at nodes 2 and 3 and also y coordinate of point P

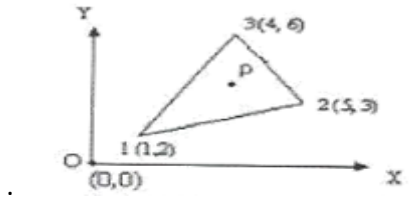


Figure.4

SECTION-IV

7. Derive a finite element equation for one dimensional heat conduction with free end convection.

(OR)

8. Consider a brick wall of thickness 0.3m, k=0.7 W/m K. The inner surface is at 28^0C and the outer surface is exposed to cold air at -15^0C. The heat transfer coefficient associated with the outside surface is 40 W/m^2K. Determine the steady state temperature distribution within the wall and also the heat flux through the wall. Use two elements and obtain the solution.

SECTION-V

9. Consider the axial vibrations of a steel bar shown in Figure.5
   a) Develop global stiffness and mass matrices,
   b) Determine the natural frequencies?

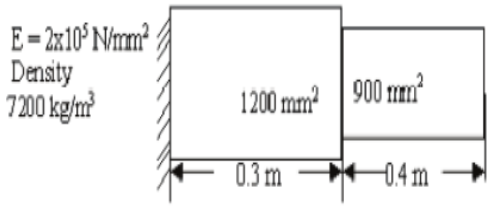


Figure.5

(OR)

10. Derive the equation of motion based on weak form for transverse vibration of a beam.

****

Code No: R18D2114

R18

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Semester Regular Examinations, June-2019
Industrial Refrigeration Systems
(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

***

SECTION-I

1 Explain the importance of refrigeration system in Food Processing industries. **[14M]**

OR

2 Explain the importance of Transportation Refrigeration. **[14M]**

SECTION-II

3 Explain different type of Economizers and capacity regulators used in refrigeration systems. **[14M]**

OR

4 Explain the different type of Compressors used in refrigeration systems. **[14M]**

SECTION-III

5 Explain the importance of Condensers and Evaporators used in refrigeration systems. **[14M]**

OR

6	Explain refrigerant piping design used in condensers and evaporators.	**[14M]**

SECTION-IV

7	Explain the importance of Vessels used in Industrial Refrigeration.	**[14M]**

OR

8	Explain high pressure and low pressure receivers.	**[14M]**

SECTION-V

9	Explain the load calculation procedure in designing a Cold storage.	**[14M]**

OR

10	Explain different type of Insulations used in refrigeration systems.	**[14M]**

****

Code No: R17D2114

R17

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Regular Examinations, July/Aug 2018

Industrial Refrigeration Systems

(TE)

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

SECTION-I

1.(a) Explain the Industrial refrigeration and air condition applications (8M)
(b) Explain the following terms
(i) Conventional Refrigeration System
(ii) Comfort air condition
(iii) Conditions for high COP (6M)

OR

2.Refrigerant choices for commercial refrigeration to find the right balance. Explain with case study and examples. (14M)

SECTION-II

3.(a) Compare the performance of reciprocating compressor and screw compressor. (7M)
(b) List out the multi stage industrial applications. (7M)

OR

4.(a) Write short notes on
(i) Economizers
(ii) Refrigeration Injection (8M)
(b) What are the advantages and disadvantages of reciprocating compressor over screw Compressor. (6M)

SECTION-III

5.Write short notes on
(a) NPSH
(b) Types of Oil Separator with neat sketch. (14M)

(OR)

6.(a) Explain different Industrial condensers arrangement. (7M)
(b) Differentiate between Top Feed and Bottom Feed refrigerant. (7M)

SECTION-IV

7.Discuss about thermo siphon receiver and oil pots and mention the advantages and Disadvantages? (14M)

8.Write short notes with neat diagram
(a) High Pressure Receiver

(b) Liquid and Vapour separator (14M)

SECTION-V

9. (a) Explain in detail about Ice builder and Ice harvester with neat sketch. (7M)
(b) What are the factors effecting the sources of losses in energy conversation. (7M)

OR

10. Explain about energy efficient components and heat reclaim thermal storage with neat Sketch (14M)

****

M.Tech II Semester Regular Examinations, April - 2016

INDUSTRIAL REFRIGERATION AND SYTEM

(Mechanical Engineering)

6.12 Time:3hours

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**

2. Answering the question in **Part-A** iscompulsory

3. Answer any **THREE** Questions from**Part-B**

6.13 *****

6.14

PART –A

1. a) Explain the term ``Tonne of refrigeration``. [4M]

   b) Whyinpracticeathrottlevalveisusedinvapourcompressionrefrigeratorratherthan anexpansioncylindertoreducepressurebetweenthecondenserandtheevaporator? 6.15 [4M]

   c) ``A completely odorless refrigerant is not desirable``, discuss the statement. [3M]

   d) Discussthefunctionofabsorberinvapourabsorptionrefrigerationsystem. [3M]

   e) Whatisthedifferencebetweenwetbulbtemperatureandthermodynamicwetbulb temperature? 6.16 [4M]

   f) Explainthefeaturesrequiredfortheproperselectionofafanforagivenapplication? [4M]

PART –B

2. a) Drawtheschematicofaboot-strapcycleofairrefrigerationsystem,andshowthecycle on T-sdiagram.

   b) Inaboot-straprefrigerationsystemforanaircrafttheambientconditionsare0.225bar and-50^{0}C.Coolingloadestimateis20tonrefrigeration(20TR).Thespeedoftheplane is 1000 km/hr. Ram efficiency is 0.9. the pressure ratio for the main compressor is 3.5 and this bled off air is further compressed in secondary compressor run by cooling air turbine on a single shaft such that output from turbine is equal to input to the compressor. The internal efficiency of main compressor as well as secondary compressoris0.9,and that of cooling turbine is 0.8. The air from secondary compressor is cooledbyramairto50^{0}C.Thecoolingairturbinerunningthesecondarycompressor has its exit pressure of 1 bar. Determine (i) Delivery pressure from the secondary compressor,(ii)Massflowratebledforcoolingthecabin,(iii)COPofthesystem.

3. a) Discuss the effect of sub-cooling on COP. Would you desire large sub-cooling and why?

   b) A refrigerating plant using CO_2 as refrigerant works between 25^{0}C and -5^{0}C. The dryness fraction of CO_2 is 0.6 at the entry of the compressor. Find the ice formed per day if the ice is formed at 0^{0}C and from the water at 10^{0}C. Quantity of CO_2 circulated=10 kg/min. Take relative efficiency=0.6. Take C_p (water) = 4.2 kJ/kg, latent heat ofice=335kJ/kg.

Temperature ^{0}C	Liquid heat (kJ/kg)	Latent heat (kJ/kg)	Entropy of liquid (kJ/kg K)
25	81.25	121.6	0.2513
-5	-7.53	245.8	-0.0419

4. a) Describetheworkingofanevaporativecondenser. [7M]
   b) Explaintheworkingoffollowingtypesofevaporatorswithneatsketches:(i)Shelland tubeevaporator,(ii)Forcedconvectionevaporator,(iii)Shellandcoilevaporator.

6.17

6.18 [9M]

5. Draw a neat diagram of lithium bromide water absorption system and explain its working in major field of applications of thissystem.

   b) Derive an expression for the COP of an ideal vapour absorption system in terms of temperature $T_G$at which heat is supplied to the generator, the temperature T_E at Which heat is absorbed in the evaporator and the temperature T_C at which heat is discharged from the condenser and absorber.

6.19 [8M]

6.20

6.21 [8M]

6. A) Explainthedifferencebetweencomfortair-conditioningandindustrialair-conditioning. [8M]
   b) Define the term `` effective temperature `` and explain its importance in air-conditioningsystem.Describethefactorswhichaffecteffectivetemperature.

6.22

7 a) Describe a centrifugal fan with the help of a neat sketch? [8M]

   b) Explain in detail about heat pump circuits? [8M]

M.Tech II Semester Supplementary Examinations, November/December - 2017

INDUSTRIAL REFRIGERATION & SYSTEM

(Mechanical Engineering)

Time: 3 hours

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**

2. Answering the question in **Part-A** is compulsory

3. Answer any **THREE** Questions from **Part-B**

*****

PART-A

1. a) What is refrigeration? Define one ton of refrigeration. [3M]

   b) Represent ideal vapour compression refrigeration system on T-S and P-h diagrams. [4M]

   c) Discuss the operation of capillary tube in a refrigeration system. [3M]

   d) State the function of absorber and rectifier in vapour absorption system. [4M]

   e) Explain in brief, an adiabatic saturation process. Represent the same on a psychrometric chart. [4M]

   f) Explain selection of the fan using fan characteristic curve. [4M]

PART-B

2. a) Explain Boot strap evaporative cooling air refrigeration system. Draw its schematic and represent the processes on T-S diagram. Write down the equations for calculating mass flow rate, power and COP of the system. [7M]

   b) An air craft moving with speed of 1000 km/h uses simple gas refrigeration cycle for air conditioning. The ambient pressure and temperature are 0.35 bar and $-10^{U}C$ respectively. The pressure ratio of compressor is 4.5. The heat exchanger effectiveness is 0.95. The isentropic efficiencies of compressor and expander are 0.8 each. The cabin pressure and [9M]

temperature are 1.06 bar and 25$^{\upsilon}$C. Determine temperature and pressures at all points of

the cycle. Also find the volume flow rate through compressor inlet and expander outlet for

100 TR. Take C_P=1.005 kJ/kg K; R=0.287 kJ/kg K and C_P/C_V=1.4 for air.

3. a) Explain the effect of evaporator pressure and condenser pressure on the performance of [7M]

vapour compression refrigeration system using P-h diagram.

b) A four cylinder, single acting R-12 compressor 30 cm x 40 cm runs at 960 rpm. The [9M]

compressor clearance factor is 0.03 and the law of compression $pV^{1.1}$=C. the operating

pressures for the vapour compression refrigeration system are: 8.47 bar (35$^{\upsilon}$C) and 1.004

bar (-30$^{\upsilon}$C). The refrigerant temperatures are: entering the compressor -20$^{\upsilon}$C, leaving the

compressor 50$^{\upsilon}$C; entering the condenser 45$^{\upsilon}$C, leaving the condenser 25$^{\upsilon}$C, entering the

expansion valve 30$^{\upsilon}$C and leaving the evaporator dry saturated. Assuming that heat

removed in the compressor is 25 kJ/sec. calculate:

i)The refrigerating capacity ii)The compressor power iii)COP

iv)Mass of condensing cooling water assuming the rise in temperature to be 10$^{\upsilon}$C

v)Also tabulate energy balance for 1 kg of refrigerant.

4. a) Give the comparison between air cooled and water cooled condenser. Explain in detail an [8M]

evaporative condenser.

b) What is an azeotrope? Give some examples to indicate its importance. [8M]

5. a) Explain with a neat sketch, the working of a vortex tube? [8M]

2. State the advantages and disadvantages of Electrolux refrigerator over conventional refrigerators. [8M]

6. a) What is an effective temperature? State and explain the factors which govern optimum effective temperature? [7M]

   b) The following data apply to an air conditioning system: [9M]

   Room sensible heat =41868 kJ/hr(11.63 kW); room latent heat=41868 kJ/hr(11.63kW); inside design condition= 25^0C, 50% RH, outside design condition=35^0C,DBT, 27.8 WBT. Return air from the room is mixed with the outside air before entering the cooling coil in the ratio of 4:1. Return air from the room is mixed with the cooling air, i.e. after the cooling coil in the ratio of 1:4. Cooling coil by pass factor is 0.1. The air may be reheated if necessary before supplying to the conditioned space. Assume ADP as 10^0C and determine,

   i) Supply air conditions into the room
   ii) Refrigeration load due to the reheat
   iii) Total refrigeration capacity
   iv) The quantity of fresh air supplied.

7. a) Explain in detail, the filters used in air conditioning systems? [8M]

   b) Explain the use of heat pump for heating and cooling cycle with a neat diagram? [8M]

*****

R18

Code No: R18D2116

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Semester Regular Examinations, June-2019

Thermal and Nuclear Power Plants

(TE)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

SECTION-I

1-A	Give the layout of a modern steam power plants and explain it briefly	**[8M]**
B	State the characteristics of a good ash handling plant	**[6M]**
	OR	
2	With the help of suitable sketch explain compounding of turbines in detail	**[14M]**

SECTION-II

3-A	What do you mean by " combination gas turbine cycle" explain in detail	**[8M]**
B	What are the major fields of applications of gas turbine?	**[6M]**
	OR	
4	What is co generation in power plants? Explain in detail.	**[14M]**

SECTION-III

5	Explain the working of pressurised water reactor with the help of line diagram and write its advantages and disadvantages over other reactors	**[14M]**
	OR	
6	Explain the following	**[14M]**

I) Radiation Shielding II) Waste Disposal III) Nuclear reactor material

SECTION-IV

7	Define the following (a) Connected load (b) load factor (c) Demand factor (d) Utilization factor	**[14M]**

OR

8-A	Define reserve factor. What is its usual value? How does it fix the maximum unit size?	**[8M]**
B	What do you mean by diversity factor?	**[6M]**

SECTION-V

9-A	Explain any one type of temperature measuring instrument.	**[8M]**
B	Explain about pollution from power plants and its control measures	**[6M]**

OR

10	Describe different methods of analysis of combustion gases.	**[14M]**

****

Code No: R17D2116 **R17**

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Regular Examinations, July/Aug 2018

Thermal and Nuclear Power Plants (TE)

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

SECTION-I

1. (a) What do you understand by ash plant handling of coal? What are the different methods of out plant handling? (7M)
   (b) Why Non Conventional sources are considered as future major power resources to Face power crisis in the world? Which of them are more prominent? and justify. (7M)

(OR)

2. (a) Classify the Dust collector . Explain with a neat sketch. (7M)
   (b) With a neat diagram explain about the Jet and Surface condenser. (7M)

SECTION-II

3. (a) Define Cogeneration. Explain with a neat sketch. (6M)
4. (b) A gas turbine power plant consists of a two stage compressor with inter cooling and single stage turbine with regenerator. Air enters the compressor at 1 bar, 20^0C. The maximum temperature of the cycle is limited to 9000C and the maximum pressure ratio is 6. The effectiveness of the regenerator is 0.7. The rate of air flow through the plant is 210 kg/s and the calorific value of the fuel used is 40.8 MJ/kg. The isentropic efficiency of the turbine is 0.92, the combustion efficiency is 0.95, the mechanical efficiency is 0.96 and the regenerator efficiency is 0.95. Take cp of air = 1.005 kJ/kg-K and g = 1.4 and for gases cp = 1.08 kJ/kg-K and g = 1.33. Assuming perfect inter cooling and neglecting pressure and heat losses, estimate

   (a) Air-fuel ratio.

   (b) Cycle efficiency.

   (c) Power supplied by the plant and

   (d) Specific fuel consumption of the plant and fuel consumption per hour. (8M)

(OR)

5. (a) Explain the following terms
   (i) Combined gas turbine and

(ii) Diesel power plant

(6M)

(b)The gas turbine has an overall pressure ratio of 5:1and a maximum cycle temperature of 550°C. The turbine drives the compressor and an electric generator, the mechanical efficiency of the drive being 97%. The ambient temperature is 20°C and the isentropic efficiencies of the compressor and turbine are 0.8 and 0.83 respectively. Calculate the power output in kilowatts for an air flow of 15kg/s. Calculate also the thermal efficiency and the work ratio. Neglect changes are kinetic energy, and the loss of pressure in combustion chamber.

(8M)

SECTION-III

6.(a) How does a nuclear fission differ from nuclear fusion? (7M)

(b) Enumerate and explain the essential components of nuclear reactor? (7M)

(OR)

6. (a) Compare the economic (cost) of nuclear power plant with steam power plant. (7M)

(b) What are the different components of a nuclear power plant? Explain the working of a nuclear power plant. What are the different fuels used in such a power plant? (7M)

SECTION-IV

7. Explain the performance and operating characteristics of power plant. (14M)

(OR)

8. (a) What is the criteria for optimum loading explain in detail? (7M)

(b) What is meant by power plant economics? What are Fixed and Operating Costs. (7M)

SECTION-V

9. (a) What is the green house gases and their effects? Explain (7M)

(b) Briefly explain the analysis of combustion gases. (7M)

(OR)

10. (a) Explain in detail about Temperature measurement and Flow measurement. With a neat sketch. (7M)

(b) What are the steps taken for reduce air pollution? (7M)

****

R18

Code No: R18DME56

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

M.Tech I Year - II Semester Regular Examinations, June-2019

Industrial Management

(MD, TE & ASP)

Roll No										

Time: 3 hours **Max. Marks: 70**

Note: This question paper Consists of 5 Sections. Answer **FIVE** Questions, Choosing ONE Question from each SECTION and each Question carries 14 marks.

****

SECTION-I

1 a) Explain various functions of management. **[7M]**

b) Explain the scope of management in an entrepreneurship and organization. **[7M]**

OR

2 a) Explain briefly the Fayol's principles of management and Mayo's Hawthorne Experiments. **[7M]**

b) Critically examine Herzberg"s two factor theory of motivation. **[7M]**

SECTION-II

3 a) What do you mean by matrix organization? How does it differ from project organization? Discuss the situations under which matrix organization can be used fruitfully. **[7M]**

b) What are the merits and demerits of boundaryless organization structure? **[7M]**

OR

4 a) What are the merits and demerits of inverted pyramid structure? **[7M]**

b) How does line and staff organization structure differ from pure line organization structure? What are the benefits and limitations of line and staff organization structure? **[7M]**

SECTION-III

5 a) A time study was made of a punch press operator. The average observed time after discounting non normal occurrences was 0.52 minute per unit. The operator performance was judged to be 90 and the allowances for this type of work total 12 percent. What is the normal time and standard time for this job? **[7M]**

b) Discuss the differences between micromotion and macromotion studies. **[7M]**

OR

6 Identify an appropriate layout for each of the following situations. Justify your choice in a sentence or two: **[14M]**

i) A manufacturer of garments for Van Heusen
ii) A multi cuisine restaurant in a posh residential area in Mumbai.
iii) The overhaul of helicopters.
iv) A fabricator of custom made PCBs for a large number of electronic applications.
v) An eye hospital.
vi) A motor manufacturer manufacturing 4 product groups for worldwide markets.
vii) A manufacturer of large turbines for power sector applications.

SECTION-IV

7 a) Differentiate between CPM and PERT. **[7M]**

b) Discuss about various costs associated with inventory. **[7M]**

OR

8 How are inventories classified? Describe them in detail. **[14M]**

SECTION-V

9 a) Enumerate the various steps involved in job evolution procedure. **[7M]**

b) What do you mean by sampling? Explain the process of double sampling. **[7M]**

OR

10 a) What do you mean by quality control? **[4M]**

b) Define control charts and their significance. What are various types of control charts and describe them in brief. **[10M]**

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MODEL PAPER 1

SUB: INDUSTRIAL MANAGEMENT

ANSWER THE FOLLOWIENG QUESTIONS, EACH QUESTION CARRIES EQUAL MARKS

1] a. Discuss committee organization, along with merits and demerits.
b. Explain matrix organization. State advantages, disadvantages and applications

[Or]

2] State and explain in detail the five levels in Maslow's need hierarchy.

3] What is the importance of plant location? Discuss in detail various factors affecting the plant location.

[or]

4] What are the types of plant layouts? Discuss any two with their merits and demerits.

5] What is ABC Analysis? Discuss in detail.

[or]

6] Explain the purchase function and its objectives. Write purchase cycle.

7] Draw the network for the following project; it is further given that project completion time is 42 days. Find the find the project duration. Also identify the critical path.

Activity	Description	Duration-days
1-2	Idea generation	7
1-3	Market survey	10
2-4	Prototype making	7
3-5	Advertising campaign	9
4-5	Distribute samples	5
4-6	Commencement of production	5
5-7	Fixing up sales outlet	7
6-7	Manufacture	14

[or]

8 Given the following data, work out the minimum duration of the project and corresponding cost.

Activity	Job	Time		Cost	
A	1-2	10	6	400	600
B	1-3	4	2	100	140
C	2-4	6	4	360	440
D	3-4	8	4	600	900
E	2-5	8	6	840	1100
F	4-6	6	2	200	300
G	5-6	10	8	1200	1400

9] (a) Explain the characteristics of Single Sampling Plain (SSP).
(b) Write a short note on control charts for variables.

[or]

10 Construct $\bar{X}$ and R Charts from the following information and state whether the process is in control. For each of the following $\bar{X}$ has been computed from a sample of 5 units drawn at an interval of half an hour from an ongoing manufacturing process.

Sample	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	20	34	45	39	26	29	13	34	37	23
R	23	39	14	5	20	17	21	11	40	10

MODEL PAPER 2

SUB: INDUSTRIAL MANAGEMENT

ANSWER THE FOLLOWIENG QUESTIONS, EACH QUESTION CARRIES EQUAL MARKS

1 Explain in detail functions of Management.

2 Or

State and explain in detail the five levels in Maslow's need hierarchy.

3 Define production. How do production is classified? Discuss differences between job production and batch production.

4 Or

Differentiate between product layout and process layout.

5 What are the objectives of inventory control and factors affecting inventory control function?

6 Or

Discuss in brief with a simple format of each

a) Purchase order
b) Invoice
c) Bin Card
d) Material Requisition Note
e) Goods Received/Returned Note

7 The following details relate to a small project with the help of which compute the probability of completion of project within scheduled time. The expected time of each activity is as follows:

Sl. No.	1	2	3	4	5	6	7	8	9
Activity	1-2	1-3	2-4	3-4	4-5	5-6	3-5	5-7	6-7
Activity	6	8	7	12	3	5	7	11	10

8 Or

A manufacturing company is planning to introduce a new product commercially. The list of activities to be carried out with the corresponding duration of time in weeks is listed below.

Activity	description	duration	immediate predecessor
A	initial discussions	3	-
B	product design	11	A
C	market survey	9	A
D	market evaluation	2	C
E	product costing	5	B
F	Sales plan	6	C
G	Product pricing	2	D,E
H	Prototype construction	11	F,G
I	Market information preparation	8	B
J	Prototype testing	9	H,I

Draw the network to represent various activities of the project, determine the minimum duration of the project.

9 For each of the 14 days a number of magnets used in electric relays are inspected and the number of defectives is recorded. The total number of magnets tested is 14,000. The following are the particulars of number of defectives found every day.

Day Number	Number of defectives
1	100
2	50
3	150
4	200
5	150
6	50

7	80
8	120
9	60
10	140
11	50
12	70
13	40
14	140

Or

10 What are the functions of Human Resource Management/Development? Discuss Job evaluation and brief any two types of evaluation methods.

MODEL PAPER 3

SUB: INDUSTRIAL MANAGEMENT

ANSWER THE FOLLOWIENG QUESTIONS, EACH QUESTION CARRIES EQUAL MARKS

1 State and explain Henry Fayol's principles of management. Identify any four principles which you consider as very significant.

Or

2 Explain Mc-Gregor's Theory-X and Theory-Y.

3 What are the objectives and benefits of work study?

Or

4 What is method study? Discuss outline of method study presenting stages involved in method study.

5 What is ABC Analysis? Discuss in detail.

6 Or

Discuss in brief with a simple format of each

f) Purchase order
g) Invoice
h) Bin Card
i) Material Requisition Note
j) Goods Received/Returned Note

7 A small project consists of the following activities with the given time estimates.

	Estimated duration in month		
Project event-successor event	Optimistic time (t_o)	Most likely time (t_m)	Pessimistic time (t_p)
1-2	2	2	14
1-3	2	8	14
1-4	4	4	16
2-5	2	2	2
3-5	4	10	28
4-6	4	10	16
5-6	6	12	30

(a) Draw the network,
(b) Calculate the average expected time for each activity,
(c) Calculate the earliest expected time and latest allowable time for each event, and
(d) Determine the critical path considering project completion time of 36 months.

8 Or

With the help of the following data, draw the net work.
(a) draw the network
(b) Find project duration for the following project and
(c) Identify the critical path.

Activity	1-2	1-3	1-4	2-4	2-5	3-4	3-7	4-6	4-7	5-6	5-7
Time(months)	4	6	12	7	11	7	8	8	13	4	4

9 For each of the 14 days a number of magnets used in electric relays are inspected and the number of defectives is recorded. The total number of magnets tested is 14,000. The following are the particulars of number of defectives found every day.

Day Number	Number of defectives
1	100
2	50
3	150
4	200
5	150
6	50
7	80
8	120
9	60
10	140
11	50
12	70
13	40
14	140

Or

10 Write a note on

a) Merit rating, and different methods
b) Job Description and Job Evaluation

MODEL PAPER 4

SUB: INDUSTRIAL MANAGEMENT

ANSWER THE FOLLOWIENG QUESTIONS, EACH QUESTION CARRIES EQUAL MARKS

1 Discuss Functional organization and Line and Staff organization structure along with their merits and demerits?

2 Or

What are the principles of organization? Discuss in detail.

3 Write various symbols and their meanings used to record the process of doing job (Process chart).

4 Or

Explain in detail any two types recording techniques used in method study.

5 Write stages involved VED Analysis.

Or

6 What is Total Quality Management? Explain with reference to any standard organization structure.

7 From the activity details given below, determine the optimal project duration and optimal project cost. Indirect cost is Rs. 75 per day.

Activity	Normal		Crash	
	Time (days)	Cost in Rs.	Time(days)	Cost in Rs.
1-2	8	100	6	200
1-3	4	150	2	350
2-4	2	50	1	90
2-5	10	100	5	400
3-4	5	100	1	100
4-5	3	80	1	100

Or

8 Following data relates to a certain project.

Activity	Optimistic time (t_o)	Most likely time (t_m)	Pessimistic time (t
1-2	2	5	14
1-3	3	12	21
2-4	5	14	17
3-4	2	5	8
4-5	1	4	7
3-5	6	15	30

(a) Construct the network, (b) Find the project, (c) Identify the critical path, and (d) Find slack at each event.

9 What is OC Curve? Draw OC curve. Discuss producer's risk and consumer risk with refence to OC Curve.

Or

10 What is product life cycle? Explain various stages involved in product life cycle.

MODEL PAPER 5

SUB: INDUSTRIAL MANAGEMENT

ANSWER THE FOLLOWIENG QUESTIONS , EACH QUESTION CARRIES EQUAL MARKS

1 Discuss Herz Berg's Two factor theory of motivation.

2 Or

Discuss criticism on
a)Taylor's Scientific Management.
b)Fayol's Principles of Management.

3 What is flow process chart? Draw flow process chart for making/manufacturing a screw.

4 Or

A work sampling study on a long cycle operation records the following data:

The total time of study	= 5 days
Total Number of observations	=1000
Observation of production activity	= 725
Manually controlled elements	=250
Total acceptable units produced	=2500 pieces
Average rating index	=120%
Observation of unavoidable delay	=100

Calculate the standard time assuming 8 hrs working schedule per day without any overtime.

5 What is benchmarking? What are all the reasons for bench marking? How does a benchmarking play a role in performance of an organisation?

6 Or

What are the benefits of ISO certification to the industry and to the customer? List out ISO 9000 series.

7 Crash the following project network, if overhead charges are Rs.100/day.

Activity	Normal Time	Normal Cost	Crash Time	Crash Cost
1-2	3	350	2	400
2-3	6	1440	4	1620
2-4	9	2160	8	2220
2-5	7	1300	5	1600
3-5	8	500	7	600
4-5	5	1600	3	1770
5-6	8	450	7	750

Or

8 For the following data related to a project, draw the network diagram. Determine the Critical Path and expected project completion time.

Task	A	B	C	D	E	F	G
Duration	10	7	5	3	2	1	14
Precedence	-	-	A	C	D	B,E	E,F

9 Construct $\bar{X}$ and R Charts from the following information and state whether the process is in control. For each of the following $\bar{X}$ has been computed from a sample of 5 units drawn at an interval of half an hour from an ongoing manufacturing process.

Sample	1	2	3	4	5	6	7	8	9	10
$\bar{X}$	20	34	45	39	26	29	13	34	37	23
R	23	39	14	5	20	17	21	11	40	10

Or

10 Discuss the following

a) Total Quality Management
b) Quality Circle

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