ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES:: RAJAMPET

(AN AUTONOMOUS INSTITUTION)

www.aitsrajampet.ac.in

DEPARTMENT OF MECHANICAL ENGINEERING

ACADEMIC REGULATIONS (R15)

AND

COURSE STRUCTURE & SYLLABI

For the students admitted to

B. Tech., Regular Four Year Degree Programme in CBCS from the Academic Year 2015-16

and

B. Tech., Lateral Entry Scheme from the Academic Year 2016-17

B. Tech., MECHANICAL ENGINEERING

VISION AND MISSION OF THE INSTITUTION

Vision

We impart futuristic technical education and instill high patterns of discipline through our dedicated staff who set global standards, making our students technologically superior and ethically strong, who in turn shall improve the quality of life of the human race.

Mission

Our mission is to educate students from the local and rural areas, and from other states so that they become enlightened individuals, improving the living standards of their families, industry and society. We provide individual attention, world-class quality of Technical education and take care of character building.

VISION AND MISSION OF THE DEPARTMENT

Vision

We envision the department as one of the best in the region with a stimulating environment to make an impact on, and lead in the field through its education and research.

Mission

The mission of the Department is to provide an excellent and comprehensive education in the field of Mechanical engineering which in turn mould students for a wide range of careers and to exhibit a high level of professionalism, ethical behavior and exercise social responsibility.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The B. Tech., Mechanical Engineering graduates will be able to:

PEO 1. Work productively as Mechanical engineers, including supportive and leadership roles on multi- disciplinary teams.

PEO 2. Meet the needs of Indian and Multinational companies to synthesize data and technical concepts for application in new product design.

PEO 3. Communicate effectively, recognize, and incorporate societal needs and constraints in their professional endeavors along with professional ethics in their professional practice.

PEO 4. Engage in continuous learning, such as graduate study to remain current in their profession and be leaders in the technological society.

PROGRAMME OUTCOMES (POs)

A graduate of Mechanical Engineering will have an ability to:

PO1 Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long learning: Recognize the need for, and have the preparation and abilityto engage in independent and life-long learning in the broadest context of technological change.

Correlation levels 1, 2 and 3 as defined below

1. Slightly(Low)
2. 2. Moderate (Medium)
3. 3. Substantial (High)

No correlation, put "-"

Index

ACADEMIC REGULATIONS

B. Tech, Four Year Degree Programme with CBCS
(For the batches admitted from the academic year 2015-16)
and
B. Tech. Lateral Entry Scheme
(For the batches admitted from the academic year 2016-17)

The following rules and regulations will be applicable for the batches of Four year B.Tech. degree admitted from the academic year 2015-16 onwards.

1. ADMISSION:

1.1 Admission into First year of Four year B. Tech. Degree programme of study in Engineering:

As per the existing stipulations of Andhra Pradesh State Council of Higher Education (APSCHE), Government of Andhra Pradesh, admissions are made into the first year of four year B. Tech. Degree programme as per the following pattern.

a) Category-A seats will be filled by the Convener, AP-EAMCET.

b) Category-B seats will be filled by the Management as per the norms stipulated by Govt. of Andhra Pradesh.

1.2 Admission into the Second Year of Four year B.Tech. Degree programme(lateral entry).

As per the existing stipulations of Andhra Pradesh State Council of Higher Education (APSCHE), Government of Andhra Pradesh. Seats will be filled by the Convener, AP-ECET.

2. PROGRAMMES OF STUDY OFFERED BY AITS LEADING TO THE AWARD OF B.TECH DEGREE:

Following are the four year Under Graduate Degree Programmes of study offered in various disciplines at Annamacharya Institute of Technology and Sciences, Rajampet leading to the award of B.Tech. (Bachelor of Technology) Degree:

1. B.Tech. (Computer Science and Engineering)
2. B.Tech. (Electrical and Electronics Engineering)
3. B.Tech. (Electronics and Communication Engineering)
4. B.Tech. (Information Technology)
5. B.Tech. (Mechanical Engineering)
6. B.Tech. (Civil Engineering)

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

3. ACADEMIC YEAR:

The entire course of study is of four academic years and each year will have **TWO** Semesters (Total **EIGHT** Semesters). The minimum instruction days for each semester shall be 90.

4. COURSE STRUCTURE:

Each programme of study shall consist of:

4.1 General Courses comprising of the following:(5 to 10%)

a) Language / Communication Skills
b) Humanities and Social Sciences : Environmental Science
c) Economics and Accounting
d) Principles of Management

4.2 Basic Science Courses comprising of the following: (15 to 20%)

a) Computer Literacy with Numerical Analysis
b) Mathematics
c) Physics
d) Chemistry

4.3 Basic Engineering Courses comprising of the following (depending on the branch):(15 to 20%)

a) Engineering Drawing
b) Engineering and IT Workshop
c) Engineering Mechanics
d) Basic Mechanical Engineering
e) Electrical and Electronics Engineering
f) Basic Civil Engineering
g) Computer Programming

4.4 Compulsory Discipline Courses:(30 to 40%)

The lists of professional subjects are chosen as per the suggestions of the experts, to impart broad based knowledge needed in the concerned branch of study.

4.5 Professional subjects - Electives: (10 to 15%)

Electives will be offered to the students to diversify the spectrum of knowledge, based on the interest of the student to broaden his individual skill and knowledge.

4.6 Open Electives: (5 to 10%)

Open subjects will be offered from other technical and / or emerging subject areas

4.7 Project Work, Seminar and /or Internship:(10-15%)

Project Work, Seminar and /or Internship in industry or elsewhere.

4.8 Mandatory Courses:

Environmental Studies, Technical English and Technical Communication & Soft Skills are included as subjects under mandatory courses but with credit weightage.

4.9 There shall be a subject like comprehensive Mechanical Engineering with 2 hours per week introduced in final year first semester.

4.10 Every programme of study shall be designed to have 42-44 theory courses and 19- 22 laboratory/seminar/comprehensive courses.

4.11 Every programme has included foundation courses to the extent of 30%, programme core and programme elective subjects to the extent of 60%,open electives and mandatory courses to the tune of 10% approximately of the total credits.

4.12 Audit Courses(to be included in III B.Tech. I Sem& II Sem):

Interested students who want to supplement their knowledge can opt for audit courses namely Professional Ethics/Stress Management & Advanced English Communication laboratory and can appear/Pass in Continuous Internal Evaluation and Semester End Examination of these courses,will be included in marks memo only when they pass.

4.13 Open Elective:

IV Year I Semester student has to necessarily select a subject from the list of open electives.

4.14 Contact Hours: Depending on the complexity and volume of the course, the number of contact hours per week will be assigned.

5. CREDIT SYSTEM:

Credits are assigned based on the following norms.

	Semester Pattern	
	Period(s) / Week	Credit(s)
Theory	01	01
Practical	03	02
ComprehensiveCourse	02	02
Seminar	–	02
Final Year Project	12	08

6. EXAMINATION SYSTEM: All components in any programme of study will be evaluated continuously through internal evaluation and an external evaluation component conducted as semester-end examination.

6.1 Distribution of Marks:

S. No.	Description	Marks	Examination and Evaluation	Scheme of Evaluation
1	Theory	70	Semester-End Examination.	The question paper shall be of subjective type with **Five**questions with internal choice to be answered in 180 Minutes duration.
		30	Mid-Examinations of 120 Minutes duration to be evaluated for 20marks. The question paper shall be of subjective type in which four questions with an internal choice are to be answered. Remaining 10 marks is for continuous evaluationwhich includesweekly/fortnightly class tests, homework assignments, problem solving, group discussions, quiz, seminar, mini-project and other means. The method of allotting these marks will be decided by the teacher dealing that subject in consultation with the Head of the Department. Teacher has to announce the evaluation method in the beginning of the semester.	**Two** MID - Examinations are to be conducted for 20 marks each in a semester. 80% weightage for better performance and 20% for other shall be considered. **MID-I:** after first spell of instructions(I & II-Units). **MID-II:** after second spell of instructions(III,IV&V-Units). The student who has missed both the Mid examinations will be permitted to appear for a substitute examination covering the total syllabus. This substitute examination will be given a weightage of 80%. This is to be conducted before the commencement of end semester exams, can be even outside the working hours, can be even two mid exams a day also.

S. No.	Description	Marks	Examination and Evaluation	Scheme of Evaluation
2	Laboratory or Drawing	70	Semester - End Lab Examination	**For laboratory courses: 180 minutes** duration – two examiners. For Drawing and /or Design: like for the theory examination.
		30	**20 Marks** for Day to Day evaluation	Performance in laboratory experiments
			10 Marks for Internal evaluation	Performance of one best out of two tests to be considered.
3	Seminar	100	**Internal Evaluation:** 20 Marks for Report 20 Marks for subject content 40 Marks for presentation 20 Marks for Question and Answers	Continuous evaluation during a semester by the Departmental Committee (DC) consisting of two/three faculty members allotted by Head of the Department.
4	Comprehensive Course	100	The marks can be allotted based on the performance in viva-voce conducted by Head of the department and two senior faculty members in the department.	
5	Project Work	100	70 Marks for External evaluation	Semester-End Project Viva-Voce Examination by Committee as detailed under 6.2
			30 Marks for Internal evaluation	Continuous evaluation by the DC 15 Marks by DC as detailed under 6.2.1 15 Marks by Supervisor

6.2 Project Work Evaluation:

6.2.1 The Internal Evaluation shall be made by the Departmental Committee, on the basis of average of two seminars presented by each student on the topic of his project, the best one to be considered. The presentations shall be evaluated by the Departmental Committee (DC) consisting of Head of the Department, supervisor and a senior faculty member.

6.2.2 The Semester-End Examination (viva-voce) shall be conducted by a Committee consisting of External examiner nominated by the Chief Controller of Examinations, HOD and Supervisor. The evaluation of project work shall be conducted at the end of the IV year II Semester.

6.3 Eligibility to appear for the Semester-End examination:

6.3.1 A student shall be eligible to appear for end examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects in the semester.

6.3.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the Institute Academic Committee if the reason for shortage is convincing.

6.3.3 Shortage of Attendance below 65% in aggregate shall in no case be condoned.

6.3.4 A stipulated fee shall be payable towards condonation of shortage of attendance to the Institute as per following slab system

1st Slab: Less than 75% attendance but equal to or greater than 70% a normal condonation fee can be collected from the student.

2nd Slab: Less than 70% but equal to or greater than 65%, double the condonation fee can be collected from the student.

6.3.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their End Examination of that class and their registration for that semester shall stand cancelled.

6.3.6 A student will not be promoted to the next semester unless he satisfies the attendance requirements of the current semester, as applicable.

6.3.7 A student detained due to shortage of attendance, will have to repeat that semester when offered next.

6.4 Revaluation / Recounting:

Students shall be permitted to request for recounting/ revaluation of the end theory examination answer scripts within a stipulated period after payment of prescribed fee.

After recounting or revaluation, records are updated with changes if any and the student will be issued a revised memorandum of marks. If there areno changes, the student shall be intimated the same through a letter or a notice.

6.5 Improvement of Marks:

Students are permitted for improvement examinations once for a maximum of four subjects after completion of the study course but before applying for provisional certificate and consolidated marks memo after payment of prescribed fee.

6.6 Readmission of Students:

A student who has satisfied the minimum attendance requirement in any semester may repeat that semester, after obtaining written permission from the Principal and cancelling the previous record of attendance and academic performance (viz ; internal evaluation and external evaluation marks) of the semester or year. This facility may be availed by any student at the maximum twice for a 4 year B.Tech., and only once by Lateral Entry student & PG student during the entire course of study.

6.7 Supplementary Examination:

a) All Regular examinations are understood as Regular/Supplementary examinations. The supplementary students have to appear for the supplementary examinations along with their regular examinations conducted at the end of each semester. However, separate supplementary examinations will be conducted for the II-Semester subjects at the end of I-Semester and vice-versa.

b) In case of Seminars and Comprehensive Viva-Voce examinations, supplementary seminar / comprehensive Viva-Voce will be conducted along with the next batch of students if available. If the next batch of students is not available, a separate supplementary examination will be conducted.

6.8 Internship Programme:

The weightage of two credits given for an internship of three weeks duration and more, when a student undergoes internship / industrial training from the Specified Industries / Research Organizations / Universities. In such a case, the student has to submit a report on that internship which will be evaluated by a team of three faculty members (decided by the HOD) of the department for those two credits. Student is given a chance to drop one seminar in place of a successful internship / industrial training.

6.9 Massive Open Online Course (MOOC):

MOOC is one of the courses introduced in IV year II semester. The list of subjects under MOOC will be intimated before commencement of class work.

7. ACADEMIC REQUIREMENTS FOR PROMOTION/ COMPLETION OF B.TECH PROGRAMME OF STUDY:

The following academic requirements have to be satisfied in addition to the attendance requirements for promotion/ completion of B.Tech.Programme of study.

7.1 For students admitted into B.Tech. (Four Year) programme:

7.1.1 A student shall be deemed to have satisfied the minimum academic requirements for each theory, practical, drawing subject if he secures not less than 35% of marks in the End Examination and a minimum of 40% of marks in the sum total of the Internal Evaluation and End Examination taken together.

7.1.2 For promotion from I B.Tech.to II B.Tech.a student must satisfy the attendance requirements in I year (two semesters).

7.1.3 A Student shall be promoted from II year to III year, if he fulfills the academic requirements of securing a minimum of **50** credits from I year I and II-Semesters, II year I and II-Semesters examinations conducted till that time.

7.1.4 A student shall be promoted from III year to IV year if he / she fulfill the academic requirements of securing a minimum of **74** credits from I year I and II-Semesters, II year I and II-Semesters and the III year I and II- Semester examinations conducted till that time.

7.1.5 A student shall register for all the subjects and earn all the**195**credits. Marks obtained in all the credits shall be considered for the calculation of the class based on CCPA.

7.1.6 A student who fails to earn all the **195** credits as indicated in the course structure within **Eight**academic years from the year of admission shall forfeit his seat in B.Tech.Programme and his admission stands cancelled.

7.2 For Lateral Entry Students (batches admitted from 2016-2017):

7.2.1 Academic requirements for pass in a subject are the same as in 7.1.1 and attendance requirements as in 6.3.

7.2.2 A student shall be promoted from II year to III year if he fulfills the academic requirements of securing a minimum of **22** credits from II year I and II-Semesters examinations conducted till that time.

7.2.3 A student shall be promoted from III year to IV year if he fulfills the academic requirements of securing a minimum of **46** credits from II year I and II-Semesters and the III year I and II-Semester examinations conducted till that time.

7.2.4 A student shall register for all the subjects and earn all **139** credits. Marks obtained in all such credits shall be considered for the calculation of the class based on CCPA.

7.2.5 A student who fails to earn all the **139** credits as indicated in the course structure within **six** academic years from the year of his admission shall forfeit his seat in B.Tech.Programme and his admission stands cancelled.

8. TRANSITORY REGULATIONS:

Students who got detained for want of attendance (or) who have not fulfilled academic requirements (or) who have failed after having undergone the course

in earlier regulations (or) have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work for the next batch or later batches with the same (or) equivalent subjects as and when subjects are offered and they continue to be in the academic regulations of the batch he is joining later.

9. CREDIT POINT AVERAGE (CPA) AND CUMULATIVE CREDIT POINT AVERAGE (CCPA):

9.1 For a Semester:

Credit Point Average [CPA] $= \frac{1}{10} \frac{\sum_i C_i T_i}{\sum_i C_i}$

Where C_i= Credits earned for Course i in any semester,

T_i= Total marks obtained for course i in any semester.

9.2 For the entire programme:

Cumulative Credit Point Average [CCPA] $= \frac{1}{10} \frac{\sum_n \sum_i C_{ni} T_{ni}}{\sum_n \sum_i C_{ni}}$

Where *n*= the semester in which such courses were credited

9.3 Overall Performance:

CCPA	Classification of final result
7.0 & above	First class with distinction
6.0 & above but below 7.0	First class
5.0 & above but below 6.0	Second class
4.0 & above but below 5.0	Pass

10. TRANSCRIPTS:

After successful completion of the entire programme of study, a transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued, if required, after payment of requisite fee. Partial transcript will also be issued up to any point of study to a student on request.

11. ELIGIBILITY:

A student shall be eligible for the award of B.Tech. Degree if he fulfills all the following conditions:

(i) Registered and successfully completed all the components prescribed in the programme of study to which he is admitted.

(ii) Successfully acquired all **195/139 credits** as specified in the curriculum corresponding to the branch of study within the stipulated time.

(iii) No disciplinary action is pending against him.

12. AWARD OF B.TECH DEGREE:

12.1 A student is permitted to select one of the extracurricular / extension activities like NSS / Sports / Games / Cultural activities. A certificate in one of these activities is a must for the student to become eligible for the award of Provisional Certificate or Degree.

12.2 The B.Tech. Degree will be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Ananthapuramu on the recommendations of the Principal of Annamacharya Institute of Technology and Sciences, Rajampet.

13. AMENDMENTS TO REGULATIONS:

The chairman, Academic Council of Annamacharya Institute of Technology and Sciences, Rajampet reserves the right to revise, amend, or change the Regulations, Scheme of Examinations, and / or Syllabi or any other policy relevant to the needs of the society or industrial requirements etc., without prior notice.

14. Any legal issues are to be resolved in Rajampet Jurisdiction.

15. GENERAL:

Where the words "he", "him", "his", "himself" occur in the regulations, there include "she", "her", "herself".

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CURRICULUM STRUCTURE

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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DEPARTMENT OF MECHANICAL ENGINEERING

Regulations :**R15** Programme Code: **G5**

I Year B. Tech., I Semester

Subject Code	Subject Name	Hours / Week			C
		L	T	P	
5GC11	English through Literature	2	1	0	2
5GC12	Engineering Chemistry	4	1	0	4
5GC14	Engineering Mathematics-I	3	1	0	3
5G111	Problem solving techniques and introduction to C Programming	3	1	0	3
5G511	Engineering Mechanics - Statics	3	1	0	3
5G512	Engineering Graphics –I	2	--	6	5
5GC16	ELCS Lab-I	--	--	3	2
5GC17	Engineering Chemistry Lab	--	--	3	2
5G113	Problem solving through C Lab	--	--	3	2
5G514	Engineering workshop	--	--	3	2
	Total	**17**	**5**	**18**	**28**

I Year B. Tech., II Semester

Subject Code	Subject Name	Hours / Week			C
		L	T	P	
5GC21	Technical English	2	1	0	2
5GC23	Engineering Physics	4	1	0	4
5GC24	Engineering Mathematics-II	3	1	0	3
5G121	C programming and Data Structures	3	1	0	3
5G521	Engineering Mechanics - Dynamics	3	1	0	3
5G522	Engineering Graphics –II	2	--	6	5
5GC26	ELCS Lab-II	--	--	3	2
5GC28	Engineering Physics Lab	--	--	3	2
5G123	Programming in C and Data structures Lab	--	--	3	2
5G124	IT Workshop	--	--	3	2
	Total	**17**	**5**	**18**	**28**

Note: L - Lecture; T-Tutorial; P – Practical; C – Credits

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Regulations :**R15** Programme Code: **G5**

II Year B. Tech., I Semester

Subject Code	Subject Name	Hours / Week			C
		L	T	P	
5GC31	Engineering Mathematics -III	3	1	0	3
5G531	Mechanics of Solids	3	1	0	3
5G532	Metallurgy & Material Science	3	1	0	3
5G533	Basic Thermodynamics	3	1	0	3
5G534	Manufacturing Technology	3	1	0	3
5G535	Machine Drawing[#]	2	--	6	3
5GC35	Aptitude And Reasoning Skills	2	--	0	2
5G536	Manufacturing Technology Lab	0	--	3/2	2
5G537	Material Science Lab and Mechanics of Solids Lab[*]	0	--	3/2	2
	Sports & Extension Activities	--	--	1	0
	Total	**19**	**05**	**7/4**	**24**

NOTE:

[*]The Students will attend the Material Science lab and Mechanics of Solids lab in alternate week that is 3/2 per week.

[#]The End exam for Machine Drawing will be for 4 hrs in the following format.

All questions are to be answered

Q1: Questions set on section I & II of the syllabus 2 out of 3 or 2 out of 4 to be answered with a weightage of 4 marks each – 08 marks

Q2: Questions set on Section II of the syllabus 2 out of 3 to be answered with a weightage of 10 marks each – 20 marks

Q3: Drawing of assembled views of Section III items of Syllabus with a weightage of 42 marks. Note that, all answers should be on the drawing sheet only. Answers on the drawing sheet only will be valued.

II Year B. Tech., II Semester

Subject Code	Subject Name	Hours / Week			C
		L	T	P	
5GC42	Probability and Statistics	3	1	0	3
5GC43	Environmental Science	3	1	0	3
5G245	Electrical and Electronics Engineering	3	1	0	3
5G541	Applied Thermodynamics - I	3	1	0	3
5G542	Fluid Mechanics and Hydraulic Machinery	3	1	0	3
5G543	Kinematics of Machinery	3	1	0	3
5G249	Electrical and Electronics Engineering lab*	0	--	3	2
5G544	Fluid Mechanics and Hydraulic Machines Lab	0	--	3	2
5G545	Seminar – I	0	--	2	2
	Total	**18**	**06**	**08**	**24**

Note: L - Lecture; T-Tutorial; P – Practical; C – Credits

* The Students will attend the Electrical Engineering lab and Electronics Engineering lab in alternate week that is 3/2 per week.

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Regulations :**R15** Programme Code: **G5**

III Year B. Tech., I Semester

Subject Code	Subject Name	Hours / Week			C
		L	T	P	
5GA51	Managerial Economics and Financial Analysis	3	1	0	3
5G551	Applied Thermodynamics - II	3	1	0	3
5G552	Dynamics of Machinery	3	1	0	3
5G553	Machine Tools	3	1	0	3
5G554	Design of Machine Elements-I	3	1	0	3
5G555	Heat Transfer	3	1	0	3
5GC52	English For Competitive Examinations	2	--	0	2
5G556	Heat Transfer Lab	0	--	3	2
5G557	Thermal Engineering Lab	0	--	3	2
AUDIT COURSE	Professional Ethics / Stress Management	2	--	--	0
	Total	**22**	**06**	**06**	**24**

III Year B. Tech., II Semester

Subject Code	Subject Name	Hours / Week			C
		L	T	P	
5G561	Instrumentation and control systems	3	1	0	3
5G562	CAD/CAM	3	1	0	3
5G563	Metrology and Surface Engineering	3	1	0	3
5G564	Applied Thermodynamics-III	3	1	0	3
5G565	Design of Machine Elements-II	3	1	0	3
5G566	Industrial Management	3	--	0	3
5G567	Metrology Lab and Machine Tools Lab	0	--	3/2	2
5G568	Machine dynamics lab	0	--	3	2
5G569	Seminar – II	0	--	2	2
AUDIT COURSE	Advanced English Communications skills Laboratory	--	--	3	0
	Total	**18**	**05**	**11/2**	**24**

Note: L - Lecture; T-Tutorial; P – Practical; C – Credits

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Regulations :**R15** Programme Code: **G5**

IV Year B. Tech., I Semester

Subject Code	Subject Name	Hours / Week			C
		L	T	P	
5G571	Operations Research	3	1	0	3
5G572	Automobile Engineering	3	1	0	3
5G573	Finite Element Methods	3	1	0	3
	Open Elective	3	1	0	3
PROFESSIONAL ELECTIVE –I		3	1	0	3
5G574	Tribology				
5G575	Advanced Manufacturing Systems				
5G576	Automation and Robotics				
PROFESSIONALELECTIVE –II		3	1	0	3
5G577	Un conventional Machining process				
5G578	Gas turbines and jet propulsion				
5G579	Rapid Prototyping				
5G57A	Instrumentation lab and optimization lab with MATLAB software	0	--	3	2
5G57B	CAD/CAM Lab	0	--	3	2
5G57C	Comprehensive Mechanical Engineering	0	--	3	2
	Total	**18**	**06**	**9**	**24**

LIST OF OPEN ELECTIVE SUBJECTS		**Offered By Department of**
5G679	Disaster Management	CE
5G27C	System Modelling and Simulation	EEE
5G57D	Total Quality Management	ME
5G57E	Integrated Product Development	ME
5G377	Nano Technology and Applications	ECE
5G378	Medical Instrumentation	ECE
5G178	.NET Technologies	CSE
5G47B	Cyber Laws	IT
5GA71	Intellectual Property Rights	DBA
5GA72	Human Resource Management	DBA

IV Year B. Tech., II Semester

Subject Code	Subject Name	Hours / Week			C
		L	T	P	
PROFESSIONALELECTIVE III		3	1	0	3
5G581	Turbo-machinery				
5G582	Computational Fluid Dynamics				
5G583	Non-Conventional sources of Energy				
PROFESSIONALELECTIVE IV		3	1	0	3
5G584	Power plant engineering				
5G585	Production and operations management				
5G586	Supply Chain Management				
5G587	Seminar – III	0	--	2	2
5G588	Project Work			8	8
	MOOCs				3
	Total	**6**	**2**	**10**	**19**

Note: L - Lecture; T-Tutorial; P – Practical; C – Credits

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	2	**1**	**0**

Course Code : **5GC11**
Course Name : **ENGLISH THROUGH LITERATURE**
Course prerequisites : NIL
Course Objectives:

- To improve the language proficiency of the students in English through literature.
- To enhance the vocabulary of the students in English through the use of diverse authentic materials.
- To enable the students absorb the human values expressed in literature.

Expected Outcomes:

1. Students will be able to read, interpret, and evaluate select literary works.
2. Students will be able to identify literary, cultural, and philosophical sensitivity.
3. Students will learn about great engineers and scientists.
4. Students will relish the experience of reading challenging literature: appreciate literature's ability to elicit feeling, cultivate the imagination and teach English language.
5. Students will be able to read complex texts actively; recognize key passages; raise questions; appreciate complexity and ambiguity; comprehend the literal and figurative uses of language.

Unit I

Detailed Study: *Cabuliwallah* by Rabindranath Tagore; *The Road not Taken* by Robert Frost

Non-detailed Study: G. D. Naidu

Unit II

Detailed Study: *A Dog's Tale* by Mark Twain*; If* by Rudyard Kipling

Non-detailed Study: Sudha Murthy

Unit III

Detailed Study: *The Gift of Magi* by O. Henry; *Leisure* by W. H. Davies

Non-detailed Study: Vijay Bhatkar

Unit IV

Detailed Study: *An Astrologer's Day* by R. K. Narayan: *Night of the Scorpion* by Nissim Ezekiel*;*

Non-detailed Study: Jagadish Chandra Bose

Unit V

Detailed Study: *The Proposal* by Anton Chekhov

Non-detailed Study: Homi Jehangir Baba

TextBooks:

1. For Detailed study: Texts from Open Sources (Available on Web)
2. For Non-detailed study: *Trailblazers* published by Orient Black Swan

- Texts from open sources are included in the syllabus to make the teaching-learning process more interesting and inspiring. Also, the literary texts from open sources will allow the student learn language through literature. The book for the non-detailed study allows the student to have an insight into the lives and careers of some legendary personalities.
- The text for non-detailed study is meant for extensive reading by the students. They may be encouraged to read some select topics on their own, which could lead into a classroom discussion. In addition to the exercises from the texts done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements etc.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	3	-	2
CO2	-	-	-	-	-	-	-	2	-	2	-	3
CO3	-	-	-	-	-	3	-	2	-	2	-	2
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	4	**1**	**0**

Course Code : **5GC12**
Course Name : **ENGINEERING CHEMISTRY**
Course prerequisites : NIL.
Course Objectives :

- The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications.
- The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.
- The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example.
- After the completion of the course, the student would understand about the concepts of chemistry in respect of Electrochemical cells, fuel cells, mechanism of corrosion and factors to influence, polymers with their applications, analytical methods, engineering materials and water chemistry.

Expected Outcomes :

1. Students will be able to understand the basic concepts of water analysis methods which helps them in solving problems related to boiler troubles and also in various water treatment methods
2. Students will be able to understand the basic principles of batteries & fuel cells, and extends the knowledge to different types of sensors, corrosion and their prevention methods
3. Students will be able to synthesize and differentiate different types of polymers
4. Students will be able to derive/ manufacture different types of fuels and elucidate their properties
5. Students will be able to manufacture cement, understand the basic concepts of propellants, refractoriness, lubricants and elucidate their properties.

Unit I

WATER TREATMENT : Impurities in water, Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity and chlorides in water, Water treatment for domestic purpose Disinfection-Definition, Kinds of disinfectants (Bleaching powder, Ozone, chloramine, UV light and Chlorine), Break point chlorination.

Industrial Use of water: For steam generation, Boiler troubles: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion.

Treatment of Boiler Feed water: Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate conditioning. External Treatment: Permutit/ Zeolite process, Ion-Exchange process, Desalination of brackish water by Reverse Osmosis.

Unit II

ELECTROCHEMISTRY: Electrochemical cells: Basic concepts, classification of electrochemical cells, numerical calculations, Batteries: classification of batteries: Primary (Leclanche battery, mercury battery) and Secondary /rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries) Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen)

Electrochemical sensors: Potentiometric Sensors and voltammetric sensors. Examples: analysis of Glucose and urea.

Corrosion: Definition & Types (dry & wet Corrosions), Electrochemical Theory of corrosion, concentration cell corrosion, galvanic corrosion, factors affecting the corrosion, Prevention: Anodic and Cathodic protection, Electroplating (Nickel, copper and chromium) & Electrolessplating

Unit III

POLYMERS: Introduction to polymers, Polymerization process- types (without mechanism),Plastics: Thermosetting and Thermoplastics, Preparation, properties and Engineering applications of PVC, Bakelite, nylons.

Natural Rubber: Processing, vulcanization and compounding of rubber. Elastomers: Preparation, properties and engineering applications of Buna-S, Buna-N and polyurethane rubbers.

Conducting polymers: Mechanism, synthesis and applications of polyacetylene, polyaniline. Biodegradable polymers Carbohydrates, proteins

Inorganic Polymers: Basic Introduction Silicones, polyphosphazines.

Unit IV

FUEL TECHNOLOGY: Classification of Fuels – Characteristics of Fuels-Calorific Value – Units, its determination using bomb calorimeter, Numerical Problems. Solid Fuels-Coke: Manufacture of Metallurgical Coke by Otto Hoffmann's by product oven processes.

Liquid Fuels: Petroleum: Refining of Petroleum, Gasoline: Knocking, Octane Number, Synthetic Petrol: Bergius Processes, Fischer Tropsch's synthesis. Diesel and Cetane number. Power Alcohol: Manufacture, Advantages and Disadvantages of Power Alcohol

Gaseous Fuels: Origin, Production and uses of Natural gas, Producer gas, Water gas, Coal gas and Biogas. Flue Gas analysis by Orsat's apparatus, Solving of problems on Combustion.

Unit V

CHEMISTRY OF ENGINEERING MATERIALS

Cement: Composition & manufacture of Portland cement, Setting and Hardening (Hydration and Hydrolysis), Refractories: Classification with suitable examples, properties and applications

Lubricants: Definition andproperties of lubricants, theory of lubrication, and applications of lubricants.

Rocket Propellants: Classification, Characteristics of a good propellant

Text Books:

1. Engineering Chemistry by K.N.Jayaveera, G.V.Subba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, New Delhi, Fourth Edition, 2012.
2. A Text Book of Enigneering Chemistry, Jain and Jain, DhanapathRai Publishing Company, New Delhi, 15th Edition, 2010.

Reference Books:

1. A Text book of Engineering Chemistry by S.S Dhara, S.S.Umare, S. Chand Publications, New Delhi, 12th Edition, 2010.
2. Engineering Chemistry by K.B.ChandraSekhar, UN.Das and Sujatha Mishra, SCITECH, Publications India Pvt Limited, Chennai, 2nd Edition, 2012.
3. Concepts of Engineering Chemistry- Ashima Srivastava and N.N. Janhavi, Acme Learning Pvt Ltd, First Edition, 2013.
4. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.AgarwalandAndra Naidu, BS Publications, Hyderabad, 3rd Edition, 2008.

5. Text Book of Engineering Chemistry, Shashichawla, DhanapathRai Publications, New Delhi, 4th Edition, 2011.
6. Engineering Chemistry, K. SeshaMaheswaramma and MrudulaChugh, Pearson Education, First Edition, 2013.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-	-	-	-
CO5	2	-	-	3	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5GC14**
Course Name : **ENGINEERING MATHEMATICS – I**
Course prerequisites : NIL.
Course Objectives :

- To understand the Differential equations of first, second and higher orders with their applications.
- To understand the concept of partial differentiation and its applications.
- To understand the concept of curve tracing in various forms

Expected Outcomes :

1. Students will be able to solve first order differential equations and their applications.
2. Students will learn the usage of higher order differential equations that are applied to real world problems
3. Students will be able to apply his knowledge to solve the problems on Mean value theorems, series and sequences in day to day life.
4. Students will exhibit an ability to identify, formulates, and solves the problems on functions of several variables
5. Students develop an ability to trace the curve for a given equation of a curve & its nature

Unit I

Linear and Bernoulli equations.Applications to Newton's law of cooling, law of natural growth and decay, Chemical reaction and solutions, orthogonal trajectories.

Unit II

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, sin*ax*/cos*ax*, polynomials in x, e^{ax}V(x), xV(x), method of variation of parameters. Applications to oscillatory electrical circuits.

Unit III

Rolle's Theorem – Lagrange's Mean Value Theorem (without proof).Simple examples of Taylor's and Maclaurin's Series.

Infinite series – Comparison test, Integral test, Ratio test, Cauchy's root test– Alternating series: Leibnitz rule (Without proof).

Unit IV

Functions of several variables – Partial differentiation- Chain rule-Jacobian – Maxima and Minima of functions of two variables, Lagrangian method of Multipliers with three variables only.

Unit V

Curve tracing – Tracing of Cartesian, polar and parametric curves.

Text Books:

Higher Engineering Mathematics, B.S.Grewal, Khanna publishers-43rd Edition (2014)

Reference Books:

1. Higher Engineering Mathematics, by Kreyszing
2. A Text Book of Engineering Mathematics, B.V. Ramana, Tata McGraw Hill.
3. A Text Book of Engineering Mathematics, Vol – 1, T.K.V. Iyengar, B. Krishna Gandhi and others, S.Chand& Company.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	-	-	-	-	-	-	-	-	3
CO2	3	-	2	-	-	-	-	-	-	-	-	2
CO3	3	3	-	-	-	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	-	-	-	-	-	-	-	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G111**

Course Name : **PROBLEM SOLVING TECHNIQUES AND INTRODUCTION TO C PROGRAMMING**

Course prerequisites : NIL

Course Objectives :

- To remember the basic concepts of problem solving aspect, algorithms, flowcharts and SDLC.
- To understand the structure of a C language program.
- To apply C program statements, Two-way selection, Multi-way selection, Loop control statements and other related statements.
- To apply Arrays and Strings for solving different problems.
- To analyze recursive and non-recursive functions.

Expected Outcomes :

1. To define the basic concepts of problem solving aspect, algorithms, flowcharts and SDLC.
2. To explain the structure of a C program.
3. To implement C program statements, Two-way selection, Multi-way selection, Loop control statements and other related statements.
4. To use two dimensional, Multidimensional arrays and Strings in C programs.
5. To differentiate recursive and non-recursive functions in different applications of C programs.

Unit– I

Introduction to Computer Problem Solving: Introduction to Computer Systems, Computer Environments, Computer Languages, Introduction to Problem Solving Aspect, Top- down Design, Implementation of Algorithms, Flow Charts, SDLC.

Unit– II

Introduction to C Language: Structure of a C Language program, Creating and Running C programs, Keywords, Identifiers, Data Types, typedef, enumerated Types variables, constants, input/output. Operators and Expressions, precedence and associatively, Type Conversions, Bitwise Operators. Example programs for each topic.

Unit– III

C Program Statements, Selection and Decision making Statements-two way selection – if…else statements, multi way selection-switch statements. Loop Control Statements-concept

of a loop, Loops in C-while loop, do…while loop, for loop, Other Related Statements -break, continue, goto. Example programs for each topic.

Unit– IV

ARRAYS: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Multidimensional Arrays.

Strings: String Basics, String Library Functions, Array of Strings. Example programs for each topic.

Unit– V

Functions: Library Functions in C, User defined Functions,-declaration, definition, calling of function, types of User defined functions, Parameter passing methods-pass by value, pass by reference, Scope, Storage Classes - Auto, Register, Static, Extern, Scope rules, Type Qualifiers, Recursion - Recursive Functions, Preprocessor Commands. Using Array Elements as Function Arguments. Example programs for each topic.

Text Books:

1. C Programming and Data Structures.B.AForouzan,R. F.Gilberg,Cengage learning, Indian edition.
2. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
3. C and Data Structures, E.Balaguruswamy, Tata McGraw Hill.
4. How to Solve it By Computer, R.G.Dromey,PHI.

Reference Books:

1. C and Data Structures, A snapshot oriented treatise with live engineering examples, Dr. N.B.Venkateswarlu, Dr. E.V.Prasad, S. Chand.
2. LET US C, YeswanthKanitkar, Ninth Edition, BPB Publication.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	-	2	-	-	-	-	-	-	3
CO2	-	-	2	3	-	-	-	-	2	-	2	-
CO3	2	-	3	2	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	2	-	-	2
CO5	-	2	3	-	-	-	-	-	-	-	3	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G511**
Course Name : **ENGINEERING MECHANICS-STATICS**
Course prerequisites : Engineering Mathematics, Physics.
Course Objectives :

- This course will serve as a basic course by introducing the concepts of basic mechanics which will help as a foundation to various courses.
- Develop an understanding of the principles of statics and the ability to analyze problems in a systematic and logical manner, including the ability to draw free-body diagrams. Ability to analyze the statics of trusses, frames and machines.

Expected Outcomes : Student will be able to:

1. Use the concepts of force, moment and its application.
2. Construct free-body diagrams and to calculate the reactions necessary to ensure static equilibrium.
3. Get knowledge of internal forces and moments in members.
4. Learn concept of friction and applications.
5. Drawing free body diagrams. Solution to problems using graphical methods and law of triangle of forces.
6. Find centroid and centre of gravity of simple and composite bodies.
7. Find moment of inertia including transfer methods and their applications

Unit I

INTRODUCTION TO ENGINEERING MECHANICS: Basic concepts - System of forces–Resultant of a force system, Moment of forces and its Application & Couples, Spatial Forces-Components in space, Resultant Equilibrium of system forces, free body diagrams.

Unit II

TYPES OF SUPPORTS: Support reactions for beams with different types of loading – concentrated, uniformly distributed load, uniformly varying loading and couple.

ANALYSIS OF FRAMES (ANALYTICAL METHOD): Types of Frames – Assumptions for forces in members of a perfect frame. Method of Joints, Method of Sections, Cantilever trusses and Simply supported trusses.

Unit III

FRICTION: Types of friction– Static and Dynamic Frictions, laws of Friction–Limiting friction and impending motions–Cone of limiting friction– Motion of bodies – Wedge friction – Ladder friction.

Unit IV

CENTROID AND CENTER OF GRAVITY: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies –Theorem of Pappu's and Guldinus Centre of Gravity of Composite figures. (Simple problems only).

Unit V

MOMENT OF INERTIA: Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures,

MASS MOMENT OF INERTIA: Moment of Inertia of Simple solids, Moment of Inertia of composite masses. (Simple problems only)

Text Books:

1. Engineering Mechanics-Statics and Dynamics, A.Nelson, Tata McGraw-Hill Company.
2. Engineering Mechanics, R.K Bansal - Laxmi Publications
3. Singer's Engineering Mechanics, B. Vijay kumarreddy – B.S. Publishers.
4. Engineering Mechanics, Bhavikatti and Rajasekharappa

Reference Books:

1. Engineering Mechanics by Timoshenko & young, Tata McGraw-Hill Company
2. Engineering Mechanics – B. Bhathacharya- Oxford University Publications
3. Engineering Mechanics –Arthur P. Boresi and Richard J. Schmidt. – Brooks/Cole – Cengage Learning
4. Engineering Mechanics-Statics & Dynamics—Johnson & Beer

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-	-
CO7	3	-	-	-	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip tests.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	2	**0**	**6**

Course Code : **5G511**
Course Name : **ENGINEERING GRAPHICS - I**
Course prerequisites : Knowledge of basic math concepts
Course Objectives :

- Learn to sketch and take dimensions.
- Learn basic engineering drawing formats.
- To increase an ability to communicate with people.
- To prepare the student for future Engineering positions.

Expected Outcomes : Student will be able to

1. Understands the concepts of Conic Sections.
2. Understands the concept of Cycloidal Curves, Involutes and the application of industry standards.
3. Students are capable to understand the Orthographic Projections of Points and Lines and are able to improve their visualization skills so that they can apply these skills in developing the new products.
4. Students are capable to understand and apply Orthographic Projections of Planes wherever necessary
5. Understands and becomes efficient in applying the concept of Auxiliary Projections of Points, Lines and Planes in industrial applications

UNIT – I

INTRODUCTION: Lettering – Geometrical constructions - Curves used in Engineering Practice: Conic Sections– General method only.

Special methods: Ellipse – Oblong method, Arcs of circle method, Concentric circles methods - Rectangle method and Tangent method for Parabola - Rectangular Hyperbola.

UNIT – II

CYCLOIDAL CURVES: Cycloid, Epicycloid and Hypocycloid (treatment of simple problems)

Involutes – Square, Pentagon, Hexagon and Circle.

UNIT – III

PROJECTIONS OF POINTS AND LINES: Projections of Points and Projections of Lines-inclined to one reference plane - inclined to both reference planes, finding the True lengths - Traces.

UNIT – IV

PROJECTIONS OF PLANES: Projections of regular Plane surfaces inclined to one reference plane and both reference planes.

UNIT – V

AUXILIARY PLANES: Projection of lines and planes using auxiliary planes

Text Books:

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers
2. Engineering Drawing, K.L. Narayana, P. Kanniah, Scitech Pub.

References:

1. Engineering Drawing and Graphics, Venugopal/ New age.
2. Engineering Drawing, Johle, Tata McGraw-Hill
3. Engineering Drawing, Shah and Rana, 2/e, Pearson Education.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	3	2	-	1	2	-	-
CO2	3	-	-	-	-	3	2	-	1	2	-	-
CO3	3	2	-	-	-	3	2	-	1	2	-	-
CO4	3	2	-	-	-	3	2	-	1	2	-	-
CO5	3	2	-	-	-	3	2	-	1	2	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation like drawing the corresponding sketches on drawing charts

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5GC16**
Course Name : **ENGLISH LANGUAGE COMMUNICATION SKILLS LAB - I**
Course prerequisites : NIL
Course Objectives :

- To train students to use language effectively in everyday conversations
- To expose the students to a varied blend of self-instructional, learner-friendly modes of language learning
- To enable the students learn better pronunciation through emphasis on individual speech sounds

Expected Outcomes :

1. Students will learn about the significance of accent and intonation and will attempt to neutralize their accent
2. Students will be able to express themselves fluently in social and professional contexts
3. Students will be able to converse over phone confidently and clearly in English
4. The student will be able to describe people, objects and situations using adjectives

The following course content is prescribed for the **English Language Laboratory** sessions:

1. **Introduction to the Sounds of English- Vowels, Diphthongs & Consonants**
2. **Situational Dialogues and Role-play**
3. **Telephone Skills**
4. **Describing Objects / Situation / People**

Manual cum Record, prepared by the Faculty Members of English of the college will be used by Students.

Minimum Requirement:

The English Language Lab shall have two parts:

- **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
- **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V. an LCD projector, a digital stereo –audio & video system and camcorder etc.

Suggested Software:

Sky Pronunciation Suite

Connected Speech from Clarity

Clarity Pronunciation Power – Part I

Mastering English in Vocabulary, Grammar, Spellings, Composition

English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

Language in Use, Foundation Books Pvt Ltd with CD

Learning to Speak English - 4 CDs

Cambridge Advanced Learners' English Dictionary with CD.

Murphy's English Grammar, Cambridge with CD

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	3	-	3
CO2	-	-	-	-	-	-	-	-	3	3	-	3
CO3	-	-	-	-	-	-	-	-	3	3	-	3
CO4	-	-	-	-	-	-	-	-	1	3	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5GC17**
Course Name : **ENGINEERING CHEMISTRY LAB**
Course prerequisites : NIL
Course Objectives :

- The student will learn practical understanding of the redox reaction.
- The student will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications.
- The student will also learn the hygiene aspects of water would be in a position to design methods to produce potable water using modern technology.

Expected Outcomes :

1. Students will understand the concept of redox systems
2. Students will exhibit skills to handle the analytical methods with confidence
3. Students will be able to acquire the operating principles and the reaction mechanisms of the instruments
4. Students will be able apply his knowledge on the basic principles of batteries

LIST OF EXPERIMENTS:

Any 10 of the following experiments has to be performed

VOLUMETRIC ANALYSIS

Redox titrations

1. Estimation of iron (II) using Diphenylamine indicator (Dichrometry – Internal indicator method)
2. Estimation of Chloride ion using potassium Chromite indicator (Mohr's method)

Water analysis

3. Determination of total hardness of water by EDTA method
4. Estimation of Dissolved Oxygen by Winkler's method
5. Determination of acidity of Water

6. Determination of Alkalinity of Water.

Complexometry

7. Determination of Copper by EDTA method

Iodometry

8. Determination of Copper by Iodometry

INSTRUMENTATION

Colorimetry

9. Estimation of Iron in Cement by Colorimetry.

Conductometry

10. Conductometric titration of strong acid Vs strong base (Neutralization titration)

Fuel analysis

11. Determination of Calorific Value of fuel by using Bomb Calorimeter

Lubricants

12. Determination of Viscosity of oils using Redwood Viscometer I
13. Determination of Viscosity of oils using Redwood Viscometer II

PREPARATION OF POLYMERS

14. Preparation of bakelite
15. Preparation of Thiokol rubber

Manual cum Record: Prepared by the Faculty Members of Engineering Chemistry of the college will be used by Students.

Equipment Required:

- ✓ Analytical weighing balance
- ✓ Digital Conductometer
- ✓ Photo-colorimeter
- ✓ Bomb calorimeter
- ✓ Redwood viscometers
- ✓ Deionizer plant
- ✓ Digital electronic balance

Glassware Required: Pipettes, burettes, conical flasks, standard flasks, beakers, reagent bottles, spatulas, wash bottles, BOD Bottles, measuring cylinders, glass rods, Bunsen burners, funnels, thermometers etc.

Chemicals Required:EDTA, Hypo, Mohr Salt Solution, HCl, Sulphuric Acid, Copper Solution, Iron Solution, Potassium Dichromate Solution, Potassium Iodide

Solution, Buffer Solution, diphenyl amine, EBT indicator, NaOH solution, Benzoic acid Urea, distilled water etc.

References:

1. Vogel's Text book of Quantitative Chemical Analysis, J. Mendham et al, Pearson Education, Sixth Edition, 2012.
2. Chemistry Practical – Lab Manual by K.B.ChandraSekhar, G.V. Subba Reddy and K.N.Jayaveera, SM Publications, Hyderabad, 3rd Edition, 2012.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	2	2	-	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	-
CO3	3	-	-	2	-	-	-	-	-	-	-	-
CO4	2	-	-	2	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G113**
Course Name : **PROBLEM SOLVING THROUGH C LAB**
Course prerequisites : NIL
Course Objectives :

- To learn simple mathematical programs in C.
- To understand different arithmetic operators, Expressions and type conversions.
- To apply the syntax of Two-way selection, Multi-way selection and other related statements in C programs.
- To analyze string handling functions and arrays of strings in sorting the names of students.
- To differentiate the user defined functions, recursive and non-recursive functions in C programs.

Expected Outcomes : The students will be able:

1. To understand programs with simple data types, variables, constants and I/O statements in C.
2. To recognize and write programs on different arithmetic operators, Expressions and type conversions in C.
3. To find greatest number among different numbers using C programs.
4. To sort different names in alphabetical order with string handling functions and array of strings.
5. To discriminate user define functions, recursive and non-recursive functions in C programs.

LIST OF EXPERIMENTS

Recommended Systems/Software Requirements:

Intel based desktop PC with ANSI C/ TURBO C Compiler and Supporting Editors

Exercise l:

Minimum of 4 programs on Data types, Variables, Constants and Input and Output.

Exercise 2:

Minimum of 4 programs on each Operator, Expressions and Type Conversions.

Exercise 3:
Minimum of 4 programs on Conditional Statements [two way and multipath].

Exercise 4:
Minimum of 4 programs on each Loop Control Statements[for, while and do-While]

Exercise 5:
Minimum of 4 programs on Unconditioned JUMP Statements- break, continue, Goto.

Exercise 6:
Minimum of 4 programs on Declaring Arrays, Referencing Arrays, Array Subscripts. Using for loop for sequential Access.

Exercise 7:
Minimum of 4 programs on Multidimensional Arrays.

Exercise 8:
Minimum of 4 programs on String Basics, String Library Functions and Array of Strings.

Exercise 9:
Minimum of 4 programs on simple user defined functions, Parameter passing methods- pass by value, pass by reference.

Exercise 10:
Minimum of 4 programs on Storage classes- Auto, Register, Static and Extern

Exercise 11:
Minimum of 4 programs on Recursive Functions, Preprocessor commands.

Exercise 12: Minimum of 4 programs on using Array Elements as Function Arguments.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	-	2	-	-	-	-	-	-	3
CO2	-	-	2	3	-	-	-	-	2	-	2	-
CO3	2	-	3	2	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	2	-	-	2
CO5	-	2	3	-	-	-	-	-	-	-	3	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. I Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G514**
Course Name : **ENGINEERING WORKSHOP**
Course prerequisites : NIL
Course Objectives :

- To understand the usage of tools in manufacturing of components in the trades of Fitting, carpentry, Foundry, Tin smithy, welding.
- To identify the tools and use basic electrical engineering knowledge for house wiring practice.

Expected Outcomes :

1. An ability to identify and apply suitable tools for manufacturing of components in workshop trades of Fitting, Carpentry, Foundry, Tin smithy, Welding.
2. An ability to identify and use hand tools for electrical wiring and give power supply to domestic installations.

LIST OF EXPERIMENTS

1. TRADES FOR EXERCISES:

a. **Carpentry shop**– Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, cross lap joint, mortise and tenon T joint, Bridle T joint from out of 300 x 40 x 25 mm soft wood stock

b. **Fitting shop**– Two joints (exercises) from: square joint, V joint, half round joint or dove tail joint out of 100 x 50 x 5 mm M.S. stock.

c. **Sheet metal shop**– Two jobs (exercises) from: Tray, cylinder, hopper or funnel from out of 22 or 20 guage G.I. sheet.

d. **House-wiring**– Two jobs (exercises) from: wiring for ceiling rose and two lamps (bulbs) with independent switch controls with or without looping, wiring for stair case lamp, wiring for a water pump with single phase starter.

e. **Foundry–**Preparation of two moulds (exercises): for a single pattern and a double pattern.

f. **Welding** – Preparation of two welds (exercises): single V butt joint, lap joint, double V butt joint or T fillet joint

2. TRADES FOR DEMONSTRATION:

a. Plumbing

b. Machine Shop

c. Metal Cutting

Apart from the above the shop rooms should display charts, layouts, figures, circuits, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, Plastics, steels, meters, gauges, equipment, CD or DVD displays, First aid, shop safety etc. (though they may not be used for the exercises but they give valuable information to the student). In the class work or in the examination knowledge of all shop practices may be stressed upon rather than skill acquired in making the job.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3		1	-	1	-	-	-	-	-	-	1
CO2	2	-	1		1	-	-	-		-		1

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	2	**1**	**0**

Course Code : **5GC21**
Course Name : **TECHNICAL ENGLISH**
Course prerequisites : NIL.
Course Objectives :

- To improve the language proficiency of the students in English with an emphasis on LSRW skills
- To equip the students with comprehension skills to study academic subjects with greater facility.
- To develop English communication skills of the students in formal and informal situations

Expected Outcomes :

1. Students will increase his vocabulary through the study of word parts, use of context clues, idiomatic expressions, and practice with a dictionary
2. Students will exhibit their ability to read, comprehend, organize, and retain written information
3. Students will practice the unique qualities of technical writing style, such as sentence conciseness, clarity, accuracy, avoiding ambiguity, using direct order organization, readability, coherence and transitional devices
4. Students exhibit effective writing skills and create effective documents in technical communication such as letters, reports and emails
5. Students will understand the factors that influence the use of grammar and vocabulary in speech and writing

Unit I

Sure Outcomes: Technology with a Human Face

Grammar: Kinds of Verbs and their Use; Writing: Official Letters; Vocabulary: Synonyms and Antonyms, Prefixes and Suffixes, Idioms and Phrases

Unit II

Sure Outcomes: Climatic Change and Human Strategy

Grammar: Tenses; Writing: Letters of Application; Vocabulary: One-word Substitutes

Unit III

Sure Outcomes: Emerging Technologies: Solar Energy in Spain

Grammar: Types of Sentences: Simple, Compound and Complex; Declarative, Interrogative, Imperative and Exclamatory; Writing: E-mails; Vocabulary: Commonly Confused Words

Unit IV

Sure Outcomes: Water: The Elixir of Life

Grammar: Subject-Verb Agreement; Writing: Official Reports, Technical Reports; Vocabulary: English Spelling, Commonly misspelt words

Unit V

Sure Outcomes: The Secret of Work

Grammar: Active and Passive Voice; Writing: Note-making; Vocabulary: Connotations

Text Books:

Sure Outcomes published by Orient Black Swan (with CD)

- The book prescribed serves as students' handbook. The reader comprises essays which are particularly relevant to engineering students.
- The teacher should focus on developing LSRW skills of students while using the prescribed text and exercises. The classes should be interactive. The students should be encouraged to participate in the classroom proceedings and also to write short paragraphs and essays. The main aim is to encourage two-way communication in place of one-sided lecture.

Reference Books:

1. Essential Grammar in Use, (with CD), Raymond Murphy, 3/e, Cambridge University Press, 2009
2. Basic Communication Skills for Technology, Andrea J Ruthurford, Pearson Education, Asia.
3. English for Technical Communication, AyshaViswamohan, Tata Mc-Graw Hill
4. English Grammar and Composition, David Grene, Mc Millan India Ltd.
5. Murphy’s English Grammar, Raymond Murphy, CAMBRIDGE
6. Everyday Dialogues in English by Robert J. Dixson, Prentice-Hall of India Ltd., 2006.
7. Communication Skills for Technical Students, Farhathullah, T.M., Orient Blackswan, 2008
8. Developing Communication Skills, 2/e. by Krishna Mohan &MeeraBanerji , Macmillan, 2009

9. English for Technical Communication, Vol. 1 & 2, by K. R. Lakshmi Narayanan, Sci tech. Publications.
10. Longman Dictionary of Contemporary English with DVD, Pearson Longman

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	3	-	3
CO2	-	-	-	-	-	-	-	-	1	3	-	3
CO3	-	-	-	-	-	-	-	-	2	3	-	3
CO4	-	-	-	-	-	-	-	-	1	3	-	3
CO5	-	-	-	-	-	-	-	-	1	3	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	4	**1**	**0**

Course Code : **5GC23**
Course Name : **ENGINEERING PHYSICS**
Course prerequisites : NIL.
Course Objectives :

- The mission of the Engineering Physics course is to prepare students for careers in engineering where physics principles can be applied to the advancement of technology.
- The Engineering Physics course educates the principles of optical science and engineering necessary to understand optical systems.
- The Crystallography, X-ray diffraction of crystals and crystal defects explains how basic structure modulate properties of materials.
- The principles of quantum mechanics and electron theory of metals gives an idea on basic development of energy in metals.
- The main objective of this course is to provide basic understanding of different engineering materials (semiconductors, magnetic, superconducting and nano materials).

Expected Outcomes :

1. Students gain knowledge about basic concepts of optics, fiber optics, and lasers
2. Students will be able to identify different types of crystal structures that occur in materials and understand production and application of acoustics
3. Students exhibits knowledge of the roots and founding principles of Quantum Mechanics and band theory of solids.
4. Students develop an understanding of the basic principles underlying the magnetic and semiconductor
5. Students becomes familiar with the general physics of superconducting materials and nanomaterials

UNIT I

PHYSICAL OPTICS, LASERS AND FIBRE OPTICS:

Physical Optics: Introduction - Interference in thin films by reflection – Newton's Rings – Fraunhofer diffraction due to single slit, double slit and diffraction grating.

Lasers: Introduction - Characteristics of laser – Spontaneous and stimulated emission of radiation – Einstein's coefficients - Population inversion – Ruby laser - He-Ne laser – Semiconductor laser - Applications of lasers. Holography: Construction and Re-Construction of hologram - Applications

***Fiber optics*:** Introduction– Construction and working principle of optical fiber – Numerical Aperture and acceptance angle – Types of optical fibers – Optical fiber communication system – Applications of optical fibers in communications, sensors and medicine.

UNIT II

CRYSTALLOGRAPHY AND ULTRASONICS:

Crystallography: Introduction – Space lattice –Unit cell – Lattice parameters – Bravias lattice –Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Inter planar spacing in cubic crystals – X-ray diffraction - Bragg's law – Powder method– Defects in solids: point defects and types.

***Ultrasonics*:**Introduction – Properties – Production of ultrasonics by piezoelectric method and detection – Applications in non-destructive testing.

UNIT III

QUANTUM MECHANICS AND FREE ELECTRON THEORY:

Quantum Mechanics: Introduction to matter waves – de-Broglie's hypothesis - Heisenberg's uncertainty principle - Schrodinger's time independent wave equation – Significance of wave function - Particle in a one dimensional infinite potential well.

Free electron theory: Classical free electron theory –- Sources of electrical resistance – Equation for electrical conductivity - Quantum free electron theory – Fermi-Dirac distribution – Kronig - Penny model (qualitative) – Origin of bands in solids – Classification of solids into conductors, semiconductors and insulators.

UNIT IV

SEMICONDUCTORS AND MAGNETIC MATERIALS:

Semiconductors: Introduction – Intrinsic and extrinsic semiconductors – Drift & diffusion currents and Einstein's equation – Hall Effect - Direct and indirect band gap semiconductors – Working principle of p-n junction diode, LED and photodiode.

Magnetic materials: Introduction and basic definitions – Origin of magnetic moments – Bohr magneton – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials – Hysteresis - Soft and hard magnetic materials and applications.

UNIT V

SUPERCONDUCTIVITY AND NANOMATERIALS:

Superconductivity: Introduction –Properties of superconductors - Meissner effect – Type I and type II superconductors – Flux quantization – London penetration depth – BCS theory (qualitative) –ac and dc Josephson effects- Applications of superconductors.

***Nanomaterials*:** Introduction - Significance of nanoscale –Basic principles of nano materials (Surface area and quantum confinement) – Physical properties: optical, thermal, mechanical and magnetic properties –Synthesis of nanomaterials: ball mill, chemical vapor deposition, sol-gel, plasma arcing methods – Carbon nanotubes (CNT) and properties – Applications of nanomaterials.

Text Books:

1. Engineering physics –K.Thyagarajan, MacGraw Hill Publishers,2013.
2. Engineering Physics – S. ManiNaidu, Pearson Education, I Edition, 2012.
3. Engineering physics –P.K.palanisamy,scietech publisher,Edition,2013.

Reference Books:

1. Engineering Physics – RV.S.S.N. Ravi Kumar and N.V. Siva Krishna, Maruthi Publications , 2013
2. Engineering Physics – D.K.Battacharya and A.Bhaskaran,OxfordHeigher Education I Edi 2010.
4. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning, I Edition, 2012.
5. Engineering Physics – D.K.Bhattacharya and A.Bhaskaran, Oxford University press.
6. Engineering Physics – M. Arumugam, Anuradha Publications II Edition, 1997.
7. Engineering physics – M.N. Avadhanulu and P.G. KrshiSagar, Chand and Co, Revised Edi 2013.

8. Solid State Physics – A.J. Dekkar, McMillan Publishers, Latest edition, 2012.
9. Engineering Physics – Gaur and Gupta Dhanapati, RaiPublishers , 7th Edition, 1992.
10. Text book of Nanoscience and Nanotechnology: B S Murthy, P.Shankar, Baldev Raj B B Rath, James Murday, University Press, I Edition, 2012.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	3	-	-	-	-	-	-	-	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5GC24**
Course Name : **ENGINEERING MATHEMATICS – II**
Course prerequisites : **ENGINEERING MATHEMATICS – I**
Course Objectives : The course aims to provide the student with the ability

- To apply this knowledge to evaluate the multiple integrals in real life situations.
- To apply the knowledge of Laplace transforms and vector calculus for engineering problems

Expected Outcomes :

1. Students will understand the applications of Multiple Integration
2. Students will exhibit the knowledge of Laplace transforms
3. Students will be able to apply Ordinary Differential equations with giveninitial and boundary conditions in engineering subjects
4. Students will be able to analyze the Vector differentiation and Integration in various domains
5. Student understands the applications of Vector Integral theorems.

Unit I

Multiple integral: –Double integral – Evaluation - Change of Variables - Change of order of integration- Area and volumes using double integral. Triple integral - Evaluation.

Unit II

Laplace transform of standard functions – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Second shifting theorem– Laplace transform of Periodic functions – Inverse Laplace transform – Convolution theorem.

Unit III

Application of Laplace transforms to ordinary differential equations of first and second order.

Unit IV

Vector Calculus: Scalar and vector point functions, Gradient and its geometrical interpretation, Divergence –physical interpretation of divergence, Curl -physical interpretation of curl, Del applied twice to point functions, Line integral - Area, Surface and volume integrals.

Unit V

Vector integral theorems: Green's theorem – Stoke's theorem and Gauss's Divergence Theorem (without proofs) and their applications.

Text Book:

Higher Engineering Mathematics, B.S.Grewal, Khanna publishers-43rdEdition (2014)

Reference Books:

1. Higher Engineering Mathematics, by Kreyszing
2. A Text Book of Engineering Mathematics, B.V. Ramana, Tata McGraw Hill.
3. A Text Book of Engineering Mathematics, Vol – 1, T.K.V. Iyengar, B. Krishna Gandhi and others, S. Chand & Company.* Tutorial

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3
CO3	3	2	-	1	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3
CO5	3	3	-	2	-	-	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G121**
Course Name : **C PROGRAMMING AND DATA STRUCTURES**
Course prerequisites : **C Language**

Course Objectives : The students will able

- To learn the basic concepts of pointers and its applications.
- To understand the syntax of structures, unions, files and different sorting and searching techniques.
- To differentiate linear data structures such as stacks, queues, circular queues and their applications.
- To compare different linear data structures such as single linked list, double linked list, circular linked list and their applications.
- To analyze non- linear data structures such as trees, graphs and their applications.

Expected Outcomes : The students will able

1. To understand the basic concepts of pointers and how the memory will be allocated dynamically using pointers.
2. To compare the syntax of structures, unions with arrays, and to create simple text vs. binary files and different sorting and searching techniques.
3. To analyze different linear data structures such as stacks, queues, circular queues and their applications.
4. To implement appropriate linear data structures such as single linked list, double linked list, circular linked list in different applications of C programs.
5. To construct non- linear data structures such as trees, graphs.

Unit– I

Pointers - Introduction, Features of Pointers, Pointer Declaration and Definition, Void Pointers, pointers for inter function communication, Pointers to Pointers, Pointer Applications: arrays and pointers, pointer arithmetic, Dynamic Memory Allocation, Pointers to Functions, pointer to void and command line arguments.

Unit– II

Structures – Definition, initialization, accessing structures, nested structures, array of structures, structures and functions. Pointers and Structures. Unions. Sample programs

Files: Introduction to Streams and Files, Standard library input / output functions, formatted input / output functions, character input/output functions; Text verses binary Streams, Standard library functions for files. File examples.

Searching and Sorting - Exchange (Bubble) Sort, Selection Sort, Quick Sort, Insertion Sort, Merge Sort, Searching- Linear and Binary Search Methods.

Unit– III

Data Structures: Overview of Data Structure. **Stack:** Representation of a Stack, Operation on a Stack, Implementation of a Stack using Arrays and Pointers, Representation of Arithmetic Expressions, Infix, Prefix, and Postfix Notations, Evaluation of Postfix Expression, Recursion.

Queues: Representation of Queue, Insertion, Deletion, Searching Operations, Circular Queues.

Unit– IV

Linked List: Singly Linked List, Linked List with and without header, Insertion, Deletion and Searching Operations.

Doubly Linked List: Insertion, Deletion and Searching Operations.

Circular Linked List: Insertion, Deletion and Searching Operations.

Unit– V

Trees: Introduction to Trees, Binary Trees, creation of binary tree, Operations on Binary Tree. Introduction to Binary Search Tree, Operations on Binary Search Trees.

Graphs: Defining graph, basic terminology, graph representation.

Text Books:

1. C Programming and DataStructures.B.AForouzan,R. F.Gilberg,Cengage learning, Indian edition.
2. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
3. Data Structures and Algorithms: Concepts, Techniques and ApplicationsG.A.V. Pai[UNIT-V]

Reference Books:

1. C and Data Structures, A snapshot oriented treatise with live engineering examples, Dr. N.B.Venkateswarlu, Dr. E.V.Prasad, S. Chand.
2. LET US C, YeswanthKanitkar, Ninth Edition, BPB Publication.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	-	2	-	-	-	-	-	-	3
CO2	-	2	-	3	-	-	-	-	2	-	2	-
CO3	2	3	3	2	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	2	-	-	2
CO5	-	-	3	-	2	-	-	-	-	-	3	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G521**
Course Name : **ENGINEERING MECHANICS-DYNAMICS**
Course prerequisites : Engineering Mathematics, Physics, Engineering Mechanics-Statics.
Course Objectives :

- This course will serve as a basic course by introducing the concepts of Basic mechanics which will help as a foundation to various courses.
- To teach the basic principles of particle and rigid body kinematics and kinetics. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems

Expected Outcomes : Student will be able to:

1. Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts).
2. Understand basic dynamics concepts – force, momentum, work and energy
3. Understand and be able to apply Newton's laws of motion.
4. Understand and be able to apply other basic dynamics concepts - D'alembert's principle, the Work-Energy principle, Impulse-Momentum principle and the coefficient of restitution.

Unit I

KINEMATICS OF PARTICLES: Introduction, motion of particle, displacement, velocity and acceleration, Rectilinear motion, Rectilinear motion Along X-axis, Uniformly Accelerated motion, motion curves, rectilinear motion along vertical Y-axis

CURVILINEAR MOTION: introduction, rectangular coordinates, projectile motion, tangential and normal components of acceleration, radial and transverse components of acceleration.

Unit II

KINEMATICS OF RIGID BODIES: Introduction, rotational motion about a fixed axis, rotational motion with constant angular acceleration, rotational motion with constant angular velocity, relationship between angular and linear motions, general plane motion.

Unit III

KINETICS OF PARTICLES: Introduction, laws of motion, mass of bodies in rectangular coordinates, motion of connected bodies, D'alembert's principle, variable acceleration, tangential and normal components of acceleration, Virtual work method.

Unit IV

WORK AND ENERGY: Introduction, work done by a force, work done by a variable force, work done in stretching a spring, power, energy, work done by internal forces, potential energy.

IMPULSE AND MOMENTUM: Introduction, impulsive force, impulse and momentum, non-impulsive force, impact of jet on plates or vanes.

Unit V

KINETICS OF RIGID BODIES: Introduction, system of particles, translational motion of a system of particles, rotational motion of system of particles, kinetic equations of motion for a rigid body, work energy method.

Text Books:

1. Engineering Mechanics-Statics and Dynamics, A.Nelson, Tata McGraw-Hill Company.
2. Engineering Mechanics, R.K Bansal - Laxmi Publications
3. Singer's Engineering Mechanics, B. Vijay kumarreddy – B.S. Publishers.
4. Engineering Mechanics, Bhavikatti and Rajasekharappa

Reference Books:

1. Engineering Mechanics by Timoshenko & young, Tata McGraw-Hill Company
2. Engineering Mechanics – B. Bhathacharya- Oxford University Publications
3. Engineering Mechanics –Arthur P. Boresi and Richard J. Schmidt. – Brooks/Cole – Cengage Learning
4. Engineering Mechanics-Statics & Dynamics—Johnson & Beer

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester

L	T	P
2	0	6

Course Code : **5G522**
Course Name : **ENGINEERING GRAPHICS - II**
Course prerequisites : Engineering Graphics - I
Course Objectives :

- To increase an ability to communicate graphically and orally with the people.
- To prepare the student for future Engineering positions.

Expected Outcomes : Student will be able to

1. Able to understand and analyze the Orthographic Projections of Solids.
2. Able to apply sectional views for industrial engineering components.
3. Students are capable to develop a sheet which meets the specifications of an object and can analyze the image of an intersected solids.
4. Can employ freehand 3D pictorial sketching to aid in the visualization process and to efficiently communicate ideas graphically.
5. Analyze a drawing and can efficiently communicate ideas graphically.

UNIT I - PROJECTIONS OF SOLIDS:

Projections of Regular Solids – Cylinder, Cone, Prism and Pyramid - inclined to one reference plane & both reference planes – Auxiliary Views.

UNIT II-SECTIONS OF SOLIDS:

Section Planes and Sectional views of Right Regular Solids–Prism, Cylinder, Pyramid and Cone. True shapes of the sections.

UNIT III- DEVELOPMENT OF SURFACES:

Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid, Cone and their Sectioned parts.

INTERPENETRATION OF RIGHT REGULAR SOLIDS:

Projections of curves of Intersection of Cylinder Vs Cylinder - Cylinder Vs square prism – Cylinder Vs Cone and Square prism Vs Square prism (Axis bisecting problems only).

UNIT – IV - ISOMETRIC PROJECTIONS / VIEWS:

Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids.

UNIT – V

CONVERSION OF VIEWS: Conversion of Isometric views to Orthographic Views and Conversion of Orthographic views to Isometric views.

Text Books:

1. Engineering Drawing, N.D. Bhatt, Charotar Publishers
2. Engineering Drawing, K.L. Narayana, P. Kanniah, Scitech Pub.

References:

1. Engineering Drawing and Graphics, Venugopal/ New age.
2. Engineering Drawing, Johle, Tata McGraw-Hill
3. Engineering Drawing, Shah and Rana, 2/e, Pearson Education

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	2	2	-	3	3	-	-	-
CO2	3	-	-	-	-	2	-	3	3	-	-	-
CO3	3	2	-	-	-	2	-	3	3	-	-	-
CO4	3	2	-	-	-	2	-	3	3	-	-	-
CO5	3	2	-	-	-	2	-	3	3	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5GC26**
Course Name : **ENGLISH LANGUAGE COMMUNICATION SKILLS LAB - II**
Course prerequisites : NIL
Course Objectives :

- To enable a learner sharpen his public speaking skills
- To expose the students to a varied blend of self-instructional, learner-friendly modes of language learning
- To enable the student learn better pronunciation through emphasis on word accent, intonation, and rhythm

Expected Outcomes :

1. Students will be able to understand the importance of intonation, word and sentence stress for improving communication competence to identify and to overcome mispronunciation
2. Students will be able to make spontaneous a speech confidently
3. Students will enhance their public speaking skills and make technical presentations
4. Students will analyze, interpret and compare data from graphs/pie charts

The following course content is prescribed for the **English Language Laboratory** sessions:

1. **Introduction to Stress and Intonation**
2. **'Just A Minute' (JAM)**
3. **Oral Presentations**
4. **Information Transfer**

Manual cum Record, prepared by the Faculty Members of English of the college will be used by Students.

Minimum Requirements:

The English Language Lab shall have two parts:

- **The Computer aided Language Lab** for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

- **The Communication Skills Lab** with movable chairs and audio-visual aids with a P.A System, a T. V. an LCD projector, a digital stereo –audio & video system and camcorder etc.

Suggested Software:

Sky Pronunciation Suite

Connected Speech from Clarity

Clarity Pronunciation Power – Part I

Language in Use, Foundation Books Pvt Ltd with CD

Learning to Speak English - 4 CDs

Cambridge Advanced Learners' English Dictionary with CD.

Murphy's English Grammar, Cambridge with CD

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	3	-	2
CO2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5GC28**
Course Name : **ENGINEERING PHYSICS LAB**
Course prerequisites : NIL
Course Objectives :

- The student will able to handle and understanding of different apparatus to perform experiments.
- The student will learn practical measurement of different physical quantities.
- The student will able to characterize the materials and their properties.
- The student allows to learn practical experience of theory conceptual values.

Expected Outcomes :

1. Students will understand the characteristics and behavior of various materials
2. Students will be able to understand the applications of optics using basic fundamentals of physics
3. Students will exhibit an ability to use techniques and skills associated with modern engineering tools such as lasers and fiber optics
4. Students will be able to measure properties of a semiconductor and magnetic materials

Any 10 of the following experiments has to be performed

1. Determination of wavelengths of various colors of mercury spectrum using diffraction grating in normal incidence method
2. Determination of dispersive power of the prism
3. Determination of thickness of thin object by wedge method
4. Determination of radius of curvature of lens by Newton's Rings
5. Laser : Diffraction due to single slit
6. Laser : Diffraction due to double slit
7. Laser: Determination of wavelength using diffraction grating
8. Determination of Numerical aperture of an optical fiber

9. Meldi's experiment: Determination of the frequency of tuning fork
10. Determination of particle size by using laser.
11. Energy gap of a material using p-n junction diode
12. Hall effect : Determination of mobility of charge carriers in semiconductor
13. B-H curve
14. Magnetic field along the axis of a current carrying coil – Stewart and Gee's method.
15. Determination of rigidity modulus –Torsional pendulum

Manual cum Record:

Prepared by Engineering Physics Faculty Members of Annamacharya Institute of Technology and Sciences.

Reference Book:

Engineering Physics Practicals – Dr. B. Srinivasa Rao V.K.V. Krishna K.S Rudramamba 2.Engineering Practical Physics – S.L Kakani& Shubra Kakani

Equipment required:

Spectrometers
Microscopes
Meldi's apparatus
Stewart-Gee's apparatus
Torsional pendulum
Light sources
Optical fiber cables

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	-	-	-	-
CO3	2	-	2	-	3	-	-	-	-	-	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G123**
Course Name : **PROGRAMMING IN C AND DATA STRUCTURES LAB**
Course prerequisites : **C Language and Data Structures**
Course Objectives : The students will able

- To learn simple programs of pointers and dynamic memory allocations in C.
- To understand the syntax of structures, unions, files and different sorting and searching techniques.
- To differentiate stacks, queues and circular queues programs using arrays and pointers.
- To compare single linked list, double linked list and circular linked list programs using arrays and pointers.
- To analyze the operations on binary tree.

Expected Outcomes : The students will able

1. To write simple programs of pointers and how memory will be allocated dynamically in C.
2. To discuss syntax of structures, unions, files and different sorting and searching techniques.
3. To apply arrays and pointers in writing C code for stacks, queues and circular queues programs
4. To distinguish single linked list, double linked list and circular linked list programs using arrays and pointers.
5. To create binary tree and display the tree traversals of binary tree.

List of Experiments:

Recommended Systems/Software Requirements:

Intel based desktop PC with ANSI C/ TURBO C Compiler and Supporting Editors

Exercise 1 : Minimum of 4 Programs on pointer basics.
Exercise 2 : Minimum of 4 Programs on Pointers applications.
Exercise 3 : Minimum of 4 programs on structures and unions
Exercise 4 : Minimum of 4 programs on basic File operations.
Exercise 5 : Minimum of 4 programs on searching and sorting techniques.

Exercise 6 : Implementation of Stack and perform all Stack operations using

i) Arrays ii) Pointers

Exercise 7 : Implementation of Queue and perform all Queue operations using

i) Arrays ii) Pointers

Exercise 8 : Implement Circular Queue (its operations) using

i) Arrays ii) Pointers

Exercise 9 : Implementation of Single Linked List and its operations using

i) Arrays ii) Pointers

Exercise 10 : Implementation of Double Linked List and its operations using

i) Arrays ii) Pointers

Exercise 11 : Implementation of Circular Linked List and its operations using

i) Arrays ii) Pointers

Exercise 12 : C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression

ii) Evaluating the postfix expression

Exercise 13 : Implement Binary Tree using Double Linked List and its operations.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	2	-	2	-	-	-	-	-	-	3
CO2	-	2	-	3	-	-	-	-	2	-	2	-
CO3	2	3	3	2	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	2	-	-	2
CO5	-	-	3	-	2	-	-	-	-	-	3	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Continuous Evaluation.
3. 10% of marks for Internal Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
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Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

I Year B. Tech. II Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G124**
Course Name : **I.T. WORKSHOP**
Course prerequisites : NIL
Course Objectives :

- To identify various parts of a computer and to learn Assembling of a Computer
- To demonstrate installation of various operating systems like windows, linux
- To learn about Networking of computers and use Internet facility for Browsing and Searching.
- To choose different anti-virus software's to enhance the system performance
- To develop Productivity tools like Word processors, Spreadsheets, Presentations

Expected Outcomes :

1. Able to identify various parts of a computer and to learn Assembling of a Computer
2. Able to explain installation of various operating systems like windows, linux
3. Able to administer about Networking of computers and use Internet facility for Browsing and Searching.
4. Able to distinguish different anti-virus software's to enhance the system performance
5. Able to develop Productivity tools like Word processors, Spreadsheets, Presentations

Preparing your Computer

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available

(eg: beeps). Students should record the process of assembling and trouble shooting a computer.

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: Operating system features: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and Internet

Task 5: Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc should be done by the student. The entire process has to be documented.

Task 6: Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, search process using different natural languages, and creating e-mail account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

Productivity tools

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

Task 9: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

Task 10: Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking,

running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

Optional Tasks:

Task 11: Laboratory Equipment: Students may submit a report on specifications of various equipment that may be used by them for the laboratories in their curriculum starting from I B.Tech to IV. B.Tech. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop computer
- Server computer
- Switch (computer science related)
- Microprocessor kit
- Micro controller kit
- Lathe machine
- Generators
- Construction material
- Air conditioner
- UPS and Inverter
- RO system
- Electrical Rectifier
- CRO
- Function Generator
- Microwave benches

Task 12: Software: Students may submit a report on specifications of various software that may be used by them for the laboratories in their curriculum starting from I B. Tech., to IV. B.Tech., The software may be proprietary software or Free and Open source software. It can vary from department to department. Students can refer to their syllabus books, consult staff members of the concerned department or refer websites. The following is a sample list. Instructors may make modifications to the list to suit the department concerned.

- Desktop operating system
- Server operating system
- Antivirus software
- MATLAB
- CAD/CAM software
- AUTOCAD

REFERENCE BOOKSS:

1. Introduction to Computers, Peter Norton, Mc Graw Hill
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.

3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs", Bigelows, TMH

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	-	3	-	-	-	-	-	-	-
CO2	-	3	-	2	-	-	-	-	-	-	-	3
CO3	-	-	-	2	3	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	2	-	3	-	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Continuous Evaluation.
3. 10% of marks for Internal Evaluation

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5GC31**

Course Name : **ENGINEERING MATHEMATICS – III**

Course prerequisites : ENGINEERING MATHEMATICS – II

Course Objectives :

- This course aims at providing the student with the concepts of Matrices, Numerical differentiation and Numerical integration, Numerical solution of ordinary differential equations, Fourier series, partial differential equations, complex variables and complex integrations which find the applications in engineering.
- Emphasis will be more on logical and problem solving development in Numerical methods and their applications.

Expected Outcomes: Student will be able to

1. Apply the knowledge of numerical methods to solve algebraic, transcendental and ordinary differential equations.
2. Improve the ability of data analysis in numerical differentiation and integration with the help of interpolation.
3. Derive the equations of various curves by the method of least squares to assess the relation between them and to solve partial differential equations.
4. Derive Fourier series for the given periodic function in any arbitrary intervals.
5. Apply the knowledge of Fourier integrals and Fourier transforms to solve differential equations.

Unit I

Rank – Echelon form Solution of Linear System of Homogenous and Non Homogeneous equations

Eigen values-Eigen vectors-properties, Cayley -Hamilton theorem-inverse and powers of a matrix by Cayley Hamilton theorem.

Unit II

Solution of algebraic and transcendental Equations-Bisection Method-Method of false position-Newton-Raphson method

Interpolation-Forward differences-Backward differences-Newton’s forward and backward difference formulae – Lagrange’s interpolation formula.

Numerical Differentiation-Numerical integration-Trapezoidal Rule-Simpson's one third Rule-Simpson's 3/8th Rule (without proofs).

Unit III

Numerical solutions of ordinary differential equations-Taylor's series-Euler's method-Picard's method- Runge-kutta fourth order method-Milne's predictor-corrector method (Without proofs).

Unit IV

Fourier Series-Determination of Fourier coefficients-Fourier series-Even and Odd functions-Fourier series in an arbitrary interval-even and odd periodic continuation- Half –range Fourier sine and cosine expansions.

Partial differential equations: Formation of partial differential equations by eliminating arbitrary constants and functions--Method of separation of variables

Unit V

Functions of complex variable –continuity-differentiability-Analyticity-Properties-Cauchy Riemann equations in Cartesian and polar co-ordinates(without proofs).Harmonic and conjugate harmonic functions-Milne-Thomson's method.

Complex integration: Cauchy's integral Theorem-Cauchy's integral Formula-Generalized integral formula (without proofs).

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, 40thEdition, Khanna Publishers, New Delhi.
2. A text book of Mathematical Methods, E. Keshava Reddy, and G. Sankara Rao, I. K. International.

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 8thEdition, New Age International (Pvt) Limited.
2. A text book of Engineering Mathematics, B. V. Ramana, Tata McGraw Hill.
3. Mathematics - II, T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
4. Mathematics - III, E. Keshav Reddy and Rukmangadachari, Pearson Education.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	3	-	-	-	-	-	-	2
CO2	3	3	-	2	-	-	-	-	-	-	-	1
CO3	3	-	-	3	2	-	-	-	-	-	-	2
CO4	3	2	-	-	-	-	-	-	-	-	-	2
CO5	3	2	-	-	2	-	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G531**

Course Name : **MECHANICS OF SOLIDS**

Course prerequisites : Engineering Mechanics, Engineering Mathematics.

Course Objectives :

- To understand the nature of stresses induced in material under different loads.
- To plot the variation of shear force and bending moments over the beams under different types of loads.
- To understand the behavior of beams subjected to shear loads.
- To understand the behavior of beams under complex loading.
- To analyze the cylindrical shells under circumferential and radial loading conditions.

Expected Outcomes : Student will be able to:

1. Determine the simple stresses and strains when members are subjected to axial loads.
2. Draw the shear force and bending moment diagrams for the beam subjected to different loading conditions.
3. Evaluate stresses induced in different cross-sectional members subjected to shear loads.
4. Evaluate the deflections in beams subjected to different loading conditions. Evaluate the shear strength of the shafts which are subjected to torsional loading conditions.
5. Analyze the columns and struts, thin and thick cylindrical shells.

Unit I

SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains– Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Mohr's circle for plane stress and plain strain (Simple problems).

Unit II

SHEAR FORCE AND BENDING MOMENT: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, UDL, uniformly varying loads and

combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Unit III

FLEXURAL STRESSES: Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis –Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T angle sections.

Unit IV

DEFLECTION OF BEAMS: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, - U.D.L uniformly varying load.

TORSION OF CIRCULAR SHAFTS: Theory of pure torsion- Derivation of torsion equations; T/J=q/r=Nθ/l – Assumptions made in the theory of pure torsion- torsional moment of resistance- polar section modulus

Unit V

THIN CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders– Thin spherical shells.

Thick cylinders–lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

COLUMNS AND STRUTS: Classification of columns – Assumptions – Expression for cripping load of different cases – effective length of a column-slenderness ratio – limitation of Euler's formula – Rankine's formula

Text Books:

1. Bhavikatti, *Strength of Materials,* Lakshmi publications.
2. B C Punmia, *Mechanics of Materials*, Lakshmi publications.

References:

1. Jindal, *Strength of Materials*. Umesh Publications.
2. Vazirani and Ratwani*, Analysis of structures*, Khanna publishers.
3. S.B.Junnarkar *, Mechanics of Structures Vol-III*, Charotar publishing house.
4. S.Timoshenko, *Strength of Materials, D Van Nostrandcompany.*

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	3	3	-	-	-	-	-
CO2	3	3	3	-	-	3	3	-	-	-	-	-
CO3	3	3	3	-	-	3	3	-	-	-	-	-
CO4	3	3	3	-	-	3	3	-	-	-	-	-
CO5	3	-	3	-	-	3	3	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G532**

Course Name : **METALLURGY AND MATERIAL SCIENCE**

Course prerequisites : Engineering Physics, Engineering chemistry.

Course Objectives :

- To gain and understand the relationship between the basic structure, properties of metals mechanism of crystallization, imperfections in crystals.
- To learn about the method of processing, heat treatment and applications of metallic, non metallic components to select suitable materials for various engineering applications.
- To learn about Ceramic and composite materials for various engineering applications
- To learn about various methods of steel making processes and its application

Expected Outcomes : Student will be able to:

1. Get knowledge on various crystal structures, types of bonds in solids, mechanism of crystallization, imperfections in crystals and methods of determining grain size.
2. Understand alloys & its necessity, solid solutions, factors affecting solid solution and the concept of intermediate alloy phases.
3. Understand the concept of equilibrium diagrams, Isomorphous alloy systems, peritectic systems, Solid state transformations etc., and will be able to construct equilibrium diagrams by experimental methods.
4. Learn the structure and properties of cast iron, steels and Non ferrous metals- Aluminum, Titanium.
5. Learn the various heat treatment processes and TTT diagrams, surface hardening methods, and cryogenic treatment of alloys.
6. Understand the importance of advanced composite materials in application to sophisticated machine and structure of components.
7. Learn the various methods of steel making processes

Unit I

STRUCTURE OF METALS: Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size.

CONSTITUTION OF ALLOYS: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

Unit II

EQUILIBRIUM OF DIAGRAMS: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni, Al-Cu and Fe-Fe_3C.

Unit III

CAST IRONS AND STEELS: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

NON-FERROUS METALS AND ALLOYS: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

Unit IV

HEAT TREATMENT OF ALLOYS: Effect of alloying elements on Iron – Iron carbon system, Annealing, normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

UnitV

CERAMIC MATERIALS: Crystalline ceramics, glasses, cermets.**Composite materials:** Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

Metallurgy: Steel Making - Introduction, Methods of steel making – crucible process, Bessemer converter process, Open Hearth Process, Electric Furnace Process.

Text books:

1. Kodgire, *Material Science and Metallurgy, 42nd edition Everest Publishing House2017.*
2. *Donald R.Askeland, Essential of Materials Science and Engineering. Thomson Publications 2014.*

References:

1. Sidney H. Avener, *Introduction to Physical Metallurgy, TMH*
2. William and collister, *Materials Science and Engineering*, *wiley pub. 2014.*
3. V. Raghavan, *Material scienceand engineering, PH Pub. 2015*.
4. R.K.Rajput, *Engineering materials and metallurgy*. *S.Chand & Co. 2006.*
5. O.P. Khanna, *Material Science and Metallurgy. Dhanpatrai Pub. 2014*

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	-	-	-	-	-	-	2
CO2	3	2	2	1	1	-	-	-	-	-	-	2
CO3	3	2	2	1	1	-	-	-	-	-	-	2
CO4	2	-	1	-	-	-	2	-	-	-	-	2
CO5	3	2	2	1	1	-	-	-	-	-	-	2
CO6	2	-	1	-	-	-	2	-	-	-	-	2
CO7	2	-	1	-	-	-	2	-	-	-	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip test.

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ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

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Department of Mechanical Engineering

R15Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G533**
Course Name : **BASIC THERMODYNAMICS**
Course prerequisites :Physics, Engineering Mathematics, Chemistry.
Course Objectives :

- To get the awareness on fundamental laws of thermodynamics.
- To enable the students to understand second law of thermodynamics and its applications to various systems.
- To make students understand about properties of pure substances and usage of mollier chart and steam tables.
- To help the students understand various gas laws and equations of state and can able to solve problems of estimating enthalpy, entropy, specific heat, internal energy and concepts of mixture of gases and also to calculate the property values during any process.
- To learn the concept of various air standard cycles with the help of P-V and T-S Diagrams.

Expected Outcomes:

1. Apply the fundamentals to the thermodynamic problems.
2. Solve the problems related to performance of thermal engineering devices by the concept of Second law of Thermodynamics.
3. Demonstrate the importance of phase change diagrams of various pure substances and calculate the performance of vapour power cycles by using Mollier charts and steam tables.
4. Differentiate the ideal and real gas behavior and can evaluate the performance of gas power cycles by demonstrating the usage of thermodynamic properties and equations of state and also solve various thermodynamic properties during mixing process of perfect gases.
5. Able to apply the second law of thermodynamics to calculate the performance of various air standard cycles and demonstrate the variation of air standard cycles.

Unit I

BASIC CONCEPTS: System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility, Quasi – static Process, Irreversible Process, Causes of

Irreversibility – Energy in State and in Transition - Types, Work and Heat, Point and Path function.

Zeroth Law of Thermodynamics –Ideal Gas Scale – PMM I - Joule's Experiments – First law of Thermodynamics – Corollaries – First law applied to a Process – applied to a flow system – Steady Flow Energy Equation.

Unit II

Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialities, Thermodynamic scale of Temperature.

Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

Unit III

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation, Constructional use of Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Unit IV

PERFECT GAS LAWS: – Equation of State, specific and Universal Gas constants – various Non-flow processes, properties, end states, Heat and Work Transfer, changes in Internal Energy – Throttling and Free Expansion Processes – Flow processes – Deviations from perfect Gas Model – Vander Waals Equation of State – Compressibility charts – variable specific Heats – Gas Tables.

MIXTURE OF PERFECT GASES: – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, specific heats and Entropy of Mixture of perfect Gases and Vapour.

Unit V

POWER CYCLES: Otto, Diesel, Dual Combustion cycles, Stirling Cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – comparison of Cycles.

Text Books:

1. *Engineering Thermodynamics*. PK Nag, TMH, 5TH Ed.2013.
2. *Basic Engineering Thermodynamics*. A. Venkatesh, Universities Press; First edition (2007).
3. Thermodynamics – An Engineering Approach. YunusCengel& Boles, TMH.Mcgraw Higher Ed Edition: 8, 2015

References:

1. *Fundamentals of Thermodynamics*. Sonntag, Borgnakke and Van wylen, John Wiley & sons (ASIA) Pt Ltd.Publisher: Wiley; 8 edition (December 26, 2012)
2. *Thermodynamics.*McGrawHill J.P.Holman,McGraw-Hill College; 4th edition (January 1, 1988)
3. *An introduction to Thermodynamics.* YVC Rao, Universities Press, 3rd edition 2004
4. *Engineering Thermodynamics*, Jones & Dugan,PHI INDIA (2011)

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	3	-	-	-	-	3
CO2	3	3	-	-	-	-	3	-	1	-	-	3
CO3	3	3	-	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3
CO5	3	2	2	-	-	1	1	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip tests.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G534**

Course Name : **MANUFACTURING TECHNOLOGY**

Course prerequisites : Metallurgy & Material Science

Course Objectives:

- By this subject the students will understand how manufacturers use technology to change raw materials into finished products. The students shall also introduce the basic concepts of casting, pattern preparation, gating system
- Students shall also introduce the basic knowledge on basic features of various welding and cutting processes.
- To study the concepts of hot working and cold working processes, rolling processes, metal forming processes, extrusion of metals, their principle of working, mechanism and their machining process, applications. And also to study the concept of forging process, tools and dies, its types, their principle of working and applications.
- Students shall also introduce the basic knowledge on plastics, classification, processing of plastics and its applications.

Expected Outcomes : Student will be able to:

1. Understand the elements of casting process, construction of patterns and gating systems, moulds, methods of moulding, and solidification of castings of various metals.
2. Understand the different types of special casting methods and their applications, design of risers and feeding systems.
3. Identify and analyze various welding and metal cutting operations.
4. Apply the knowledge of metal working process in sheet metal forming processes, drawing and rolling and analyzing the process variables.
5. Understand the primary forming processes like forging, extrusion, equipment used, and process variables.
6. Identify various plastic parts manufacturing techniques and their methods.

Unit I

CASTING: Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction, Principles of Gating, Gating ratio and design of Gating systems- defects in casting.

SOLIDIFICATION OF CASTING– Concept – Solidification of pure metal and alloys, short & long freezing range alloys, Solidification time calculations. Risers – Types, function and

design, casting design considerations, special casting processes 1) Centrifugal 2) Die 3) Investment.

Unit II

WELDING: Classification of welding process, types of welds and welded joints.Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.Inert Gas welding, TIG & MIG welding Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive and nondestructive testing of welds.

CUTTING OF METALS: Oxy – Acetylene Gas cutting, Cutting of ferrous, non-ferrous metals.

Unit III

METAL WORKING PROCESS: Hot working, cold working, strain hardening, recovery, recrystallization and grain growth, Comparison and properties of Cold and Hot worked parts, Rolling fundamentals – theory of rolling, types of Rolling mills and products. Problems on Forces in rolling and power requirements – defects in rolled products.

PRESS WORKING PROCESS: Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning.Force and Power calculations.

Unit IV

EXTRUSION OF METALS: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion.

FORGING PROCESSES: Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.

Unit V

Plastics: Classification – Properties – Plastics as engineering materials – Method of processing plastics – Injection moulding, Blowmoulding, extrusion moulding,compression moulding, transfer moulding.

Text Books:

1. P.N. Rao, *Manufacturing Technology.* TMH.
2. Kalpak Jain, *Manufacturing Technology*. Pearson education.

Reference books:

1. R.K. Jain, *Production Technology, Khanna Publishers.*
2. Lindberg, PE, *Process and materials of manufacturing*, Allyn and Bacon.
3. Rosenthal, *Principles of Metal Castings*, TMH.
4. Parmar, *Welding Process, Khanna Publishers.*

5. R.K. Rajput, *Manufacturing Technology.* Laxmi Publications.
6. Rafiq Noorani, *Rapid Prototyping Principles and Applications*. Wiley Pub.
7. V.K. Jain, *Unconventional Machining Processes*. Allied Pub.
8. K.L Narayana, *Production Technology.* I.K. International Pub.

Mapping of COs and POs:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	3	-	3	3	-	-	-	-	-
CO2	3	-	3	3	-	3	3	-	-	-	-	-
CO3	3	3	-	3	-	3	3	2	-	-	-	-
CO4	3	3	3	-	-	3	3	-	-	-	-	1
CO5	3	3	3	3	-	3	3	-	-	-	-	-
CO6	3	-	3	-	-	3	3	2	-	-	1	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	2	**-**	**6**

Course Code : **5G535**
Course Name **: MACHINE DRAWING**
Course prerequisites : Engineering Graphics, Engineering Mathematics.
Course Objectives :

- Student shall understand and draw conventional representation of material and machine elements.
- Students shall understand to draw keys, cotter joints, riveted joints and shaft couplings.
- Students shall understand to create assembly drawings from sub assembly components.
- Students shall understand to draw part drawings of the machine components.

Expected Outcomes : Student will be able to:

1. Understand the conventional representation of materials, machine parts and draw the simple machine parts. Student has an idea at International standards and will be able to convey the drawings much effective.
2. Draw the machine elements including keys, cotter joints and bearings. These drawings can be easily understood by the people in a manufacturing industry and the consumers too.
3. Draw the machine elements including riveted joints and shaft couplings. These drawings can be easily understood by the people in a manufacturing industry and the consumers too.
4. Construct assembly drawings using part drawings of machine components. So that he/she will be able to produce the final product by procuring the units from various sources/suppliers and still to produce any useful product serving effectively.
5. Draw the part drawings of the machine components.

I. DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS:

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cotter joints- socket and spigot, sleeve and cotter, gib and cotter and knuckle joint.
c) Riveted joints for plates

d) Shaft couplings- sleeve, clamp, flange and flexible, spigot and socket pipe joint.
e) Journal, pivot and collar and foot step bearings.

II.ASSEMBLY DRAWINGS:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a)Engine parts – stuffing box, cross head, Eccentric, Petrol Engine connecting rod, piston assembly.

b)Other machine parts – Screw jack, Machine Vice, Drill jig, Tailstock.

c)Valves: Steam stop valve, feed check valve and air cock.

III.PART DRAWINGS:

Plummer block, Blow- off cock, indexing drill jig, Tool post, Petrol Engine connecting rod.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Text books:

1. Dhawan, *Machine Drawing*. S.Chand Publications.
2. K.L.Narayana, P.Kannaiah & K. Venkata Reddy, *Machine Drawing*. New Age Publishers.
3. Production Drawing, K.L. Narayana, New Age International.

Reference books :

1. P.S.Gill, *Machine Drawing*, S K Kataria & Sons
2. .Luzzader, *Machine Drawing*.
3. .K.C.John, *Textbook of Machine Drawing.* PHI learning, 2009.

Mapping of COs and POs:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	-	-	-	-	3	-	-
CO2	3	-	3	-	-	-	-	-	-	3	-	-
CO3	3	-	3	-	-	-	-	-	-	3	-	-
CO4	3	-	3	-	-	-	-	-	-	3	-	-
CO5	3	-	3	-	-	-	-	-	-	3	-	-
CO6	3	-	3	-	-	-	-	-	-	3	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation by day to day performance .

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	2	**-**	**0**

Course Code : **5GC35**
Course Name **: APTITUDE AND REASONING SKILLS**
Course prerequisites : Engineering Mathematics.
Course Objectives :

- To equip students with aptitude and reasoning skills in order to help them succeed in competitive exams.
- To help students improve their knowledge of quantitative and reasoning skills, which in turn helps them comprehend and solve various mathematical problems in professional life.

Expected Outcomes : Student will be able to:

1. The student will be able to apply the knowledge of general mathematical models discussed to solve a variety of problems pertaining to Quantitative functions
2. The Student will be able to read between the lines and understand various mathematical and reasoning concepts, puzzles, charts and interpret their logic

QUANTITATIVE APTITUDE:

1. Number Systems
2. Averages
3. Problems on ages
4. Allegations
5. Percentages
6. Profit and loss
7. Simple interest and Compound interest
8. Ratio and Proposition and variation
9. Time and Work
10. Time and Distance
11. Mensuration
12. Permutation and Combinations
13. Progressions
14. Inequalities
15. Logarithms

16. HCF and LCM
17. Decimal Fractions
18. Simplification
19. Square Roots and Cube Roots
20. Pipes and Cisterns
21. Area, Volume and Surface Areas
22. Calendar, Clocks
23. True Discount, Banker's Discounts
24. Data Interpretation, Tabulation, Bar Graphs, Pie charts, Line Graphs

Reasoning:

1. Directions
2. Blood Relations
3. Problems on Cubes
4. Series and Sequences
5. Odd man out
6. Coding and Decoding
7. Data sufficiency
8. Logical deductions
9. Arrangements and Combinations
10. Groups and Teams
11. Puzzles to Puzzle you. More puzzles, Brain Teasers, Puzzles and Teasers

Text books:

1. Mittal.U, Puzzles to Puzzle you (Book-I & II).
2. Aptitude (Quantitative, Analytical, Logical), By Globarena.
3. Aptitude – Student work book, Part-I &II, By Globarena.
   Material for Soft Skills, By Globarena

Reference books :

1. Arun Sharma, How to Prepare for Quantitative Aptitude, TMH Publishers, New Delhi, 2003.
2. R.S. Agarwal, Quantitative Aptitude, S. Chand Publishers, New Delhi, 2005.
3. Sharon Weiner-Green, Irn K.Wolf, Barron's GRE, Galgotia Publications, New Delhi, 2006.
4. R.S.Agarwal, Vrebal and Non-Verbal Reasoning, S.Chand Publishers, New Delhi, 1998.
5. Shakuntala Devi, Puzzles to Puzzle you, Orient Paper Backs Publishers(OPB), New Delhi, 2005.

6. Shakuntala Devi, More Puzzles, OPB, New Delhi, 2006.
7. Ravi Narula, Brain Teasers, Jaico Publishing House, New Delhi, 2005.
8. George J Summers, Puzzles and Teasers, Jaico Publishing House, Mumbai, 2005.

Mapping of COs and POs:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	2	-	-	-	-	3	-	-	-	-	-	1

Mode of Evaluation:

1. Formative assessment is done during semester for 30 marks.
2. Summative assessment is done at end of semester for 70 marks.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	0	**-**	**3/2**

Course Code : **5G536**
Course Name : **MANUFACTURING TECHNOLOGY LAB**
Course prerequisites : Manufacturing Technology
Course Objectives :

- To gain the knowledge of making of patterns and calculation of its allowances.
- To gain the knowledge of prepare a mould cavity and casting..
- To gain the knowledge of joining of metals by welding process, and its heat affected zone on weldments
- To gain the knowledge of joining thin metals by spot welding
- To gain the knowledge of joining of metals by TIG welding and Gas welding processes.
- To gain the knowledge of making hallow parts like bottles by the blow moulding machine.
- To gain the knowledge of making plastic components by the injection moulding machine.

Expected Outcomes :

1. An ability to understand the making of patterns and calculation of its allowances.
2. An ability to prepare a mould cavity and casting.
3. An ability to understand the joining of metals by welding process, and its heat affected zone on weldments
4. An ability to understand the joining thin metals by spot welding.
5. An ability to understand the joining of metals by TIG welding and Gas welding processes.
6. An ability to understand the moulding sand properties with the help of permeability meter, universal sand strength machine.
7. An ability to understand the making of hallow parts like bottles by the blow moulding machine.
8. An ability to understand the plastic components by the injection moulding machine.
9. An ability to demonstrate different deformation processes of manufacturing.

List of Experiments:

I. METAL CASTING LAB:

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 1 Experiment.
3. Moulding Melting and Casting - 1 Experiment.

II. WELDING LAB:

1. ARC Welding Lap & Butt Joint - 2 Experiments.
2. Spot Welding - 1 Experiment.
3. TIG Welding - 1 Experiment.
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device).

III. MECHANICAL PRESS WORKING:

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations.

IV. PROCESSING OF PLASTICS

1. Injection Moulding.
2. Blow Moulding.

Note: Minimum of 10 Experiments need to be performed.

Mapping of CO's & PO's

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	-	-	-	-	3	1	-	1
CO2	3	2	1	3	2	-	-	-	3	1	-	1
CO3	3	2	1	1	2	-	-	-	3	-	-	1
CO4	3	2	1	1	2	-	-	-	3	-	-	1
CO5	3	2	1	1	2	-	-	-	3	-	-	1
CO6	3	3	1	3	1	-	-	-	3	-	-	1
CO7	3	2	1	1	2	-	-	-	3	-	-	1
CO8	3	2	1	1	2	-	-	-	3	-	-	1
CO9	3	2	1	1	2	-	-	-	3	-	-	1

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Day to Day Evaluation.
3. 10% of marks for Internal Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. I Semester	**L**	**T**	**P**
	0	**-**	**3/2**

Course Code : **5G537**
Course Name : **MATERIAL SCIENCE LAB AND MECHANICS OF SOLIDS LAB**
Course prerequisites : Material Science & Mechanics of Solids
Course Objectives :

- To gain the knowledge of microstructures of different ferrous and non ferrous alloys.
- To gain the knowledge of calculating hardness number of heat treated steels.
- To gain the knowledge of conducting experiment on jominy & quench apparatus for hardenability.
- To find the Young Modulus, torsional strength, hardness and tensile strength of given specimens.
- To find impact strength of given specimens.
- To find the compressive strength of given specimens.
- To find stiffness of springs.

Expected Outcomes : Student will be able to:

1. Know and draw the microstructure of ferrous and non ferrous alloys.
2. Calculate the hardness of treated and untreated steels.
3. Conduct experiment for hardenability.
4. Determine the simple stresses and strains when members are subjected to axial loads.
5. Draw the shear force and bending moment diagrams for the beam subjected to different loading conditions.
6. Evaluate stresses induced in different cross-sectional members subjected to shear loads.
7. Evaluate the deflections in beams subjected to different loading conditions.
8. Analyze the columns and struts, thin and thick cylindrical shells.

SECTION A: MATERIAL SCIENCE LAB:

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low carbon

steels, high carbon steels.

3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardeneability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

SECTION B: MECHANICS OF SOLIDS LAB:

1. Direct tension test
2. Bending test on
   a. Simple supported beam
   b. Cantilever beam
3. Torsion test
4. Hardness test
   a. Brinell hardness test
   b. Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	3	-	-	-	-	-	-	-	-
CO2	3	-	-	3	-	-	-	-	-	-	-	-
CO3	3	-	-	3	-	-	-	-	-	-	-	-
CO4	3	3	-	3	-	-	3	-	3	-	3	3
CO5	3	3	-	3	-	-	3	-	3	-	3	3
CO6	3	3	-	3	-	-	3	-	3	-	3	3
CO7	3	3	-	3	-	-	3	-	3	-	3	3
CO8	3	3	-	3	-	-	3	-	3	-	3	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Day to Day Evaluation.
3. 10% of marks for Internal Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5GC42**
Course Name : **PROBABILITY AND STATISTICS**
Course prerequisites : Engineering Mathematics

Course Objectives:

- To quantify the measure of uncertainty.
- To apply this knowledge to Insurance, statistics, Engineering.

Expected Outcomes: Student will be able to

1. Understand the basic concepts of probability and random variables.
2. Gain the knowledge on probability distributions.
3. Understand the concepts of sampling distributions and theory of estimation.
4. Able to test various hypothetical statements for large and small samples.
5. Provide the knowledge in testing the goodness of fit and decision-making process.

Unit I

Probability: Sample space and events – Probability – The axioms of probability – Some Elementary theorems - Conditional probability – Baye's theorem. Random variables – Discrete and continuous – Distribution functions - mean and variance.

UnitII

Binomial distribution –Poison distribution- Uniform distribution - Normal distribution.

UnitIII

Sampling distribution: Population and sample - Sampling distributions of means (σ known and unknown).Estimation: Point estimation – interval estimation - one mean –two means (large sample) and one proportion – two proportions (large sample).

UnitIV

Test of Hypothesis – Large samples: hypothesis concerning one and two means. Test of proportions (one and two).Small samples: t- test.

UnitV

F-test, $\chi 2$–Tests– goodness of fit, rxc contingency tables.

Text Books:

1. Fundamentals of Mathematical Statistics, S C Gupta and V K Kapoor, Sultan schand & sons.
2. A text book of Probability & Statistics, B. V. Ramana, Tata McGraw Hill.

Reference Books:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 8th edition, New Age International (Pvt) Limited.
2. Probability & Statistics, T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Company.
3. Probability & Statistics for Engineers, Miller and John E. Freund, Prentice Hall of India.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	-	-	-	-	-	-	3
CO2	3	2	-	2	-	-	-	-	-	-	-	3
CO3	3	3	-	2	-	-	-	-	-	-	-	3
CO4	3	3	-	2	2	-	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by conducting slip test & assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5GC43**
Course Name : **ENVIRONMENTAL SCIENCE**
Course prerequisites : NIL

Course Objectives:

- Understand & appreciate the importance of Environmental Science.
- In order to make the students environmentally educated.
- To protect the environment by preventing environmental pollution& degradation.

Expected Outcomes:

1. The student will understand the importance of environment.
2. The student develops critical thinking to conserve natural resources.
3. The student will understand the concept of ecosystem and biodiversity and its conservation.
4. The student knows about different types of pollutions, their sources, effects and control measures.
5. The student will apply the knowledge to solve the social issues and human population issues related to environment.

Unit I

Multidisciplinary nature of environmental studies - Scope & Importance of environmental studies - Need for public awareness - Global environmental crisis (over-exploitation of natural resources, decline of ecosystems, loss to biodiversity, environmental pollution, and population growth) – People in environment – Institutions in environment

Unit II

Renewable & non-renewable natural resources. Forest resources: Use – deforestation, case studies - dams & their effects on forest & tribal people Water resources: Use - floods, drought- conflicts over water. Mineral resources: Use - environmental effects of extracting mineral resources, case studies. Food resources: Impacts of over grazing, traditional agriculture and modern agriculture, Energy resources: Renewable and non – renewable energy resources

- use of alternate energy resources. Land resources: Land as a resource, land degradation, soil erosion. Role of an individual in the conservation of natural resources.

Unit III

Ecosystems:Producers, consumers & decomposers - Food chains, food webs & ecological pyramids - Energy flow in the ecosystem- Cycling of nutrients (Bio geo chemical cycles-water, oxygen, carbon, nitrogen & energy cycles) – Types and characteristic features of the following ecosystems :(a)Forest ecosystems (b) Grass land ecosystems (c) Desert ecosystems (d) Aquatic ecosystems (lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation: Definition - Values of biodiversity: consumptive value, productive value, social value, ethical value, aesthetic value & option values - Hot spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wild life - Conservation of biodiversity: In –situ & Ex-situ conservation

Unit –IV

Environmental Pollution:Definition, causes, effects & control measures of: Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Marine pollution, Nuclear hazards - Solid waste management: Causes, effects and control measures of urban wastes.

Unit V

Social Issues and the Environment:Rain water harvesting - Environmental ethics: Issues & possible solutions - Global warming - Acid rain - Ozone layer depletion – Wasteland reclamation - Environment protection Act.-Air (Prevention & Control of Pollution) Act.-Water (Prevention & Control of Pollution) Act.-Wildlife Protection Act-Forest Conservation Act.

Human Population & Environment: Population explosion – Family Welfare Program -Environment & human health - Human Rights (in relation to environment) - Value Education (environmental values) - HIV/AIDS.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, University press.
2. Environmental Studies by R. Rajagopalan Oxford University Press.

3. Perspectives In Environmental Studies by Anubha Kaushik and C.P.kaushik, New Age International Publishers.

Reference Books:

1. Comprehensive Environmental Studies by J.P.Sharma, Laxmi Publications.
2. Environmental Studies by Anindita Basak – Pearson education.
3. Environmental Studies by Benny Joseph, Mc.GrawHill Publications.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	1	3	-	-	-	-	3
CO2	1	1	-	-	-	3	3	-	-	-	-	3
CO3	1	1	-	-	-	-	3	-	-	-	-	3
CO4	2	2	-	-	-	3	3	-	-	-	-	3
CO5	3	3	-	-	-	3	3	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by conducting slip test & assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G245**
Course Name : **ELECTRICAL AND ELECTRONICS ENGINEERING**
Course prerequisites : Engineering Physics, Engineering Mathematics

Course Objectives:

- To impart the basic knowledge about the Electric circuits.
- To understand the working of various Electrical Machines.
- To know about various electronic devices.
- To understand the various parts of CRO.

Expected Outcomes: Student will be

1. Able to apply fundamental concepts to find response of electrical circuits
2. Able to identify the types of DC-Machines and their applications
3. Able to explain the principle operation of Transformer, Induction Motor.
4. Able to identify the semi-conductor devices.
5. Able to explain the types of heating and working principle of CRO.

Unit I

ELECTRICAL CIRCUITS: Basic definitions, types of elements, ohm's law, resistive, inductive, capacitive networks, series- parallel circuits, star and delta transformations, Kirchhoff's laws.

Unit II

DC MACHINES:

DC Generator: Principle of operation, emf equation, types.

DC Motor: principle of operation, torque equation, types, three point starter, losses and efficiency.

Testing: brake test, Swinburne's test, and speed control methods.

Unit III

AC MACHINES:

1-φTransformers: Principle of operation, emf equation, losses, efficiency and regulation. OC and SC tests.

Alternator: Principle of operation of alternators-Regulation by synchronous impedance method.

3-φ Induction motor: Principle of operation of induction motor-slip-torque characteristics.

Unit IV

DIODE AND TRANSISTORS:

Diode: PN junction diode, symbol, V-I characteristics, applications, Half wave, full wave and bridge rectifiers (simple problems).

Transistors: PNP and NPN junction transistors, Transistor as an amplifier, single stage CE amplifier, Frequency response of CE amplifier, concepts of feedback amplifier and necessary conditions for oscillators.

Unit V

ELECTRIC HEATING AND CRO:

Induction Heating: Theory of induction heating, applications in industries.

Dielectric heating: Theory of dielectric heating and its industrial application

CRO: Principle of CRT (cathode ray tube), Deflection sensitivity, electronic and magnetic deflection, applications of CRO, voltage, current and frequency measurements.

Text books:

1. V.K.Mehta, *Principles of Electrical and Electronics Engineering*. S.Chand&Co.
2. T.Thyagarajan, *Fundamentals of Electrical and Electronics Engineering*. SciTech publications, 2007, 5th Ed.

Reference books:

1. M.S Naidu and S.Kamakshaiah, *Introduction to Electrical Engineering.* TMH Publications.
2. Kothari and Nagrath, *Basic Electrical Engineering*, TMH, 2nd Ed.
3. Mill man and Halkias, *Electriconics devices and circuits*.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	-	-	-	-	3	-	3	-
CO2	3	3	3	3	-	-	-	-	3	-	3	-
CO3	3	3	3	3	-	-	-	-	3	-	3	-
CO4	3	3	-	3	-	-	-	-	3	-	3	-
CO5	3	3	-	3	-	-	-	-	3	-	3	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by conducting slip test & assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G541**
Course Name : **APPLIED THERMODYNAMICS-I**
Course prerequisites : Basic knowledge in Thermodynamics

Course Objectives:

- An ability to solve common engineering problems in the thermal sciences field, including problems involving application of the first and second laws of thermodynamics in the analysis of energy (availability).
- To make student aware of actual cycles and their analysis.
- An ability to understand the working and combustion phenomena of I C engines.
- An ability to solve and evaluate performance parameters of I.C engines.
- An ability to learn the concept of compressors and to solve engineering problems of compressors including: Reciprocating compressors, Rotary (positive displacement type) compressors, Axial flow compressors.

Expected Outcomes:

1. Student can able to understand the differences between the actual cycles & air standard cycles in I.C. engines and also able to understand the basic working of I.C engines & its types along with its different systems like ignition system, injection system etc.
2. Student can able to understand the complete concept of combustions in S.I. engines & C.I engines.
3. Student gets the knowledge on the various parameters of performance of the I.C. engines and various engine testing methods.
4. Student acquires knowledge on the basic working of compressors and its types.
5. Student gets the knowledge on the basic working principle along with performances of various compressors like reciprocating, centrifugal and axial flow compressors.

Unit I

ACTUAL CYCLES AND THEIR ANALYSIS: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blowdown - Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

I.C. ENGINES: Classification - Working principles, Valve and Port Timing Diagrams, Air – Standard, air-fuel and actual cycles.

Engine systems – Fuel, Simple Carburetor, Fuel Injection System – Air Injection system, Solid Injection system and Electronic Injection system. Ignition – Battery ignition system and Magneto ignition system, Cooling – Air cooling (Cooling Fins) and liquid cooling system – Thermosyphon system and Forced Circulation system and Lubrication - Importance - Mist Lubrication System, Wet sump Lubrication system and Dry sump Lubrication system.

Unit II

COMBUSTION IN S.I. ENGINES: Normal Combustion and Abnormal Combustion – Importance of flame speed and effect of engine variables – Type of Abnormal combustion, pre-ignition and knocking (explanation) – Fuel requirements and fuel rating, anti knock additives – combustion chamber – requirements, types.

COMBUSTION IN C.I. ENGINES: Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence – open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

Unit III

TESTING AND PERFORMANCE OF ENGINES: Parameters of performance - measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, Brake power – Determination of frictional losses and indicated power – Performance test – Heat balance sheet.

Unit IV

COMPRESSORS: Classification –positive displacement and roto dynamic machinery – Power producing and power absorbing machines, fan, blower and compressor

Reciprocating: Principle of operation, work required, Isothermal efficiency volumetric efficiency and effect of clearance, stage compression, under cooling, saving of work, minimum work condition for stage compression.

Rotary (Positive Displacement Type): Roots Blower, vane sealed compressor – mechanical details and principle of working – efficiency considerations.

Unit V

DYNAMIC COMPRESSORS: Centrifugal compressors: Mechanical details and principle of operation – velocity and pressure variation. Energy transfer-impeller blade shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient – velocity diagrams – power requirements.

AXIAL FLOW COMPRESSORS: Mechanical details and principle of operation – velocity triangles and energy transfer per stage degree of reaction, work done factor - isentropic efficiency- pressure rise calculations – Polytropic efficiency.

Text Books:

1. V. Ganesan, *I.C. Engines*. TMH.
2. Thermal engineering, Rathore. TMH

Reference Books:

1. Mathur & Sharma, *IC Engines*. Dhanpath Rai & Sons.
2. Pulkrabek,*Engineering fundamentals of IC Engines*. Pearson, PHI
3. Rudramoorthy, *Thermal Engineering*. TMH.
4. B. Yadav, *Thermodynamics & Heat Engines.* Central Book Depot., Allahabad.
5. Rajput, *Thermal Engineering*. Lakshmi Publications.
6. Heywood, *I.C. Engines*. McGrawHill.
7. R.S. Khurmi & J.K.Gupta, *Thermal Engineering*. S.Chand
8. B.Srinivasulu Reddy, *Thermal engineering data book*. JK International Pub.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	3	-	-	-	1	-	-
CO3	3	3	3	-	-	3	-	-	-	-	-	3
CO4	3	3	3	3	-	3	-	1	-	-	-	3
CO5	3	3	3	3	-	3	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by conducting 2 slip test & 3 assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G542**
Course Name : **FLUID MECHANICS AND HYDRAULIC MACHINERY**
Course prerequisites : Engineering Mechanics, Engineering Mathematics.
Course Objectives :

- To give insight knowledge on fluid statics and kinematics
- To gain knowledge on fluid dynamics
- To give basic understanding of Hydro Electric power plant and importance of impact of jets.
- To become familiar about different types of turbines and able to analyze the performance characteristics of various turbines.
- To be able to understand the working of power absorbing devices like pumps and able to analyze their performance characteristics.

Expected Outcomes : Student will be able to:

1. Gain the knowledge on fluid mechanics fundamentals like fluid statics and fluid kinematics
2. Have basic idea about the fundamental equations used in Fluid Dynamics and are able to apply these concepts in real working environment
3. Study the fundamentals of turbo machinery and elements of hydroelectric power plant.
4. Measure the performance of the different types of Hydraulic Turbines
5. Calculate the performance of the different types of Hydraulic Pumps.

Unit I

FLUID STATICS: Dimensions and units: physical properties of fluids- specific gravity, viscosity surface tension- vapour pressure and their influence on fluid motion- atmospheric gauge and vacuum pressure – measurement of pressure- Piezometer, U-tube and differential manometers – Buoyancy.

FLUID KINEMATICS: Stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform & non uniform, laminar & turbulent, rotational &irrotational flows. Equation of continuity for one dimensional flow.

Unit II

FLUID DYNAMICS: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its application on force on pipe bend.

CLOSED CONDUIT FLOW: Reynold'sexperiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter and orifice meter, Flow nozzle, Turbine flow meter.

Unit III

HYDROELECTRIC POWER STATIONS: Elements of hydro electric power station-types. Concept of pumped storage plants- storage requirements.

BASICS OF TURBO MACHINERY: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Unit IV

HYDRAULIC TURBINES: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube theory- functions and efficiency.

PERFORMANCE OF HYDRAULIC TURBINES: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.

Unit V

CENTRIFUGAL PUMPS: Classification, working, work done – manometric head- losses and efficiencies specific speed- pumps in series and parallel-performance - characteristic curves, NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Text Books:

1. Modi and Seth, *Hydraulics, fluid mechanics and Hydraulic machinery*, Standard Book house
2. R. K. Bansal, *Fluid Mechanics and Hydraulic Machines*.

Reference Books:

1. D.S. Kumar, *Fluid Mechanics and Fluid Power Engineering.*Kotaria& Sons.
2. D. Rama Durgaiah, *Fluid Mechanics and Machinery*. New Age International.
3. Banga& Sharma, *Hydraulic Machines.* Khanna Publishers.
4. James W. Dally, William E. Riley, *Instrumentation for Engineering Measurements*. John Wiley & Sons Inc. 2004.
5. Rajput, *Fluid Mechanics and Hydraulic Machines*.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	3	-	3	-	-	-	-	-
CO2	3	3	3	-	3	-	3	-	-	-	-	-
CO3	3	3	3	3	-	3	3	-	-	1	-	-
CO4	3	3	3	3	3	3	3	-	2	-	-	-
CO5	3	3	3	3	3	3	3	-	2	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip tests.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G543**
Course Name : **KINEMATICS OF MACHINERY**
Course prerequisites : Engineering Mechanics, Engineering Mathematics.
Course Objectives :

- To enable the students in selection of appropriate mechanisms.
- To impart the clear idea in constructing velocities & acceleration diagrams for the given mechanisms.
- To provide an overview of straight line motion mechanisms, Steering mechanism and Hooke's Joint
- To understand the kinematic analysis of gears & gear trains.
- To develop the knowledge of kinematic analysis of cams

Expected Outcomes : Student will be able to:

1. Identify different mechanisms, inversions of different kinematic chains and mobility of mechanisms.
2. Draw velocity and acceleration diagrams of simple plane mechanisms by using relative velocity method and instantaneous center method.
3. Understand the mechanism of straight line motion mechanisms, steering mechanisms and Hooke's joint.
4. Know gear terminology, types of gears, contact ratio, interference in gears and application of bevel gears in differential gear & to calculate train value for different gear trains.
5. Draw displacement diagram and cam profile for different types of motions of the follower.

Unit I

MECHANISMS: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained.

MACHINES: Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism – inversions of quadric cycle chain, single and double slider crank chains.

Unit II

VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS: Velocity and acceleration – Motion of link in machine – Determination of Velocity and Acceleration diagrams – Graphical method – Application of relative velocity method - four bar chain.

Plane motion of body: Instantaneous center of rotation - relative motion between two bodies – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links

Analysis of Mechanisms: Analysis of single slider crank chain for displacement, velocity and acceleration of slider – Acceleration diagram for simple mechanism - Coriolis acceleration, determination of Coriolis component of acceleration- Klein's construction.

Unit III

STRAIGHT LINE MOTION MECHANISMS: Exact and approximate copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper, Watt, T-Chebicheff, Robert Mechanisms and Pantograph.

STEERING MECHANISMS: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.

HOOKE'S JOINT: Single and double Hooke's joint – Universal coupling – application – velocity ratio – simple problems.

Unit IV

GEARS: Friction wheels and toothed gears – types – law of gearing - condition for constant velocity ratio for transmission of motion - forms of teeth - cycloidal and involute profiles - velocity of sliding path of contact, arc of contact and contact ratio– phenomena of interference – methods to avoid interference - condition for minimum number of teeth to avoid interference.

GEAR TRAINS: Introduction – Train value – Types – Simple, Compound, Reverted and Epicyclic gear Train - Methods of finding train value or velocity ratio of Epicyclic gear trains- sun & planetary gear systems- Differential gear for an automobile.

Unit V

CAMS: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion, uniform acceleration and retardation method & cycloidal - Maximum velocity and maximum acceleration during outward and return strokes in the above 4 cases.

Text Books:

1. S. S. Rattan, *Theory of Machines and Mechanisms*, Tata McGraw Hill Publishers.
2. R.S Khurmi& J.K Gupta, *Theory of Machines*, S.Chand.

Reference Books:

1. Jagdish Lal, *Theory of Mechanisms and Machines*, Metropolitan Company Pvt. Ltd.
2. R.K Bansal, *Theory of Machines*, Lakshmi publications.
3. Thomas Bevan, *Theory of Machines,* CBS.
4. PL. Ballaney, *Theory of machines*, Khanna Publishers. .

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	3	-	3	-
CO2	3	3	-	-	-	-	-	-	3	-	3	-
CO3	3	3	-	-	-	-	-	-	3	-	3	-
CO4	3	3	-	-	-	-	-	-	3	-	3	-
CO5	3	3	-	-	-	-	-	-	3	-	3	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments& slip tests.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. II Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G249**
Course Name : **ELECTRICAL AND ELECTRONICS ENGINEERING LAB**
Course prerequisites : Basic Electrical and Electronics Engineering
Course Objectives :

- To provide students a chance to put theory into practice.
- To understand the basic principles of operation of rotating electric machines their classification, efficiency and performance characteristics.
- To understand the characteristics of diode and BJT.
- To study the working of CRO.

Expected Outcomes :

1. Ability to conduct testing and experimental procedure on DC Machines.
2. Ability to find the performance Characteristics of three Phase induction motor.
3. Ability to test the single phase transformer to know the performance.
4. The capability to analyze the operation characteristics of electrical machines under different loading conditions.
5. Ability to plot the VI characteristics of Diode and Transistor.
6. Ability to measure various parameters (Frequency, Peak-Peak Voltage, Time period) of signals using CRO.

LIST OF EXPERIMENTS

ELECTRICAL ENGINEERING LAB

1. Swinburne's test on D.C shunt machine (pre determination of efficiency of a given D.C shunt machine working as generator and motor).
2. OC and SC tests on single phase transformer (pre determination of efficiency and regulation at a given power factors).
3. Brake test on three phase induction motor (determination of performance characteristics).
4. Regulation of alternator by synchronous impedance method.
5. Speed control of D.C shunt motor by
   (a) Armature control method (b) field flux control method.

6. Brake test on D.C shunt motor (determination of performance characteristics).

ELECTRONICS ENGINEERING LAB

1. Study of CRO (Measurement of voltage frequency and phase of periodic signals).
2. V-I Characteristics of PN junction diode.
3. Full wave rectifier with and without capacitive filter.
4. Input and output characteristics of Common Emitter (CE) Configuration.
5. Frequency response of a single stage CE amplifier.
6. Sinusoidal signal generation using RC phase shift oscillator circuit.

Note: Any **ten** Experiments to be conducted.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	-	-	-	-	-	3	-
CO2	3	-	3	-	-	-	-	-	-	-	3	-
CO3	3	-	3	-	-	-	-	-	-	-	3	-
CO4	3	-	3	-	-	-	-	-	-	-	3	-
CO5	3	-	3	-	-	-	-	-	-	-	3	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Continuous Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

II Year B. Tech. II Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G544**
Course Name : **FLUID MECHANICS AND HYDRAULIC MACHINES LAB**
Course prerequisites : Basic knowledge in Fluid Mechanics & Hydraulic Machines

Course Objectives:

- Provides knowledge to verify Bernoulli's Theorem.
- Imparting knowledge in Fluid flow devices like Venturi meter & Orifice meter
- Provides knowledge in understanding frictional losses in pipes with various diameters.
- Provides knowledge in various hydraulic Machines like Centrifugal pump, Reciprocating pump, Pelton Turbine, Kaplan Turbine, Francis Turbine etc.
- Provides knowledge in understating impact of jet on vanes like Flat vane & Semi circular vane
- Developing the student in learning the various principles of Fluid Mechanics & Hydraulic Machines, so that they can characterize, transform and use the knowledge gained in solving the various related Engineering problems.

Expected Outcomes: Students will be able to:

1. Verify the Bernoulli's Theorem.
2. Demonstrate the knowledge on various flow measuring instruments like Venturimeter and Orifice meter.
3. Analyze the frictional losses and discharge in pipes.
4. Analyze impact of jet on vanes like Flat vane & Semi circular vane.
5. Conduct experiments, analyze the data and interpret results of hydraulic machineries.

LIST OF EXPERIMENTS

1. Impact of jet on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Multi Stage Centrifugal Pump.

7. Performance Test on Reciprocating Pump.
8. Calibration of Venturimeter.
9. Calibration of Orifice meter.
10. Determination of friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline.
12. Verification of Bernoulli's theorem.

Note: Any 10 of the above 12 experiments are to be conducted.

Mapping of COs and POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	-	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	-	-	-	-	-	-	-
CO5	3	2	3	2	-	-	-	-	-	-	-	3

Mode of Evaluation:

1) 70% of marks for External Evaluation.
2) 20% of marks for Day to Day Evaluation.
3) 10% of marks for internal Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5GA51**
Course Name : **MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**
Course prerequisites : Engineering Mathematics
Course Objectives :

- To understand the concepts and tools of economic analysis.
- To apply concepts in real life by developing problem solving skills there exists a relationship between Managerial Economics and Accounting.
- To focus on picking up the basics of Accounting such as Accounting Data and Financial Statements, which constitute the language of Business.
- The student is exposed and made familiar with journalisation, interpretation and use of Accounting Data.

Expected Outcomes : Student will be able to

1. Provides a basic insight into seeking solutions for managerial problems.
2. The student can familiarized with Accounting Data and Financial Statements that can be useful for interpreting the financial information.

Unit I

INTRODUCTION TO MANAGERIAL ECONOMICS:

MANAGERIAL ECONOMICS: Meaning and Nature, Definition, Scope, relationship with other areas.

DEMAND ANALYSIS: Definition and types of Demand, Demand Determinants, Law of Demand and its exceptions, Measurement and Significance of Elasticity of Demand, Demand forecasting methods.

Unit II

PRODUCTION AND COST ANALYSIS:

PRODUCTION: Theories of the firm, Production Function, Cobb-Douglas Production function, Iso-quants and Iso-costs, MRTS, Least Cost Combination of Inputs, Laws of Returns, Internal and External Economies of Scale.

COST ANALYSIS: Cost concepts, Determinants of cost, cost-output relationship in short run and Long run.

BREAK-EVEN ANALYSIS (BEA): Objectives, Assumptions, Importance, Graphical representation, Limitations, simple numerical problems.

Unit III

MARKET STRUCTURE AND FORMS OF BUSINESS ORGANIZATIONS:

MARKETS: Perfect, Monopoly, Monopolistic and Oligopoly Markets. Price-output determination in perfect competition and monopoly in long run and short run.

FORMS OF BUSINESS ORGANIZATIONS: Definition, Forms of Business Organizations-**Private Sector**-sole proprietary ship, Partnership, Joint Hindu family business, co-operative societies, joint stock companies.

PUBLIC SECTOR- Departmental organizations, public corporations, government companies. Joint Sector.

Unit IV

CAPITAL AND CAPITAL BUDGETING:

CAPITAL: Definition of Capital and its significance, Types of Capital, Sources of Raising Capital.

CAPITAL BUDGETING: Definition, Nature and scope of capital budgeting, features of capital budgeting, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems)

Unit V

INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS:

FINANCIAL ACCOUNTING : Definition, Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

FINANCIAL ANALYSIS: Definition of Financial Analysis, Ratios and its significance- types- liquidity Ratios, turnover Ratios - solvency Ratios and profitability ratios.

Text Books:

1. Gupta: Managerial Economics, TMH, 2009.
2. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2003.
3. Mehta P.L., Managerial Economics-Analysis, Problems, Cases, S Chand and Sons,New Delhi, 2001.
4. M.E.Thukaram Rao., Accounting for Managers, New Age International Publishers.
5. T.S, Reddy and Y. Hari Prasad Reddy, Accounting and Financial Management, Margham Publications.

Reference Books:

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
3. Suma Damodaran, Managerial Economics, Oxford University Press.
4. Lipsey&Chrystel, Economics, Oxford University Press.
5. S. A. Siddiqui & A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications.
6. Domnick Salvatore: Managerial Economics In a Global Economy, 4th Edition,Thomson.
7. Narayanaswamy: Financial Accounting—A Managerial Perspective, PHI
8. Raghunatha Reddy &Narasimhachary: Managerial Economics& Financial Analysis, Scitech.
9. S.N.Maheswari& S.K. Maheswari, Financial Accounting, Vikas.
10. Truet and Truet: Managerial Economics:Analysis, Problems and Cases, Wiley.
11. Dwivedi:Managerial Economics, 6th Ed., Vikas

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by Assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G551**

Course Name : **APPLIED THERMODYNAMICS-II**

Course prerequisites : Basic Thermodynamics

Course Objectives :

- To gain knowledge on thermodynamic vapour cycle used in thermal power plants.
- To become familiar with various boilers, draughts.
- To understand functioning of nozzle, its types, and the study of nozzle characteristics and also to provide a sound knowledge on condensers and cooling towers.
- To give better understanding on impulse turbines and their performance characteristics.
- To give better understanding on reaction turbines and their performance characteristics and also to provide sound knowledge on steam engines.

Expected Outcomes : Student will be able to

1. Evaluate the efficiency of steam power plant and recommend efficiency enhancement methods in improving the overall efficiency of the plant.
2. Identify different types of boilers and its working, draughts and can calculate the chimney height for maximum discharge.
3. Evaluate the performance characteristics of steam nozzles and different nozzles used in steam power plants and evaluate the efficiency of steam condensers and the importance of cooling towers requirement in steam power plant.
4. Calculate the performance parameters of impulse turbines and can demonstrate the influence of governing mechanisms in steam power plants.
5. Calculate the performance parameters of reaction turbines and can demonstrate the influence of governing mechanisms in steam power plants and can demonstrate the working of steam engines and to calculate its performance.

Unit I

BASIC CONCEPTS**:** Rankine's cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration – reheating- combined- cycles.

Unit II

BOILERS**:** Classification based on Working principles - Fire tube boilers, water tube boilers – High pressure Boilers, boiler Mountings & Accessories. Performance of Boilers **-** Boilers horse power, equivalent evaporation, efficiency and heat balance – Draught: classification – Height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney – artificial draught, induced and forced draught.

Unit III

STEAM NOZZLES**:** Function of nozzle – applications - types, Flow through nozzles, thermodynamic analysis – assumptions -velocity of nozzle at exit- Ideal and actual expansion in nozzle, velocity coefficient, condition for maximum discharge, critical pressure ratio.

Criteria for design of nozzle shape: Super saturated flow, its effects, degree of super saturation and degree of under cooling - Wilson line –Shock at the exit.

STEAM CONDENSERS: Requirements of steam condensing plant, rare fraction – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and its effects, air pump- cooling water requirement. Cooling towers – Types-listing.

Unit IV

IMPULSE TURBINE**:** Mechanical details – Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-Laval Turbine - its features. Methods to reduce rotor speed-Velocity compounding and pressure compounding, Velocity and Pressure variation along the flow – combined velocity diagram for a velocity compounded impulse turbine. Governing of impulse turbine.

Unit V

REACTION TURBINE**:** Mechanical details – principle of operation, thermodynamic analysis of a stage, degree of reaction –velocity diagram – Parson's reaction turbine – condition for maximum efficiency. Governing of reaction turbine. STEAM ENGINES: Classification – working – parts of steam engine – indicator diagrams – theoretical, actual, Diagram factor, Performance of steam engines, Willian's laws, Governing of simple steam engines.

Text Books:

1. Rathore, *Thermal Engineering*. TMH.1st Ed.2010
2. P.K. Nag, *Basic and Applied Thermodynamics.*TMH. 2nd Ed.2010

References:

1. R.Yadav, *Thermodynamicsand Heat Engines*. Central Book Depot.6th ed.2012
2. R.S Khurmi & JS Gupta, *Thermal Engineering*.S.Chand. 14th Ed.1997
3. M.L.Mathur& Mehta, *Thermal Engineering*. Jain bros. 3rd Ed.2013
4. B.S.Reddy and K.H. Reddy, *Thermal Engineering Data Book*. I.K. International.2007

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	-	1	1	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	3	-	-	-	-	-	-	-	-	-	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by Assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G552**

Course Name : **DYNAMICS OF MACHINERY**

Course prerequisites : Engineering Mechanics, Mechanics of Solids, Kinematics of Machinery, I.C. engines

Course objective:

- To understand the method of different force analysis on screw threads and clutches.
- To understand and analyze the concept of forces on brakes and dynamometers.
- To understand and apply the turning moment diagrams for IC engines and design aspects of flywheel.
- To understand the knowledge of solving problems on balancing of rotating masses and reciprocating masses.
- To understand the concept of vibratory systems and their analysis and also the principles of governors.

Expected Course Outcomes: Student will be able to:

1. Understand the basic concepts of friction in pivots and collars with uniform pressure and uniform wear, and also to solve the numerical problems on clutches.
2. Solve the numerical problems on brakes and dynamometers and can apply gyroscopic principles on Aeroplane, ship, four wheel and two wheel vehicles.
3. Design a flywheel for IC engine. Further to study the basics and definitions related to governors and forces acting on various governors and also to solve numerical problems on different governors.
4. Solve numerical problems on balancing of rotating masses and reciprocating masses in V-engine and multi cylinder engines.
5. Perform detailed analysis of the response of vibration systems with free and forced vibrations; evaluate the critical speed of the shaft and simple vibration calculations of rotor systems.

UNIT I

FRICTION: Inclined plane, friction of screw and nuts, pivot and collar, uniform pressure, uniform wear, Friction circle and friction axis.

Clutches: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch.

UNIT II

BRAKES AND DYNAMOMETERS: Simple block brakes, internal expanding brake, band brake of vehicle. Dynamometers – absorption and transmission types – Prony brake, Rope brake, Epi-cyclic train, Belt transmission and torsion dynamometers - General description and methods of Operation.

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, aero planes and ships.

UNIT III

TURNING MOMENT DIAGRAM: Turning moment diagrams for steam engine, I.C. Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed.

Governors: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting.

UNIT IV

BALANCING OF ROTATING & RECIPROCATING MASSES: Balancing of rotating masses - single and multiple – single and different planes.

Balancing of Reciprocating Masses: Primary, Secondary and higher balancing of reciprocating masses. graphical methods. Unbalanced forces and couples – V, multi cylinder, in -line and radial engines for primary and secondary balancing – Hammer blow, Swaying couple, variation of tractive force.

UNIT V:

VIBRATION: Introduction, types of vibration – natural frequency of longitudinal and transverse vibrations – transverse loads. Dunkerley's method, rayleigh's method. Whirling of shafts, critical speeds, torsional vibratios, single and two rotor systems.

Text books:

1. S.S Ratan, *Thoery of Machines*. MGH.
2. R.S. Khurmi, *Theory of machines*. S.Chand.

Reference books:

1. JS Rao and RV Dukkipati, *Mechanism and Machine Theory.* New Age Publ.
2. Ballaney, *Dynamics of Machinery.* Dhanpat Rai.
3. Thomas Bevan, *Theory of Machines.* CBS Publishers.
4. Jagadish Lal & J.M.Shah, *Theory of Machines*. Metropolitan.

Mapping of COs and POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	3	3	3	-	-
CO2	3	3	3	3	-	-	-	3	3	3	-	-
CO3	3	3	3	3	-	-	-	3	3	3	-	-
CO4	3	3	3	3	-	-	-	3	3	3	-	-
CO5	3	3	3	3	-	-	-	3	3	3	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G553**

Course Name : **MACHINE TOOLS**

Course prerequisites : Material science engineering, Manufacturing technology

Course Objectives :

- To understand the metal cutting operations carried out by machine tools employing single point and multi point cutting tools.
- To understand abrasive machining processes for improving surface finish and accuracy.
- To understand material properties, geometry and wear of cutting tools.
- To select abrasive wheels for specific material and applications.
- To design a simple jig or fixture.
- To calculate machining times in metal cutting operations.

Expected Outcomes : Student will be able to:

1. Understand the fundamentals of metal cutting, chip formation, cutting forces involved in orthogonal metal cutting, and access the different cutting forces.
2. Understand speed, feed, depth of cut, tool life and tool material characteristics, and access tool life for various work piece and cutting tool materials
3. Understand different operations, tool holding devices/ work holding devices and classification of lathes / automatic and semi-automatic machines
4. Understand the principles of shaping/slotting/planning machines and operations carried on these machines.
5. Understand the principles of drilling/boring machines, cutting tools and operations carried out on these machines
6. Understand the principles of grinding machine, operations carried out on these machines, grinding wheels and selection of grinding wheels for specific material and operations.
7. Understand the principles of lapping/ honing and operations carried out on these machines.
8. Understand the principles of jigs and fixtures and its applications.

Unit I

THEORY OF METAL CUTTING : Introduction to orthogonal and oblique cutting , Mechanics of chip formation, types of chip, single point cutting tool-Nomenclature – ORS, ASA systems, forces in turning process. cutting tool materials, tool wear, tool life, cutting fluids- types and functions- applications, Thermal aspects – temperature measurement.

Unit II

TURNING MACHINES: Centre lathe, constructional features, specifications, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – Automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

Unit III

RECIPROCATING, DRILLING AND GEAR CUTTING MACHINES: Reciprocating machine tools: shaper, planer, slotter- working principle- Types and operations performed.

Drilling machines- working principle, specifications, types, operations performed – tool holding devices- twist drill.

Boring machines – fine boring machines – Jig boring machine.

Milling machines – types, working principle– methods of indexing – Accessories to milling machines.

Unit IV

ABRASIVE PROCESS AND BROACHING : Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centre less grinding, internal grinding- micro finishing methods - Typical applications – concepts of surface integrity.

Broaching machines: broach construction – push, pull, surface and continuous broaching machines.

Unit V

LAPPING, HONING AND JIGS AND FIXTURES: Lapping, honing machines : Constructional features, speed and feed, machining time calculations, Comparison of grinding, lapping and honing.

JIGS AND FIXTURES: Principles of design of Jigs and fixtures and uses. Classification of Jigs & Fixtures – Principles of location and clamping– Types of clamping & work holding devices. Typical examples of jigs and fixtures.

Text Books:

1. Roy. A.Lindberg, "Process and materials of manufacture," PHI/Pearson Education fourth, Edition 2006.
2. Rao. P.N "Manufacturing Technology," Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2003.

Reference Books:

1. Richerd R kibbe, John E. Neely, Roland O.Merges and Warren J.White "Machine Tool Practices", Prentice Hall of India, 1998
2. HMT – Production Technology, Tata Mc Graw Hill, 1998.
3. Hajra Choudhury. Elements of Workshop Technology – Vol.II. Media Promoters
4. Geofrey Boothroyd, Fundamentals of Metal Machining and Machine Tools, Mc Graw Hill, 1984

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	3	2	2	-	-	-	-
CO2	3	3	2	-	-	3	2	2	-	-	-	-
CO3	3	3	-	-	-	3	-	-	-	-	-	-
CO4	3	3	-	3	-	3	-	-	-	-	-	-
CO5	3	3	-	3	-	3	-	-	-	-	-	3
CO6	3	3	-	3	-	3	-	-	-	-	-	3
CO7	3	3	-	3	-	3	-	-	-	-	-	-
CO8	3	3	1	3	-	3	-	-	1	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and quiz.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G554**

Course Name : **DESIGN OF MACHINE ELEMENTS – I**

Course prerequisites : Engineering Mechanics, Mechanics of Solids.

Course Objectives :

- To design basic machine elements in mechanical systems.
- To learn the procedure of designing the machine element.
- To design the machine elements for different types of loading.
- To learn various theories related the design of machine elements for different loading Conditions.
- To apply these principles to the solution of variety of practical problems and be able to apply their knowledge to solve more complicated problems.

Expected Outcomes : Student will be able to:

1. Understand the customer's needs, formulate the problem and draw the design specifications. Understand component behavior subjected to loads and identify the failure criteria.
2. Analyze the stresses and strains induced in a machine element under cyclic loading using Goodman's and Soderberg's criterions.
3. Design bolted and welded joints with direct loading and eccentric loading.
4. Design cotter joint, knuckle joint.
5. Design shafts, various rigid and flexible shaft couplings.

UNIT – I

INTRODUCTION: General considerations of design, design process. Selection of engineeringmaterials - properties –Manufacturing considerations in the design. BIS codes of materials. Preferred numbers.

STRESSES IN MACHINE MEMBERS: Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Various theories of failure – factor of safety – Design for strength and rigidity.

UNIT – II

DESIGN FOR STATIC AND FLUCTUATING LOADS: Stress concentration –notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman's line – Soderberg's line, Design for finite life.

UNIT – III

THREADED JOINTS: Basic types of screw fastening- cap screws, set screws, Isometric Screw threads, Bolted joint – simple analysis, eccentrically loaded bolted joints in shear, eccentric load perpendicular to axis of bolt, design of nut.

WELDED JOINTS: Stress relieving of welded joints, Strength of butt welds, strength of – parallel fillet and transverse fillet welds. Eccentric load in the plane of welds, welded joint subjected to bending moment, torsional moment.

UNIT – IV

KEYS, COTTERS AND KNUCKLE JOINTS: Design of Keys – Stresses in Keys - Cotter joints - spigot and socket, sleeve and cotter, Gib and cotter joints- Knuckle joints.

UNIT – V

SHAFTS AND SHAFT COUPLINGS:

SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Shaft sizes – BIS code.

SHAFT COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings- Flexible couplings: bushed pin type.

Text Books:

1. Pandya & Shah, Machine design. Charotar Publ.
2. V B Bhandari,Design of machine elements.
3. R.S. Khurmi & J.S.Gupta, Machine Design. S.Chand Publications.

References:

1. J.E. Shigley, Machine design.
2. T. Krishna Rao, Design of Machine Elements-I. I.K. International.
3. M.F. Spotts, Design of Machine Elements. PHI.
4. Kannaiah,Machine Design. Scietech.
5. RS Khurmi and Jk Gupta, Machine design.
6. Machine design, Schaum Series.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	3	-	3	-	3	-	3
CO3	3	3	3	3	-	3	-	3	-	3	-	3
CO4	3	3	3	3	-	3	-	3	-	3	-	3
CO5	3	3	3	3	-	3	-	3	-	3	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G555**
Course Name : **HEAT TRANSFER**
Course prerequisites : Basic Thermodynamics, Engineering Mathematics.
Course Objectives :

- An ability to get an in-depth understanding of the principles governing the transfer of heat, the techniques, tools and skills required to solve typical thermal related problems To plot the variation of shear force and bending moments over the beams under different types of loads.
- To analyze of energy flows in complicated systems and the design of efficient heat transfer equipment's.
- Enables to utilize analogies to solve heat transfer problems.
- An ability to gain hands-on experience in heat transfer experimentation through a number of laboratory tests.

Expected Outcomes : Student will be able to:

1. To identify the modes of heat transfer and calculate the conduction in various solids.
2. To calculate steady state and unsteady state heat conduction problems applied to different geometries.
3. To solve the heat convection in various medium.
4. To evaluate the heat transfer in phase change process and radiation.
5. Design heat exchange equipment based on the need that fit to application.

Unit I

INTRODUCTION: Modes and mechanisms of heat transfer – Basic laws of heat transfer – General applications of heat transfer.

CONDUCTION HEAT TRANSFER: Fourier heat transfer equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates.

Simplification and forms of the field equation – steady, unsteady and periodic heat transfer – boundary and Initial conditions.

Unit II

ONE DIMENSIONAL STEADY STATE HEAT CONDUCTION: In Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius/thickness of insulation–with internal heat sources or Heat generation. Extended surface

(fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to errors in Temperature measurement.

ONE DIMENSIONAL TRANSIENT HEAT CONDUCTION: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers - Chart solutions of transient conduction systems- Problems on semi-infinite body.

Unit III

CONVECTIVE HEAT TRANSFER: FORCED CONVECTION: External Flows: Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer for flow over-Flat plates, cylinders.

INTERNAL FLOWS: Division of internal flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of empirical relations for convective heat transfer in Horizontal Pipe Flow, annular flow.

FREE CONVECTION: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation.

Dimensional analysis Buckingham π Theorem- examples- Free & Forced convection.

Unit IV

HEAT TRANSFER WITH PHASE CHANGE: Boiling- Pool boiling – Regimes, determination of heat transfer coefficient in Nucleate boiling, Critical Heat flux and Film boiling. Condensation: Film wise and drop wise condensation.

RADIATION HEAT TRANSFER: Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities– laws of Planck, Wien, Kirchoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between gray bodies – radiation shields– electrical analogy for radiation networks.

Unit V

HEAT EXCHANGERS: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

Text Books:

1. *R.C. Sachdeva, Fundamentals of Engg. Heat and Mass Transfer. New Age International, 4th Ed.*
2. *Holman. J. P, Heat Transfer. TMH, 10th Ed.*

Reference Books:

1. P.K.Nag, *Heat Transfer.* TMH, 2011, 3rd Ed.
2. M. Thirumaleswar, *Fundamentals of Heat and Mass Transfer.* Pearson Edu
3. R. K. Rajput, *Heat and Mass Transfer*. S. Chand & Company Ltd.2015

4. Kondandaraman, C.P., *Fundamentals of Heat and Mass Transfer*. New Age Publ., 4th Ed.
5. Incropera, *Fundamentals of Heat Transfer.* Wiley India, 7th Ed.
6. Ghoshdastidar, *Heat Transfer.*2nd Ed.
7. B.S.Reddy and K.H.Reddy, *Thermal Engineering Data Book.* I.K. International, Revised Ed.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	-	3	-	-	-	-	-	-	-	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3
CO5	3	3	3	3	-	-	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by Assignments

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

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Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	2	**-**	**0**

Course Code : **5GC52**
Course Name : **ENGLISH FOR COMPETITIVE EXAMINATIONS**
Course prerequisites : English.
Course Objectives :

- To allow the students learn Advanced Grammar and English Comprehension
- To expose the students to various kinds of competitive exam papers in English

Expected Outcomes : Student will

1. achieve proficiency in English synonyms, antonyms, idiomatic expressions and, accuracy in English spelling
2. apply active reading strategies in order to comprehend, critically analyze and make inferences and predictions based on information in the text
3. apply his/her knowledge of articles, prepositions, tenses and voice correct errors or improve sentences
4. form meaningful sentences/passages out of the scrambled words/sentences

ENGLISH FOR COMPETITIVE EXAMINATIONS

CORRECT ENGLISH USAGE: Articles – Prepositions – Tenses – Voice – Error spotting and correcting – Sentence improvement

VOCABULARY: Synonyms – Antonyms – Analogy – Words often confused

ENGLISH PROFICIENCY: One-word substitutions – Idioms and Phrases – Homonyms – Spellings

LOGIC-BASED ENGLISH LANGUAGE: Rearrangement of jumbled words and jumbled sentences – word pairs – sentence completion

COMPREHENSION ABILITY: Reading comprehension – Cloze tests

Note: In each lecture class, one practice paper containing objective questions on the said aspects will be discussed thoroughly by the trainer. At the end of the semester, a minimum of 20 papers will have been practiced by students.

As regular method of external assessment is not found suitable, 100 marks will be awarded for internal examinations (30 marks from the average of two Internal Mid Exams and 70 for Internal End Exam)

Reference Books:

1. R. S. Agarwal, "Objective English", S. Chand Publishers
2. Hari Prasad, "Objective English for Competitive Exams", TMH
3. Collins Cobuild, "English Guides: Confusable Words"

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	2	-	3
CO2	-	-	-	-	-	-	-	-	-	-	-	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	-	-	1

Mode of Evaluation:

1. Formative assessment is done during semester for 30 marks.
2. Summative assessment is done at end of semester for 70 marks.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G556**
Course Name : **HEAT TRANSFER LAB**
Course prerequisites : Fundamentals of Heat Transfer
Course Objectives :

- To Acquire Knowledge of the principle of mode of heat transfer
- Ability to design and applications of heat exchanger
- To gain knowledge transient heat conduction and heat pipe
- To provide practical knowledge to determine heat transfer coefficient in boiling and condensation

Expected Outcomes :

1. Ability to determine thermal conductivity in metal bars, insulating powder, lagged pipe and composite slab.
2. Evaluate the fin efficiency and fin effectiveness
3. Evaluate convective het transfer coefficient by performing experiments in free and forced convections.
4. Ability to determine Stefan Boltzmann constant and emissivity of gray body.
5. Demonstrate practical understanding on unsteady state heat conduction, Heat pipe and Two phase flow.
6. Ability to determine convective het transfer coefficient in drop and film wise condensation.
7. Ability to determine Critical heat flux for pool boiling.
8. Analyze the performance of heat exchanger.

List of Experiments

1. Thermal Conductivity of metal (conductor).
2. Thermal conductivity of insulating powder through Concentric Sphere.
3. Overall heat transfer co-efficient through Composite Slab
4. Heat transfer coefficient in natural convection
5. Heat transfer coefficient in forced convection.
6. Heat transfer from pin-fin
7. Emissivity of a gray body through Emissivity apparatus.
8. Experiment on Stefan Boltzman Apparatus.

9. Experiment on Parallel and counter flow heat exchanger.
10. Experiment on Critical Heat flux apparatus.
11. Thermal conductivity of insulating material through lagged pipe apparatus
12. Study of Two – Phase heat flow.
13. Experiment on Transient Heat Conduction
14. Heat transfer in drop and film wise condensation.
15. Heat pipe demonstration.

NOTE: Thermal Engineering data books are permitted in the examinations.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-	-
CO7	3	2	2	-	-	-	-	-	-	-	-	-
CO8	3	3	2	2	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Continuous Evaluation
3. 10% of marks for Internal Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G557**
Course Name : **THERMAL ENGINERRING LAB**
Course prerequisites : Basic Thermodynamics, Engineering Mathematics
Course Objectives :

- To understand various engine components and demonstrate the ability the assemble / disassemble the IC engine.
- To understand the concept of valves / ports actuating mechanism.
- To study the performance characteristics of I.C engine classification, Vapour compression Refrigeration system and reciprocating air compressor.
- To understand the energy dissipation and importance of heat balance sheet in IC engine.
- To understand the working principle of various boilers used for power generation.

Expected Outcomes : Student will be able to:

1. Able to understand the applications of computer in the design and manufacturing.
2. Able to understand and develop the Mathematical representations of curves used in geometric construction.
3. Understand the concept and working principle of NC, CNC, and DNC and can develop a program using G and M codes.
4. Able to make use of GT, FMS and CAPP concepts and are able to apply these concepts in bringing the benefits of mass production in real working environment.
5. Able to plan the computer integrated production planning in working environment and able to analyze the quality of a product through computer aided quality control
6. An ability to determine the performance of the Vapour compression Refrigeration system.

List of Experiments

1. Disassembly/assembly of given engine.
2. Performance test on air compressor test rig.
3. Load test on 4-stroke diesel engine.
4. Load test on 4-stroke petrol engine.
5. Load test on 2-stroke petrol engine.

6. (a) valve timing diagram (vtd)
7. (b) port timing diagram (ptd)
8. Performance test on refrigeration test rig.
9. Heat balance sheet on 4-stroke diesel engine.
10. Heat balance sheet on 2-stroke petrol engine.
11. Heat balance sheet on 4-stroke petrol engine.
12. Morse test on 4-stroke petrol engine.
13. Motoring test on 2- stroke petrol engine.
14. Study on boliers.
15. (a) flash and fire point by cleveland (open) cup apparatus.
16. (b) calorific value of fuel using bomb calorimeter.
17. Viscosity of the oil through saybolt viscometer apparatus.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	3	3	-	-	-	3	3	-	-
CO2	3	2	-	3	1	-	-	-	-	2	-	-
CO3	3	2	-	3	1	-	-	-	-	-	-	-
CO4	3	2	-	3	1	-	-	-	-	-	-	-
CO5	-	2	3	2	2	-	-	-	-	2	-	-
CO6	3	3	2	-	2	-	-	-	-	1	-	-
CO7	3	2	2	-	2	-	-	-	1	-	-	-
CO8	3	-	-	2	-	-	-	-	3	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Continuous Evaluation
3. 10% of marks for Internal Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	2	**-**	**-**

Course Code : AUDIT COURSE
Course Name : **PROFESSIONAL ETHICS**
Course prerequisites : NIL
Course Objectives :

- To make the students understand ethics in engineering and infuse them with confidence to apply the same in their professional life.

Expected Outcomes : Student will be able,

1. To understand the relevance of ethics and morals in engineering
2. To appreciate the vulnerability to failure of engineering processes
3. To comprehend the finer aspects of safety and risk with reference to the responsibilities of engineers.
4. To understand the link between responsibility, rights and accountability
5. To understand the global impact of engineering profession

Unit–I

MORALS AND ETHICS IN ENGINEERING Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory –Indian Theory-Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

Unit–II

ENGINEERING AS SOCIAL EXPERIMENTATION Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study – Titanic disaster as Case Study

Unit–III

ENGINEER'S RESPONSIBILITY FOR SAFETY: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk – Disasters at Chernobyl and Bhopal - Case Studies

Unit–IV

RESPONSIBILITIES, RIGHTS AND ACCOUNTABILITY Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

Unit–V

GLOBAL ISSUES Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

Text Book:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 2005.

Reference Books:

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics oncepts and Cases", Thompson Learning, 2000.
2. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico,1999.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
5. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, 2004.
6. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, 2003.
7. Jayashree Suresh, Raghavan, B.S., "Professional Ethics", S. Chand & Company Ltd., 2005

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. I Semester	**L**	**T**	**P**
	2	**-**	**-**

Course Code : AUDIT COURSE
Course Name : **STRESS MANAGEMENT**
Course prerequisites : NIL
Course Objectives :

- This course examines different sources from where individuals experience a stress response. Through diligent individual and group study, students will be able to learn to apply stress management principles in order to achieve high levels of performance and understand the role of relationships to the management of stress and health.

Expected Outcomes : Student will be able,

1. Understand the physiological systems that are affected by stressors and the long-term effects and illnesses that can result from stressors.
2. Understand the specific applications of stress as it relates to the workplace and different target groups.
3. Create effective stress management plans for individual clients and for workplace environments. Enhancing significance of training and development, performance evaluation.

Unit– I

UNDERSTANDING STRESS Meaning – Symptoms – Work Related Stress – Individual Stress – Reducing Stress -sources of stress –consequence of stress-burnout-symptoms of Burnout- stress verses Burnout-model of stress-strategies for coping stress (individual and organizational strategies) –case study

Unit–II

TIME MANAGEMENT Techniques – Importance of Planning the day –developing concentration – Prioritizing Beginning at the start – Techniques for conquering procrastination – Sensible delegation – Taking the right breaks – Learning to say "No"

Unit–III

CAREER PLATEAU Career plateau – Identifying Career plateaus – Structural and Content - Plateauing – Making a fresh start – Importance of Sabbaticals – Counseling out – Executive leasing – Sustaining a marketable Career.

Unit–IV

CRISIS MANAGEMENT Implications – People issues – Structure issues – Environmental issues – Learning to keep calm - Preventing interruptions – Controlling crisis – Pushing new ideas – Empowerment – Work place Humour, developing a sense of Humour – Learning to laugh – role of group cohesion and team spirit.

Unit–V

SELF DEVELOPMENT Improving personality – Leading with Integrity – Enhancing Creativity – Effective decision making – Sensible Communication – The Listening Game – Managing Self – Mediation for peace – Yoga for Life

Text Books

1. Bhatia R.L., The Executive Track: An Action Plan for Self-Development Wheeler Publishing, New Delhi
2. Charavathy.S.K, "Human Values for Manager", McGraw Hill/HenelyManagement Series

Reference Books

1. Jeffr Davison, Managing Stress, Prentice Hall of India, New Delhi
2. Jerrold S Greenberg, Comprehensive Stress Management, Jain Books, 2009

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : 5G561

Course Name : **INSTRUMENTATION AND CONTROL SYSTEMS**

Course prerequisites : Engineering Mathematics, Engineering Physics
Electrical and Electronics Engineering

COURSE OBJECTIVE:

- Students will be able to understand generalized measurement system and its functional elements.
- Students will know about Sensors, Transducers and their working principles.
- Students will gain knowledge about the instruments, working principles of pressure, flow and temperature.
- Students will get knowledge on Measurement and their working of Force, Torque, Acceleration, Vibrations.
- Students will know about application of strain gauges for different measurements.
- Students will gain knowledge about Control Systems, Mathematical Models And Transfer Function.

Expected Course Outcomes: Student will be able to:

1. Understands the working of generalized measurement system and its functional elements..
2. Apply the working principles of various instruments used for measuring pressure, flow and temperature
3. Apply the working principles of various instruments used for measuring force, torque, acceleration, vibrations**.**
4. Analyze about measurement methods of strain gauges.
5. Evaluate a control system to meet a specified performance using analytic, graphical, empirical and computer methods.

UNIT –I

MEASUREMENT AND INSTRUMENTATION: Measurement, measurement methods, generalized measurement system and its functional elements, classification of instruments, error and its classification, static and dynamic characteristics, Sensors and Transducers: Introduction, transducers classification and description, transducer sensitivity, variable resistance transducers, variable inductance transducers, capacitive transducers, LVDT, piezo electric and photo electric transducers.

UNIT –II

MEASUREMENT OF PRESSURE, FLOW AND TEMPERATURE: Pressure measurement terms, measurements of low pressure gauges such as McLeod gauge, thermal conductivity gauge, Ionization gauge, measurement of high pressure such as Bourdon gauge and bellows, resistance gauge, Classification of flow measurement techniques, special flow meters such as Turbine flow meter, Magnetic flow meter, Hot wire anemometer, Ultrasonic flow meter. Temperature

measurement instruments, thermocouples, resistance thermometers and thermistors, radiation and optical Pyrometers.

UNIT –III

MEASUREMENT OF FORCE, TORQUE, ACCELERATION, VIBRATIONS: Basic force measurement methods such as elastic load cells, elastic strain gauge load cells, hydraulic and pneumatic load cells, Torque measurement, different types of torsion meters, piezo electric accelerometer, Strain gauge accelerometer. Mechanical type vibration instruments - Seismic instruments as an accelerometer and vibrometer, Calibration of vibration pickups.

UNIT -IV

STRAIN GAUGES AND MEASUREMENT: Strain measuring techniques, requirement of strain gauges, resistance strain gauges, strain gauges alloys and material, bonded and unbonded strain gauges, bonding techniques, temperature compensation in strain gauges.

UNIT –V

CONTROL SYSTEMS, MATHEMATICAL MODELS AND TRANSFER FUNCTION: Introduction, examples of control systems, classification of control systems, open loop and closed loop control systems, control system terminology, servomechanism. Physical system and mathematical models, mechanical systems, thermal systems, electrical systems, hydraulic and pneumatic systems, linear control system, transfer function, block diagram and its reduction process, signal flow graphs, mason's rule.

Text books:

1. Beckwith and Buck, *Mechanical Measurements*. Narosa Publication.2012
2. S. Ghosh, *Control Systems – Theory & Applications*. Pearson Education, New Delhi, 2012.
3. Er.R.K. Rajput, Mechanical Measurements and Instrumentation,S.K.Kataria, New Delhi 2015
4. Doeblin.E.O., *Measurement Systems.* TMH Publishers, New Delhi, 2016.

Reference books:

1. D.S. Kumar, *Mechanical Measurements and Control*. Metropolitan Books, New Delhi, 2015.
2. B.S.Manke, *Linear Control Systems.* Khanna Publishers, New Delhi, 2009.
3. Nagarathan and Gopal, *Control System Engineering*, Narosa Publishers.
4. Naresh K. Sinha, *Control Systems*, NAI Publishers, New Delhi, 2008.

Mapping of Cos and Pos

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	3	1	3	3	3	-	-
CO2	3	-	-	-	-	3	-	3	3	3	-	-
CO3	3	-	-	-	-	3	-	3	3	3	-	-
CO4	3	-	-	-	-	3	-	3	3	3	-	-
CO5	3	1	-	-	-	3	-	3	3	3	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester

L	T	P
3	1	0

Course Code : 5G574

Course Name : CAD / CAM

Course prerequisites : Engineering Mathematics, Manufacturing Process

COURSE OBJECTIVES:

- To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture
- To get effective knowledge on the usage of mathematical equations in model development through the computer.
- To understand different functions of computers in design and manufacturing.
- To understand the need for integration of CAD and CAM
- Study of different types of production, Knowledge of group technology (GT).
- Detailed study of Computer Aided Quality Control.

Expected Outcomes : Student will be able to:

1. Understand the applications of computer in the design and manufacturing.
2. Understand and develop the Mathematical representations of curves used in geometric construction.
3. Understand the concept and working principle of NC, CNC, and DNC and can develop a program using G and M codes.
4. Make use of GT, FMS and CAPP concepts and are able to apply these concepts in bringing the benefits of mass production in real working environment.
5. Plan the computer integrated production planning in working environment and able to analyze the quality of a product through computer aided quality control

UNIT – I

INTRODUCTION TO COMPUTER GRAPHICS: Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure of CPU, Memory types, input devices, display devices, hard copy devices and storage devices. Types of productions: job, batch, mass and continuous flow. Raster scan graphics coordinate system, representation of line and circles, database structure for graphics modeling, Transformations - 2D and 3D.

UNIT – II

GEOMETRIC MODELING AND CAD CAM INTERFACE: Introduction

to Geometric modeling, Geometric modeling Types - Wireframe, surface and solid modeling, Representation of curves- Hermite curve, Bezier curve, B-spline curves, Representation of surface – Hermite bicubic surface, Bezier and B-spline surfaces, Solid modeling techniques- CSG and B-rep. Data exchange standards- IGES-STEP.

UNIT – III

NUMERICAL CONTROL: Introduction to NC, NC modes, NC elements, NC machine tools, Structure of CNC machine tools, Direct Numerical Control machine tools, Open loop and closed loop control systems - CNC controllers, features of Machining center, turning center. Computer assisted part programming – APT language structure and commands. CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming. Adaptive control systems.

UNIT - IV

GROUP TECHNOLOGY AND FLEXIBLE MANUFACTURING SYSTEMS: Part family, Parts coding and classification, production flow analysis: optiz classification and coding system. machine cell design, applications, advantages and limitations. Computer Aided Processes Planning - Retrieval type and Generative type. FMS - Material handling systems, computer control systems, Human labor in manufacturing systems, FMS applications, advantages and limitations.

UNIT - V

COMPUTER INTEGRATED PRODUCTION PLANNING AND COMPUTER AIDED QUALITY CONTROL: Capacity planning**,** shop floor control, MRP-I, MRP-II, CIMS benefits, JIT approach. Terminology in quality control, the computer in QC, contact inspection methods, non-contact inspection methods-optical and non optical, computer aided testing, integration of CAQC with CAD/CAM.

Text books:

1. A Zimmers & P.Groover, *CAD/CAM*. PE, PHI.
2. P.N. Rao, *CAD/CAM-Principles and applications*. TMH.

Reference books:

1. Groover, P.E, *Automation, Production systems & Computer integrated Manufacturing*.
2. Radhakrishnan and Subramaniah, *CAD/CAM/CIM*. New Age.
3. Farid Amirouche, *Principles of Computer Aided Design and Manufacturing*. Pearson.
4. R. Sivasubramaniam, *CAD/CAM Theory and Practice*. TMH.

5. Lalit Narayan, *Computer Aided Design and Manufacturing*. PHI.
6. T.C. Chang, *Computer Aided Manufacturing*. Pearson.
7. CSP Rao, *A text book of CAD/CAM*, Hitech Publ.
8. *CONCEPTS AND APPLICATIONS* CHENNAKESAVA R. ALAVALA*PHI Learning Pvt. Ltd*

Mapping of Cos and Pos

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	3	-	-	-
CO2	2	2	3	2	-	-	-	-	3	-	-	-
CO3	-	-	3	2	1	-	-	-	3	-	-	-
CO4	-	2	3	-	-	-	-	-	3	-	-	-
CO5	-	-	3	-	-	-	-	-	3	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : 5G563

Course Name : METROLOGY AND SURFACE ENGINEERING

Course prerequisites : Engineering physics, Material science.

Course Objectives :

- Students will be able to understand the Limits and Fits, linear measurements and angular measurements, gauges, comparators, optical measuring methods, measurement of flatness and roughness of surface.
- Students will be able to ensure that the students can apply/analyze relevant quantitative models to solve real world problems

Expected Outcomes :

1. Students will be able to understand the limits, fits and tolerance ,different types of gauges and design of GO and NOGO gauges.
2. The principles of working of the most commonly used instruments for measuring linear and angular distances will be known to the students.
3. Students will be able to understand the measuring methods of surface roughness and different types of comparators.
4. Students will be able to understand the screw threads elements and measuring methods, gear tooth profile measurement ,CMM and its applications.
5. Students will be able to conduct alignment tests on machine tools and understand different surface treatment processes.

Unit I

SYSTEMS OF LIMITS AND FITS: Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, Tolerance analysis .Hole and shaft basis systems – interchangeability and selective assembly. Indian Standard Institution system – International Standard system for plain and work. Limit Gauges: Plug, Ring, Snap, Gap, Taper, Profile and Position gauges. Taylor's principle. Design of Go and No Go gauges..

Unit II

LINEAR MEASUREMENT: Length standard, line, ends & wavelength standards slip gauges – calibration of the slip gauges, Dial indicator, micrometers.

MEASUREMENT OF ANGLES AND TAPERS: Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate,

OPTICAL MEASURING INSTRUMENTS: optical flat and their uses, optical projector interferometers.

FLATNESS MEASUREMENT: straight edge– surface plate – optical flat and auto collimator.

Unit III

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surface waviness- Numerical assessment of surface finish – CLA, R.M.S Values – Ra , Rz

values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.

MEASUREMENT THROUGH COMPARATORS: Comparators – Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

Unit IV

SCREW THREAD MEASUREMENT: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- Tool maker's microscope.

GEAR MEASUREMENT: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness.

COORDINATE MEASURING MACHINES: Types of CMM and Applications of CMM.

Unit V

MACHINE TOOL ALIGNMENT TESTS: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools.

SURFACE ENGINEERING: Surface treatment processes and their characteristics and applications. (a) Overlay coatings (b) Diffusion coatings (c) Thermal or mechanical modification of Surfaces.

Text Books:

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH, 2012.
2. Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013
3. Statistical Quality Control by EL Grantt, McGrawhil.

References:

1. Engineering Metrology, Mahajan, DhanpatRai, 2nd edition, 2013.
2. BIS standards on Limits & Fits
3. Fundamentals of Dimensional Metrology, Connie Dotson , 4e, Thomson
4. Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, Mc Graw Hill, 2013.
5. Instrumentation, measurement &analysis, B.C.Nakra& KKChoudhary, TMH, 6th edition, 2011.
6. Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI, PE
7. Alan s.morris "the essence of measurement", prentice hall of india,2004

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	-
CO2	3	-	3	-	3	-	-	-	-	1	1	3
CO3	3	-	3	-	3	-	-	-	-	1	1	3
CO4	3	-	3	-	3	-	-	-	-	-	1	3
CO5	3	3	3	1	3	-	-	-	3	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip tests.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : 5G564

Course Name : APPLIED THERMODYNAMICS-III

Course prerequisites : Physics, Engineering Mathematics, Basic Thermodynamics, Fluid mechanics.

Course Objectives :

- To understand the working principles classification and applications of Gas Turbine and jet Propulsion.
- percieve the function and operation of the basic components of a vapour compression system.
- To recognize the basic components and working of a different vapour absorption refrigeration systems and their applications.
- To familiarize the students in understanding the psychometric process and operation of various air conditioning systems installed for different applications.
- To gain knowledge on different Air conditioning equipment and heat pump circuits.

Expected Outcomes : Student will be able to:

1. Understand the basic cycle, working principle,classification, performance of gas turbines, Jet propulsion and rocket propulsion system.
2. Examine the purpose and functioning of various components in the domestic refrigerator, analyzing the concept of sub-cooling and super heating in improving the COP.
3. Analyze the basic cycle, working principle of various types of vapour absorption refrigeration systems, its calculation of COP And Refrigerant properties.
4. Evaluate various Psychometric Properties, calculations of heat loads for various applications and selection of air-conditioning system based on climatic Seasons.
5. Select different heat pump circuits based on the requirement and Air conditioning equipment.

Unit I

GAS TURBINES: Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating –Closed and Semi-closed cycles – merits and demerits.

JET PROPULSION: Principle of Operation –Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines –Turbo jet, Turbo prop, Pulse jet – Schematic Diagram. Introduction to Rocket propulsion.

Unit II

INTRODUCTION TO REFRIGERATION: Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods - Air Refrigeration- Ideal and

Actual cycles, Open and Dense air systems – Refrigeration needs of Air craft's. Types. (Simple air cooling system and Boot Strap air cooling system- problems).

VAPOUR COMPRESSION REFRIGERATION: Basic cycle - working principle and essential components of the plant – COP – Representation η of cycle on T-S and P-h charts – Expander vs. Throttling, effect of sub cooling and super heating – cycle analysis – Actual cycle- Influence of various parameters on system performance – Construction and Use of P-h charts – numerical Problems.

Unit III

VAPOUR ABSORPTION REFRIGERATION SYSTEM: description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System -Calculation of max COP. Principle of operation of three Fluid absorption **Refrigerants** : Properties, Classification of Refrigerants, Ozone Depletion, Global Warming.

Unit IV

INTRODUCTION TO AIR CONDITIONING: Psychometric Properties & Processes – Characterization of Sensible and latent heat loads — Need for Ventilation, Consideration of Infiltrated air – Heat Load concepts: RSHF, GSHF- Problems. Requirements of human comfort and concept of Effective Temperature- Comfort chart –Comfort Air Conditioning- Summer, winter & year round air conditioning- simple problems.

Unit V

AIR CONDITIONING EQUIPMENT: Humidifiers – dehumidifiers – air filters, fans and blowers. HEAT PUMP – Heat sources – different heat pump circuits.

Text Books:

1. Refrigeration and Air Conditioning, CP Arora 3rd Edition TMH,
2. Principles of Refrigeration Dossat Pearson Education 5th Ed 2012.
3. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar Dhanpatrai & Co 2015.

Reference Books:

1. Refrigeration and Air Conditioning, Manohar Prasad, New Age, 3rd Ed,2015.
2. Refrigeration and Air Conditioning by R.K Rajput Sk Kataria & sons 3 rd Edition 2012.
3. A text book of Refrigeration and Air Conditioning,R.S.Khurmi & J.K.Gupta,S.Chand & Co 2015.
4. Refrigeration and Air Conditioning. P.L.Ballaney, Khanna Publcation 7th edition.
5. Refrigeration and Air Conditioning. R.C.Arora, PHI 2010,
6. Basic Refrigeration and Air Conditioning,Ananthanarayanan,TMH 3rd Edition.

Tables/Codes: Thermal Engineering Data Book containing Refrigerant and Psychrometric property Tables and charts

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	3	1	-	-	-	-	-
CO2	3	3	3	3	-	3	-	-	-	-	-	-
CO3	3	3	3	3	-	3	-	-	-	-	-	-
CO4	3	3	3	3	-	3	-	-	-	-	-	-
CO5	3	3	3	3	-	3	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by Assignments &slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G565**

Course Name : **DESIGN OF MACHINE ELEMENTS – II**

Course prerequisites : Engineering Mechanics, Mechanics of Solids.

Course Objectives :

- To learn the basic concepts of design of power transmission elements.
- To understand the design concepts of various types of springs, bearings and gears
- To help the students in applying design concepts of IC engine parts like Piston, cylinder, connecting rod and crank shaft.

Expected Outcomes : Student will be able to:

1. Design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings against sliding contact bearings.
2. To know various forces acting on I C engine parts and failure criteria to be adopted for various parts.
3. Design helical springs for two wheel vehicle and laminated springs for trucks.
4. Design belt drives for different input conditions.
5. Design spur and helical gears for different input conditions.

UNIT – I

SLIDING CONTACT BEARINGS: Types of Journal bearings – Lubrication – Petroff's equation, McKee's investigation, nomenclature, Bearing Modulus–bearing materials – journal bearing design.

UNIT – II

ROLLING CONTACT BEARINGS: Types of rolling contact bearings – Selection of bearing type, Static loading of ball & roller bearings Stribeck's equation, Dynamic load carrying capacity, equivalent bearing load, selection of bearing life, design for cyclic loads and speeds, bearing with a probability of survival other than 90%.

UNIT – III

ENGINE PARTS: Pistons, Forces acting on piston – Construction Design and proportions of piston - Thrust in connecting rod – stress due to whipping action on Connecting rod ends – Cranks and Crank shafts, strength and proportions of over hung cranks.

UNIT – IV

MECHANICAL SPRINGS: Introduction- types of Springs– Stress and deflection of closed under axial pull and axial couple. Springs for fatigue loading - Leaf springs.

POWER TRANSMISSIONS SYSTEMS: Design of Flat belt drives & V-belt drives.

UNIT – V

SPUR GEARS: Introduction, classification of gears, terminology of spur gears, Force analysis, beam strength of gear tooth, effective load on gear tooth, Design analysis of spur gears – Estimation of module and face width, check for plastic deformation. Check for dynamic and wear considerations for spur gears

HELICAL GEARS: Introduction, terminology of helical gears, Force analysis, beam strength of gear tooth, effective load on gear tooth, Design analysis of helical gears – Estimation of module and face width, check for plastic deformation. Check for dynamic and wear considerations for helical gears.

Text Books:

1. V B Bhandari, Design of machine elements, TMH, 2016.
2. R.S. Khurmi &J.S.Gupta, Machine Design, S.Chand Publications, 2014.

References:

1. J.E. Shigley, Machine design.
2. T. Krishna Rao, Design of Machine Elements-I. I.K. International.
3. T.V. Sundaramoorthy & N.Shanmugam, Machine Design. Khanna Publishers, 2003.
4. Kanniah, Machine Design. Scitech Publishers
5. Data Books: (i) P.S.G. College of Technology
   (ii) BalaveerSwamy and Mahadevan

Tables/Codes: Design data books are to be supplied in examination.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	3	-	-	-	2	-
CO2	3	3	3	3	-	-	3	-	-	-	2	-
CO3	3	3	3	3	-	-	3	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester	**L**	**T**	**P**
	3	**-**	**0**

Course Code : **5G566**

Course Name : **INDUSTRIAL MANAGEMENT**

Course prerequisites : Basic knowledge on engineering mathematics.

Course Objectives :

- To know the concepts of management and its functions, various organizational structures.
- To gain knowledge on plant location, layouts and analyze concepts of network techniques.
- To learn concepts related to work study and work sampling.
- To ensure that the students can apply/analyze relevant quantitative models to solve real world problems.
- To make the students capable of appraising real life business situations and suggest solution alternatives as related to operations management techniques.

Expected Outcomes :Student will be able to:

1. Understand the basic concepts of management & organization structures, types, merits and demerits.
2. Understand the importance of plant locations & plant layouts, concepts of PERT, CPM and crashing of simple networks.
3. Understand the concept of work study, method study and work measurement, work sampling.
4. Learn the concepts of material managementandQuality Control.
5. Understand the functions of HRM& marketing.

Unit I

Concepts of Management and Organization – Functions of Management – Evolution of Management Thought: Taylor's Scientific Management, Fayol's Principles of Management - Systems Approach to Management.

DESIGNING ORGANIZATIONAL STRUCTURES Basic concepts related to Organization - Departmentation and Decentralisation, Types of mechanistic and organic structures of organization (Line organization, Line and staff organization, functional organization, Committee organization, matrix organization and their merits and demerits.

Unit II

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 – travel chart (elementary treatment).

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 -critical path calculation-crashing of simple of networks.

Unit III

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- Applications.

Unit IV

MATERIALS MANAGEMENT: Objectives, Inventory – functions, types, associated costs, inventory classification techniques. Stores Management and Stores Records. Purchase management, duties of purchase manager, associated forms.

INSPECTION AND QUALITY CONTROL types of inspections – Difference between inspection & quality control. 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.

Unit V

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 life cycle.

Text Books:

1. Amrine, *Manufacturing Organization and Management.* Pearson, 2004, 2nd Ed.
2. O.P. Khanna, *Industrial Engineering and Management*. Dhanpat Rai.

Reference Books:

1. Stoner, Freeman, Gilbert, Management, Pearson Edu., 2005, 6th Ed.
2. PanneerSelvam, Production and Operations Management. PHI, 2004.
3. Dr.C. Nadhamuni Reddy and Dr. K. Vijaya Kumar Reddy, Reliability Engineering & Quality Engineering. Galgotia Publ. Pvt. Ltd.
4. Ralph M Barnes, Motion and Time Studies. John Wiley and Sons, 2004.
5. Chase, Jacobs, Aquilano, Operations Management. TMH, 2003, 10th Ed.
6. L.S. Srinath, PERT/CPM. East-West Press, 2000.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	3	3	-	3
CO2	3	3	-	3	-	-	-	-	-	-	3	
CO3	3	3	-	3	-	-	-	-	-	-	-	3
CO4	3	3	-	2	-	-	1	-	3	3	2	-
CO5	3	-	-	-	-	2	-	1	3	3		-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments& slip tests.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester	**L**	**T**	**P**
	0	**-**	**3/2**

Course Code : **5G567**
Course Name : **METROLOGY AND MACHINE TOOLS LAB**
Course prerequisites : Machine Tools, Metrology and Surface Engineering
Course Objectives :

- Demonstrate the usage of metrology lab equipment.
- Know the working principles of different instruments.
- To learn the measurement of the Angle and taper s by Bevel protractor, Sine bar, etc.
- To learn the Step turning and taper turning and thread cutting on lathe machine
- To learn the operations of Drilling, Tapping, Shaping, Slotting and milling.

Expected Outcomes : Student will be able to:

1. Apply the procedures to measure length, width, depth, bore diameters, external tapers, tool angles, and surface roughness by using different instruments.
2. Measure the angle and taper using Bevel protractor and Sine bar.
3. Conduct different machine alignment tests
4. Demonstrate knowledge of different machine tools used in machine shop.
5. Perform step, taper turning, knurling and threading operations on lathe.
6. Practical exposure on Flat Surface machining, Shaping, Slotting, Milling and grinding operations.

List of Experiments

SECTION A:

1. Measurement of lengths, heights, diameters by Vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, Vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by two wire/ three wire method.

10. Surface roughness measurement by Talysurf instrument.
11. Surface Wear Resistances Test using Electro Spark Coating Device.

SECTION B:

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planning
6. Job on Slotting
7. Job on Milling Job on Cylindrical Surface Grinding
8. Job on Grinding of Tool angles.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	3	-	-	-	3	-	-	-
CO2	3	-	-	-	3	-	-	-	3	-	-	-
CO3	3	-	-	-	3	-	-	-	3	-	-	-
CO4	3	3	3	3	3	-	-	-	3	-	-	-
CO5	2	2	-	-	2	-	-	-	2	-	-	-
CO6	3	3	-	-	3	-	-	-	3	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Continuous Evaluation
3. 10% of marks for Internal Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : **5G568**
Course Name : **MACHINE DYNAMICS LAB**
Course prerequisites : Dynamics of Machinery
Course Objectives :

- To analyze the behavior of a vibrating system subjected to vibrations under damped and undamped conditions.
- To understand the effect of radius gyration using bifilar suspension.
- To study the effect of gyroscopic couple and whirling of shaft.
- To study the characteristics of watt and proell governors.
- To Understand Static and dynamic balancing of Machine.

Expected Outcomes : Student will be able to:

1. Estimate the natural frequency for single and double rotor systems, equivalent spring mass system and transverse
2. Determine the gyration using bifilar suspension.
3. Inspect the critical speed of shaft under the given load conditions and Demonstrate the working principles of gyroscope and cam
4. Study the characteristic curves of Watt, Proell governors and motion curves for the given cam follower setup
5. Examine the balancing of rotating masses in dynamic balancing machine.

List of Experiments

1. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils.
2. Determination of steady state amplitude of a forced vibratory system.
3. CAM Analysis-Study of Jump Phenomena.
4. Determination of the magnitude and orientation of the balancing mass in Static balancing and dynamic balancing.
5. Determination of the magnitude of gyroscopic couple, angular velocity of precession, and representation of vectors.
6. Determination of critical speed of Whirling of shaft.
7. Determination of characteristic curves of watt governor.
8. Determination of characteristic curves of proell governer.

9. To determine the radius of gyration of given flat using Bifilar suspension.
10. To study the free vibrations of two rotor system and to determine the frequency of vibration theoretically and experimentally.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	-
CO4	3	-	-	3	-	-	-	-	-	-	-	-
CO5	3	3	-	3	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Continuous Evaluation
3. 10% of marks for Internal Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

III Year B. Tech. II Semester	**L**	**T**	**P**
	-	**-**	**3**

Course Code : AUDIT COURSE

Course Name : **ADVANCED ENGLISH COMMUNICATION SKILLS LAB**

Course prerequisites : NIL

Course Objectives :

- To sensitize the student with the significance of the language skills required in his professional career
- To improve reading and listening comprehension and communication skills of the student
- To enable the student discuss ideas, and face interviews with confidence
- To help the students cultivate the required ability to face computer-based competitive exams such as GRE, TOEFL, CAT, GMAT etc

Expected Outcomes :

1. The student will be able to express himself fluently in social and professional contexts.
2. The student will enhance his skills of making a presentation confidently.
3. The student will learn how to face Interviews confidently, to participate in meetings effectively.
4. The student will face CBTs with greater felicity.

Syllabus:

- **Résumé Preparation** – structure, formats and styles – planning - defining career objective - projecting one's strengths and skills - creative self-marketing–sample resumes - cover letter
- **Interview Skills**- concept and process - pre-interview planning – preparation - body language - answering strategies – frequently asked questions
- **Group Discussion** –communicating views and opinions – discussing – intervening – agreeing and disagreeing –asking for and giving clarification - substantiating - providing solution on any given topic across a cross-section of individuals - modulation of voice and clarity - body language – case study
- **Oral Presentations(Individual)** – collection of data from various sources – planning, preparation and practice – attention-gathering strategies - transitions – handling questions from audience
- **Oral Presentations(Team)**- appropriate use of visual aids –PowerPoint presentation.

- **Reading Comprehension**- reading for facts – scanning – skimming - guessing meanings from context– speed reading
- **Listening Comprehension** – listening for understanding - responding relevantly

Minimum Requirements:

Advanced English Language Communication Skills Lab is conducted at two places:

- Computer-aided Language Lab with 60 computer machines, one teacher console, LAN facility and Language Learning software for self-study.
- Communication Skills Lab with movable chairs, a discussion room, Public Address System, a Television, a DVD Player, a camcorder, an LCD Projector and a computer machine.
- Manual cum Record, prepared by Faculty Members of English of the college will be used by students.

Suggested Software:

- It's your Job published by Clarity
- Business Writing published by Clarity
- Active Listening published by Clarity
- Active Reading published by Clarity
- Software published by Globarena
- Cambridge Advanced Learner's Dictionary
- Oxford Advanced Learner's Dictionary

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ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G571**

Course Name : **OPERATIONS RESEARCH**

Course prerequisites : Engineering Mathematics, Industrial Management.

Course Objectives :

- To enable the students to the nature and scope of various decision making situations within business contexts, understand and apply operations research techniques to industrial applications.
- To learn the fundamental techniques of Operations Research and to choose a suitable OR technique to solve problem.

Expected Outcomes : Student will be able to:

1. Create mathematical models of the real life situations and capable of obtaining best solution using Graphical Method and Simplex Method, Big M method and the student must be able to implement the theory of duality for simplifying the solution procedure for certain LPPs.
2. Solve the special cases of LPP such as Transportation, Assignment and Job sequencing problems.
3. Find optimal replacement period of a machine or group of parts.
4. Choose the best strategy out of the available strategies in the competition or game.
5. Understand and will apply the fundamentals of waiting lines in real life situations.
6. Understand and will apply the fundamentals of inventory in real life situations.
7. Apply Dynamic Programming technique to solve the complex problems by breaking them into a series of sub-problems.
8. Simulate the queuing, inventory and capital budgeting models.

UNIT – I

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

LINEAR PROGRAMMING: Problem Formulation – Graphical solution – Simplex method –Artificial variables techniques –Two-phase method, Big-M method – Duality Principle.

UNIT – II

TRANSPORTATION PROBLEM: Formulation – Optimal solution, unbalanced transportation problem –Degeneracy.

ASSIGNMENT PROBLEM: Formulation – Optimal solution - Variants of Assignment Problem-Travelling Salesman problem, Job Sequencing models.

UNIT – III

REPLACEMENT MODELS: Introduction – Replacement of items that deteriorate with time – with change in money value - without change in money value – 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 – m X 2, 2 X n and m x n games – Graphical method, Dominance principle.

UNIT – IV

WAITING LINES: Introduction – single channel – Poisson arrivals – exponential service times – with infinite queue length models.

INVENTORY: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks.

UNIT – V

DYNAMIC PROGRAMMING: Introduction – Bellman's Principle of optimality – Applications of dynamic programming- shortest path problem – linear programming problem.

SIMULATION: Definition – Types of simulation models – phases of simulation– applications of simulation – Queuing problems – advantages and disadvantages – Simulation languages.

Text Books:

1. S.D. Sharma, Operations Research, Kedarnath and Ramnath Publications
2. Taha, Introduction to Operations Research. PHI
3. Hiller & Libermann, Introduction to Operations Research. TMH.

References:

1. A.M. Natarajan, P.Balasubramani, A. Tamilarasi, Operations Research. Pearson Edu.
2. Maurice Saseini, ArhurYaspan& Lawrence Friedman, Operations Research: Methods & Problems.
3. R. Panneerselvam, Operations Research. PHI Publ.
4. Wagner, Operations Research. PHI Publ.
5. J.K. Sharma, Operations Research. Mac Milan.
6. Wayne L. Winston, Operations Research. Thomson Brooks/Cole.
7. Veerachari and V. Ravi Kumar, Operations Research. I.K. International.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	1	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	3	-	-	-	-	-
CO3	3	3	2	-	-	-	3	-	-	-	-	-
CO4	3	3	-	-	-	-	3	-	-	-	-	-
CO5	3	3	2	-	-	1	3	-	-	-	-	-
CO6	3	3	-	-	-	1	3	-	-	-	-	-
CO7	3	3	-	-	-	-	3	-	-	-	-	-
CO8	3	3	-	-	1	-	3	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

. ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G572**

Course Name : **AUTOMOBILE ENGINEERING**

Course prerequisites : Basic Thermodynamics, Applied Thermodynamics

Course Objectives:

- To gain the basic knowledge on automobile components and its electrical systems.
- To understand various fuel supply systems and their emission control techniques.
- To acquire knowledge on cooling and ignition systems used in automobiles.
- To obtain knowledge on power transmission systems.
- To get the basic idea on steering, suspension, and braking systems employed in automobiles.

Expected Outcomes : Student will be able to:

1. To gain the knowledge on components and electrical system on four wheeler automobile.
2. Enrich the standards in various fuel supply systems, emission and its control techniques in automobiles.
3. Understand purpose of cooling and ignition systems used in automobiles
4. Knowledge on transmission system of an automobile.
5. Understand purpose of steering system, suspension system, braking system and their identification..

Unit I

INTRODUCTION: Components of a four wheeler automobile – chassis and body – power unit –power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – oil filters, oil pumps – crank case ventilation.

ELECTRICAL SYSTEM : Charging circuit, generator, current – voltage regulator – starting system, Bendix drive, mechanism of Solenoid switch, Lighting systems, Horn, wiper, Fuel gauge – oil pressure gauge, Engine température indicator

Unit II

FUEL SYSTEM: S.I. ENGINE: Fuel supply systems, Mechanical and electrical fuel pump – filters– carburetor – types – air filters – Gasoline injection, Fuel systems used in latest cars.

C.I. ENGINES: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle spray formation, injection timing, testing of fuel pumps,Fuel systems used in latest cars.

EMISSIONS AND TYPES OF FUEL SYSTEMS: Pollution standards National and international – Pollution Control– Techniques – Multipoint fuel injection for SI Engines-Common rail diesel injection Emissions from alternative energy sources– hydrogen, Biomass, alcohols, LPG, CNG - their merits and demerits

Unit III

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

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

Unit IV

TRANSMISSION SYSTEM: Clutches- Principle- types: cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear box- types: sliding mesh, constant mesh, synchromesh, epi-cyclic, over drive, torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential, rear axles.

Unit V

STEERING SYSTEM: Steering geometry – camber, castor, king pin rake, combined angle toe-in, center point steering. Steering gears – types, steering linkages.

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

BRAKING SYSTEM: Mechanical brake system, Hydraulic brake system, Pneumatic and vacuum brake systems, Antilock braking system and Traction control.

Text Books:

1. *Thipse, Alternate Fuels. Jaico Publ. House.1st Ed.2010.*
2. Kirpal Singh*, Automotive Mechanics –Vol.1&Vol.2.*, standard publishers distributors ,13th Ed.2013
3. William Crouse, *Automobile Engineering. 10th Ed.2006*

Reference Books:

1. R.K.Rajput, *Automobile Engineering.* Lakshmi Publ.1st Ed.2013.
2. K.K. Ramalingam, *Automobile Engineering*. SciTech Publ.3rdEd.2011.
3. Newton, Steeds & Garret, *Automotive Engines*.

Mapping of COs and POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	3	-	3	-	-	-	-	-	-	3
CO2	-	-	3	1	3	-	1	-	-	-	-	3
CO3	-	-	3	-	3	-	-	-	-	-	-	3
CO4	-	-	3	-	3	-	-	-	-	1	-	3
CO5	-	-	-	-	-	1	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G573**
Course Name : **FINITE ELEMENT METHODS**
Course prerequisites : Engineering Mechanics, Engineering Mathematics, Mechanics of solids.

Course Objectives :

- To enable the students to understand fundamentals of finite element analysis.
- To learn the principles involved in the discretization of domain with various elements, polynomial interpolation and assembly of global arrays.
- To learn the application of FEM in various structural and non structural problems by incorporating boundary conditions.

Expected Outcomes : Student will be able to:

1. Identify mathematical model to solve common engineering problems by applying the finite element method. .
2. Formulate and solve problems in one dimensional structures like bars.
3. Derive element matrices to find stresses in beams and trusses.
4. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric problems.
5. Formulate FE equations for iso-paramteric elements and heat transfer problems
6. Solve dynamic problems where the effect of mass matters during the analysis.

UNIT – I

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Strain - Displacement relations. Stress - strain relations.

ONE-DIMENSIONAL FINITE ELEMENT METHODS: Bar elements, temperature effects. Element matrices, assembling of global stiffness matrix, Application of boundary conditions, Elimination and penalty approaches, solution for displacements, reaction, stresses, temperature effects, Quadratic Element.

UNIT II

TRUSSES: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses, and temperature effects.

BEAMS: Element matrices, assembling of global stiffness matrix, solution for displacements, reaction, stresses

UNIT III

TWO DIMENSIONAL PROBLEMS: Basic concepts of plane stress and plane strain, stiffness matrix of CST element, finite element solution of plane stress problems.

AXI-SYMMETRIC MODEL: Finite element modelling of axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

UNIT IV

ISO-PARAMETRIC FORMULATION: Concepts, sub parametric, super parametric elements, 2 dimensional 4 noded iso-parametric elements, and numerical integration.

HEAT TRANSFER PROBLEMS: Heat transfer with conduction, convection, Heat transfer through fins.

UNIT V

DYNAMIC ANALYSIS: Dynamic equations, Eigen value problems and their solution methods, simple problems.

Text Books:

1. Tirupathi.R. Chandrupatla and Ashok D. Belegundu, Introduction to Finite elements in Engineering. PHI.
2. S Senthil, Introduction of Finite Element Analysis. Laxmi Publications.
3. SMD Jalaluddin, Introduction of Finite Element Analysis. Anuradha Publications.

References:

1. K. J. Bathe, Finite element procedures. PHI.
2. SS Rao, The finite element method in engineering. Butterworth Heinemann.
3. J.N. Reddy, An introduction to the Finite element method. TMH.
4. Chennakesava, R Alavala, Finite element methods: Basic concepts and applications. PHI.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	3	-	-	-	1	1	-	1
CO2	3	3	1	1	3	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	1	1	3	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip test..

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G679**
Course Name : **DISASTER MANAGEMENT (OPEN ELECTIVE)**
Course prerequisites : NIL.
Course Objectives :

- To make the students convergent with various disasters and its impacts, risk reduction methods.

Expected Outcomes :

1. The students will learn basic concepts of various disasters.
2. The students must learn various classification of disasters hazard and vulnerability profile of India.
3. The students will learn impacts, global and national disaster trends.
4. The students will learn disaster management cycle and its phases and DRR programmes in India and activities of national disaster management academy.
5. The students should be able to analyze factors affecting vulnerability of developmental projects and environmental modifications for sustainable development.

Unit I

INTRODUCTION- Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, impact, prevention, mitigation).

Unit II

DISASTERS- Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Unit III

DISASTER IMPACTS- Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

Unit IV

DISASTER RISK REDUCTION (DRR)- Disaster management cycle–its

phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Unit V

Disasters, Environment and Development- Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental-friendly recovery; reconstruction and development methods.

Text Books/References:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: techniques &Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	2	1	-	2	2	2	-	-
CO2	1	-	-	-	-	-	-	2	3	3	-	2
CO3	1	-	-	-	-	3	-	3	2	2	-	-
CO4	-	-	-	-	-	-	-	3	3	3	-	2
CO5	1	-	-	-	-	-	2	3	-	-	-	3
CO6	-	-	-	-	2	1	-	2	2	2	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G27C**

Course Name : **SYSTEM MODELING & SIMULATION (OPEN ELECTIVE)**

Course prerequisites : NIL.

Course Objectives :

- To understand the basic system concepts and definitions of system.
- Techniques to model and to simulate various systems.
- To analyze a system and to make use of the information to improve the performance

Expected Outcomes : Student will be able,

1. To understand the basic system concepts and definitions of system.
2. Techniques to model and to simulate various systems.
3. To analyze a system and to make use of the information to improve the performance

Unit–I

Basic Simulation Modeling, Systems, Models and Simulation, Discrete Event Simulation, Simulation of Single Server Queuing System, Simulation of Inventory System, Alternative approach to Modeling and Simulation.

Unit–II

SIMULATION SOFTWARE: Comparison of Simulation Packages with Programming Languages, Classification of Software, Desirable Software Features, General Purpose Simulation Packages – Arena, Extend and Others, Object Oriented Simulation, Examples of Application Oriented Simulation Packages.

Unit–III

BUILDING SIMULATION MODELS: Guidelines for Determining Levels of Model Detail, Techniques for Increasing Model Validity and Credibility, **Modeling Time Driven Systems:** Modeling Input Signals, Delays, System Integration, Linear Systems, Motion Control Models, Numerical Experimentation.

Unit–IV

EXOGENOUS SIGNALS AND EVENTS: Disturbance Signals, State Machines, Petri Nets & Analysis, System Encapsulation,

MARKOV Process: Probabilistic Systems, Discrete Time Markov Processes, Random Walks, Poisson Processes, the Exponential Distribution, Simulating a Poison Process, Continuous-Time Markov Processes.

Unit–V

EVENT DRIVEN MODELS AND SYSTEM OPTIMIZATION: Simulation Diagrams, Queuing Theory, Simulating Queuing Systems, Types of Queues, Multiple Servers, System Identification, Searches, Alpha/Beta Trackers, Multidimensional Optimization, Modeling and Simulation Mythology.

Text Books:

1. System Modeling & Simulation, an Introduction – Frank L. Severance, John Wiley & Sons, 2001.
2. Simulation Modeling and Analysis – Averill M. Law, W. David Kelton, TMH, 3rd Edition, 2003.

Reference Book:

Systems Simulation – Geoffrey Gordon, PHI, 1978.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	-	-	-	-	-	-	-	-	-
CO2	3	-	3	2	2	-	-	-	-	-	-	-
CO3	3	2	2	-	2	-	-	-	-	2	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G57D**

Course Name : **TOTAL QUALITY MANAGEMENT (OPEN ELECTIVE)**

Course prerequisites : NIL.

Course Objectives : The course aims to provide the student with the ability

- To demonstrate knowledge of quality management principles, techniques and philosophies.
- To apply statistical process control techniques to improve the quality.
- To demonstrate knowledge of TQM tools for industries.
- To apply appropriate techniques for reliability assessment.
- To demonstrate knowledge of advanced techniques for reliability engineering.

Expected Outcomes : Student will be able,

1. Understand the concept of quality management principles, techniques and philosophies.
2. Understand how to apply statistical process control techniques to improve the quality
3. Can able to demonstrate knowledge of TQM tools for industries.
4. Able to apply appropriate techniques for reliability assessment.
5. Understand the concept of advanced techniques for reliability engineering

UnitI

INTRODUCTION: Definition of Quality, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Strategic Planning, Deming Philosophy, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen

Unit II

STATISTICAL PROCESS CONTROL (SPC) : The seven tools of quality, Statistical Fundamentals, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

Unit III

TQM TOOLS AND QUALITY SYSTEMS : Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss

Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Quality Auditing

Unit IV

INTRODUCTION TO RELIABILITY : Importance of reliability, performance cost and reliability, quality and safety, system configuration with examples, stochastic processes, bathtub concept, MTBF, MTTR, hazard rate, failure rate, probability and sampling, cumulative probability distribution function, data and distributions.

Unit V

RELIABILITY IN DESIGN AND LIFE CYCLE COSTING : Survival rate, bath-tub curve analysis of characteristics of failure regimes, design synthesis, reliability effort function, safety margin, allocation of reliabilities by AGREE, ARINC, proportional distribution of unreliability, heuristic method, mean and median methods.

Text Books :

1. Joel E. Rose, *Total Quality Management*, 3rd Edition, Kogan Page Ltd., USA 1999
2. Srinath, L. S., *Reliability Engineering*, Affiliated East West Press, New Delhi 2005

Reference Books :

1. James R.Evans& William M.Lidsay, "The Management and Control of Quality", (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management", McGraw Hill, 1991.
3. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.
4. E. E. Lewis, "Introduction to Reliability Engineering", John Wiley and Sons.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	3	-	-	3	3
CO2	3	3	-	-	-	-	-	3	-	-	3	3
CO3	3	3	-	-	-	-	-	3	-	-	3	3
CO4	3	3	-	-	-	-	-	3	-	-	3	3
CO5	3	-	-	-	-	-	-	3	-	-	3	3

Mode of Evaluation:

4. 70% of marks for External Evaluation.
5. 20% of marks for Internal Evaluation.
6. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G57E**

Course Name : **INTEGRATED PRODUCT DEVELOPMENT (OPEN ELECTIVE)**

Course prerequisites : NIL.

Course Objectives : The course aim to provide the student with the ability

- To understand the various society inputs required to develop the product and methodology to be followed to develop the product.
- To understand the various requirements for the product system design, modeling and optimization of the total product system.
- To know the various activities involved in the Design and Testing of a Product and its components.
- To understand the usage of Rapid prototype technology to develop the prototypes of components, assembling of components, manufacturing of components, testing the product as per the test standards and certification from various approval agencies.
- To know the various activities involved in the product maintenance, estimation of product life, Intellectual Property Rights and configuration of management.

Expected Outcomes : Students able to

1. Learn the various society inputs required to develop the product and methodology to be followed to develop the product.
2. Understand the various requirements for the product system design, modeling and optimization of the total product system.
3. Learn the various activities involved in the Design and Testing of a Product and its components.
4. Learn the usage of Rapid prototype technology to develop the prototypes of components, assembling of components, manufacturing of components, testing the product as per the test standards and certification from various approval agencies.
5. Know the various activities involved in the product maintenance, estimation of product life, Intellectual Property Rights and configuration of management.

Unit I

FUNDAMENTALS OF PRODUCT DEVELOPMENT Global Trends Analysis and Product decision: Types of various trends affecting product decision - Social Trends-Technical Trends- Economical Trends- Environmental Trends- Political/ Policy Trends- PESTLE Analysis. Introduction to Product Development Methodologies and Management: Overview of Products and Services- Types of Product Development- Overview of Product Development methodologies - Product Life Cycle - Product Development Planning and Management .

Unit II

REQUIREMENTS AND SYSTEM DESIGN Requirement Engineering: Types of Requirements- Requirement Engineering- Analysis -Traceability Matrix and Analysis- Requirement Management. System Design & Modeling: Introduction to System Modeling- introduction to System Optimization- System Specification-Sub-System Design- Interface Design.

Unit III

DESIGN AND TESTING Conceptualization -Industrial Design and User Interface Design- Introduction to Concept generation Techniques-Concept Screening & Evaluation- Concept Design- S/W Architecture- Hardware Schematics and simulation-Detailed Design: Component Design and Verification- High Level Design/Low Level Design of S/W Programs- S/W Testing-Hardware Schematic- Component design- Layout and Hardware Testing.

Unit IV

IMPLEMENTATION & INTEGRATION Prototyping: Types of Prototypes -Introduction to Rapid Prototyping and Rapid Manufacturing. System Integration- Testing- Certification and Documentation: Introduction to Manufacturing /Purchase and Assembly of Systems- Integration of Mechanical, Embedded and S/W systems- Introduction to Product verification and validation processes - Product Testing standards, Certification and Documentation.

Unit V

SUSTENANCE ENGINEERING AND BUSINESS DYNAMICS Sustenance -Maintenance and Repair- Enhancements Product End of Life (EoL): Obsolescence Management-Configuration Management- EoL Disposal.

The Industry - Engineering Services Industry overview- Product development in Industry versus Academia The IPD Essentials- Introduction to vertical specific product development processes- Product development Trade-offs- Intellectual Property Rights and Confidentiality- Security and configuration management

Text Books :

1. NASSCOM student Handbook "Foundation Skills in Integrated Product Development".
2. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9

Reference Books:

1. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9
2. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint 2004, Pearson Education,ISBN. 9788177588217
3. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", 2nd Edition Reprint, Cengage Learning, 2010, ISBN 0495668141
4. Clive L.Dym, Patrick Little, "Engineering Design: A Project-based Introduction", 3rd Edition, John Wiley & Sons, 2009, ISBN 978-0-470-22596-7
5. Product Design Techniques in Reverse Engineering and New Product Development, KEVIN OTTO & KRISTIN WOOD, Pearson Education (LPE), 2001.
6. The Management and control of Quality-6th edition-James R. Evens, William M Lindsay Pub:son south-western(www.swlearning.com)

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	2	-	3	-	-	2	-	-	-
CO2	2	3	2	1	-	-	-	-	-	-	-	-
CO3	1	-	2	2	1	-	-	-	-	-	-	-
CO4	1	-	-	-	2	-	-	-	-	-	-	-
CO5	1	-	-	-	-	1	-	-	1	-	1	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

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ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G377**

Course Name : **NANOTECHNOLOGY AND APPLICATIONS (OPEN ELECTIVE)**

Course prerequisites : NIL.

Course Objectives : The course aims to provide the student with the ability

- To learn the fundamentals of Nano materials and technology.
- To understand the applications and limitation of Nano Technology.

Expected Outcomes : Upon completion of the course, students can

1. Learn the basics of Nano Materials and Nano Scale
2. Knows the fundamentals of Quantum Mechanics.
3. Understands the basics of different Nano Materials.

Unit-I

INTRODUCTION: Introduction to nanotechnology and materials, Nano materials, Introduction to nano-sizes and properties comparison with the bulk materials, Different shapes and sizes and morphology.

FABRICATION OF NANO MATERIALS: Top Down Approach Grinding, Planetory milling and Comparison of particles, Bottom Up Approach, Wet Chemical Synthesis Methods, Micro emulsion Approach, Colloidal Nano particles Production, Sol Gel Methods, Sono chemical Approach, Microwave and Atomization, Gas phase Production Methods : Chemical Vapour Depositions.

Unit-II

KINETICS AT NANOSCALE: Nucleation and growth of particles, Issues of Aggregation of Particles, Oswald Ripening, Stearic hindrance, Layers of surface charges, Zeta Potential and pH.

Carbon Nano materials: Synthesis of carbon bucky-balls, List of stable carbon allotropes extended, fullerenes, metallo fullerenes, solid C60, bucky onions, nano tubes, nano cones.

Unit-III

QUANTUM MECHANICS: Quantum dots and its Importance, Pauli exclusion principle, Schrödinger's equation, Application of quantum Dots: quantum well, wire, dot, characteristics of quantum dots, Synthesis of quantum dots Semi-conductor quantum dots

Unit-IV

NANOMATERIALS CHARACTERIZATION: Fractionation principles of Particle size measurements, Particle size and its distribution, XRD, Zeta potential, Electronic band structure Electron statistics Application:

Unit-V

NANOBIOLOGY: Biological synthesis of nano particles and applications in drug delivery, Nano containers and Responsive Release of active agents, Layer by Layer assembly for nano spheres, Safety and health Issues of nano materials, Environmental Impacts, Case Study for Environmental and Societal Impacts.

Text Books:

1. Kulkarni Sulabha K, Nanotechnology: Principles and Practices, Capital Publishing Company, 2007
2. Stuart M. Lindsay, Introduction to Nanoscience, Oxford University Press, 2009.
3. Robert Kelsall, Ian Hamley, Mark Geoghegan, Nanoscale Science and Technology, John Wiley & Sons, 2005.
4. Gabor L. Hornyak , H.F. Tibbals , Joydeep Dutta , John J. Moore Introduction to Nanoscience and Nanotechnology CRC Press
5. Davies, J.H. 'The Physics of Low Dimensional Semiconductors: An Introduction', Cambridge University Press, 1998.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	2	3	2	2	2	2	3	3	2
CO2	2	2	3	2	3	2	2	2	2	3	2	2
CO3	1	2	3	3	3	2	2	2	2	1	3	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G378**

Course Name : **MEDICAL INSTRUMENTATION (OPEN ELECTIVE)**

Course prerequisites : NIL.

Course Objectives : The course aims to provide the student with the ability

- To learn the fundamentals of Electro neurogram and Blood Pressure.
- To understand the applications of Blood flow measurement and Pulse Oximeter.

Expected Outcomes : Upon completion of the course, students can

1. Learn the basics of Human being Bio potentials.
2. Know the fundamentals of Blood flow and volume measurement.

Unit-I

GENERAL INTRODUCTION: The cell, body fluids, Musculoskeletal system, respiratory system, gastrointestinal system, Nervous system, endocrine system and circulatory system. Origin of Bio potentials: electrical activity of Excitable cells: the resting state, The active state, Volume conductor fields, Functional organization of the peripheral nervous system: Reflex are & Junctional transmission.

Unit-II

THE ELECTRONEUROGRAM (ENG): The H-Reflex, The Electromyogram (EMG), The Electrocardiogram (ECG), heart and the circulatory system, Electro conduction system of the heart and heart problems, ECG waveform and Physical significance of its wave features, Electrical behavior of cardiac cells, The standard lead system, The ECG preamplifier, DC ECG Amplier, Defibrillator protection circuit, Electro surgery Unit filtering, Functional blocks of ECG system, Multichannel physiological monitoring system, Common problems encountered and remedial techniques.

Unit-III

BLOOD PRESSURE: indirect measurement of blood pressure, korotkoff sounds, auscultatory method using sphygmo manometer, Oscillometric and ultrasonic non invasive pressure measurement, Direct measurement of blood pressure H2O manometers, electronic manometry, Pressure transducers,. Pressure amplifier designs, Systolic, diastolic mean detector circuits

Unit-IV

BLOOD FLOW AND VOLUME MEASUREMENT: indicator dilution methods, Transit time flow meter, DC flow meter, Electromagnetic flow meter AC electromagnetic flow meter, Quadrature suppression flow meter, Ultrasonic flow meter, Continuous-wave Doppler flow meter, Electric impedance plethysmography, chamber plethysmography, Photo plethysmography.

Unit-V

PULSE OXIMETR: Principles of Operation, Absorption Spectrum, Sensor design, Pulse oximeter, Therapeutic and Prosthetic Devices. Cardiac Pacemakers: Lead wires and electrodes, Synchronous Pacemakers, rate responsive pacemaking, Defibrillators, cardioverters, Electrosurgical-unit, Therapeutic applications of laser, Lithotripsy Haemodialysis.

TEXT BOOKS:

1. John G Webster, Medical Instrumentation: Application and Design , John Wiley,3rd Ed. 2012.
2. Joseph J. Carr & John M. Brown , Introduction to biomedical Equipment Technology, 4th Ed., Prentice Hall India, 2001.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	3	2	-	-	-	-	-	2
CO2	2	2	2	2	3	2	-	-	-	-	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test..

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G178**

Course Name : **.NET TECHNOLOGIES (OPEN ELECTIVE)**

Course prerequisites : NIL.

Course Objectives : The Objective of the course is the student should be able to do the following things:

- Understand the components and ecosystem of Microsoft .NET framework.
- Apply object oriented programming concepts to develop C#.Net applications.
- Analyze data base connectivity through ADO.NET.
- Implement server side programming concepts through ASP.NET framework.
- Learn Web services to discover, access and use remote applications and data.

Expected Outcomes : After the completion of the course the student will be able to:

1. Understand the fundamentals of Microsoft .NET framework to develop, access, and interact with Internet applications.
2. Implement Object oriented programming concepts through C#.NET framework.
3. Apply ADO.NET to access data and data services from a database.
4. Analyze ASP.NET to build dynamic sites, web applications and web administrations.
5. Apply web services like WSDL and UDDI to exchange data between applications or systems.

Unit-I

INRODUCTION TO .NET FRAMEWORK: .NET Overview- Behind Microsoft .NET- The .NET Platform-.NET Framework Design Goals- .NET Framework- Common Language Runtime –CLR Environments and Executables-Metadata-JIT Compilation-Automatic Memory Management-Assemblies and Manifests-Intermediate Language(IL)- CTS and CLS-CLR Execution.

Unit-II

INTRODUCTION TO C# .NET PROGRAMMING: A Demonstration of Visual C#-Common Elements in Visual C- C# Core Language Features- Types- Classes- Structures-Enumeration- Inheritance- Interfaces- Polymorphism- Arrays and Collections- Generics-Operator Overloading- Delegates and Events- Introduction to LINQ Programming- Exception Handling- MSIL Programming.

Unit-III

APPLICATION DEVELOPMENT USING ADO .NET: Features of ADO .NET-Architecture of ADO .NET- ADO .NET Providers- Accessing Database using ADO .NET-Connection Opening and Closing- Command Object- Data Adapter- Dataset- Data Tables-Controlling table views with Data Views and Data Relation Objects- Data-binding in Windows Forms and Web Forms.

Unit-IV

INTRODUCTION TO ASP.NET: Introduction- Working in ASP.NET Controls- Session and Cookies- Caching- Authentication and Authorization-Web User Controls- Working with Web Config file- Implementing Security- Crystal Reports-Creating Setup and Deployment.

Unit-V

WEB SERVICES: Introduction to Web Services- Web Services Protocol and Standards-WSDL-Overview of UDDI- Calling a Web Service from a Browser- Calling a Web Service by using a proxy- Creating a Simple Web Service-AJAX

Text Books:

1. Thuan L. Thai. .NET Framework Essentials. O'Reilly, 2003, 3rd Ed.
2. Donis Marshall. Programming Microsoft Visual C# 2008. Microsoft Press 2008.
3. Francesco Balena. Programming Microsoft Visual Basic .NET. Microsoft Press 2006.

Reference Books:

1. Rebecca M. Riordan. Microsoft ADO.NET Step by Step. Microsoft Press2002.
2. Kogent, ASP.NET 3.5 Black Book, Dream Tech Publications, 2010.
3. Andy Wigley, Peter Roxburgh. Building Microsoft ASP.NET Applications for Mobile Devices. Microsoft Press 2003, 2nd Ed.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**-**	-	-	**3**	1	-	-	**3**	**-**	**3**	**3**
CO2	**3**	**3**	3	1	**3**	-	-	-	**3**	**3**	**3**	**3**
CO3	**3**	**-**	3	-	**3**	1	-	-	**3**	**3**	**-**	**3**
CO4	**3**	**-**	3	-	**3**	-	-	-	**-**	**3**	**3**	**3**
CO5	**3**	**3**	-	-	**3**	3	-	-	**3**	**-**	**3**	**-**

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test..

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

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Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G47B**

Course Name : **CYBER LAWS (OPEN ELECTIVE)**

Course prerequisites : NIL.

Course Objectives : Students are able to**,**

- To explain the basic information on cyber security.
- To understand the issues those are specific to amendment rights.
- To have knowledge on copy right issues of software's.
- To understand procedural issues of electronic contracts and digital signatures.
- To understand ethical laws of computer for different countries.

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

1. Critically evaluate ongoing developments in law relating to information technologies
2. Display an understanding of how these developments relate to one another.
3. Examine areas of doctrinal and political debate surrounding rules and theories;
4. Evaluate those rules and theories in terms of internal coherence and practical outcomes;
5. Draw on the analysis and evaluation contained in primary and secondary sources.

Unit I

FUNDAMENTALS OF CYBER SECURITY Introduction-Cyber Security and its Problem-Intervention Strategies: Redundancy, Diversity and Autarchy.

Unit II

ISSUES IN CYBER SECURITY Private ordering solutions, Regulation and Jurisdiction for global Cyber security, Copy Right-source of risks, Pirates, Internet Infringement, Fair Use, postings, criminal liability, First Amendments, Data Loss.

Unit III

INTELLECTUAL PROPERTY RIGHTS Copy Right-Source of risks, Pirates, Internet Infringement, Fair Use, postings, Criminal Liability, First Amendments, Losing Data, Trademarks, Defamation, Privacy-Common Law Privacy, Constitutional law, Federal Statutes, Anonymity, Technology expanding privacy rights.

Unit IV

PROCEDURAL ISSUES Duty of Care, Criminal Liability, Procedural issues, Electronic Contracts & Digital Signatures, Misappropriation of information, Civil Rights, Tax, Evidence.

Unit V

LEGAL ASPECTS OF CYBER SECURITY Ethics, Legal Developments, Late 1990 to 2000, Cyber security in Society, Security in cyber laws case. studies, General law and Cyber Law-a Swift Analysis.

Reference Books:

1. Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 1997.
2. Mark F Grady, FransescoParisi, "The Law and Economics of CyberSecurity", Cambridge University Press, 2006.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	-	3	-	3	-	-	-	3
CO2	3	-	-	-	-	3	-	3	-	-	-	3
CO3	3	3	-	3	-	3	2	3	-	2	-	3
CO4	3	3	-	3	-	3	2	3	-	2	-	3
CO5	3	3	-	3	-	3	-	3	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5GA71**

Course Name : **INTELLECTUAL PROPERTY RIGHTS (OPEN ELECTIVE)**

Course prerequisites : NIL.

Course Objectives :

- This course is aimed at familiarizing students with the nuances of Intellectual Property Rights (IPR) so as to help them integrate the IPR process in their academic, research (project) activities and to facilitate the students to explore career options in IPR.
- To make the technological students familiar with basics of IPR and their implications in research, development and commercialization.

Expected Outcomes :

1. The students will able to understand the issues related to intellectual properties. The knowledge gained by the students on copyrights, trademarks, patents, designs, etc. shall be useful to focus on new inventions and their commercialization.

Unit-I

CONCEPT OF PROPERTY: Meaning of Property, Kinds of property: Movable and Immovable property; Tangible and Intangible property; Intellectual property; Private and Public property. Possession and ownership.

Unit-II

INTELLECTUAL PROPERTY RIGHTS: Introduction and the need for Intellectual Property Rights (IPR), IPR in India – Genesis and Development, Forms of Intellectual Property-Copyright, Trademarks, Patents, Designs, Geographical Indicators, Merchandise, Franchise and Forms of Unfair Competition. Competing rationales of the legal regimes for the protection of Intellectual Property.

Unit-III

COPYRIGHTS & TRADEMARKS: CopyRight: Meaning of Copyright, Copyright in literary, ,musical work and cinematograph films Ownership, Assignment, Author's special rights, Importation and infringement, Fair use provisions. **Trademarks:** Definition; conception of trademarks, Registration, Distinction between trademark and property mark, Standards of proof in passing ff action.

Unit-IV

PATENTS, DESIGNS & GEOGRAPHICALINDICATORS: Conception of Patent, Patentable Inventions, Process of obtaining a Patent: application, examination, opposition and sealing of patents; Rights and obligations of a Patentee, International Patents, Transfer of technology, know-how and problems of self-reliant development. Basic provisions related to Designs, Geographical Indicators.

Unit-V

INTERNATIONAL INSTRUMENTS CONCERNING INTELLECTUAL PROPERTY RIGHTS: The Berne Convention, Universal Copyright Convention, the Paris Union, the World Intellectual Property Rights Organization (WIPO),UNESCO, TRIPS, TRIMS, and WTO.

Reference Books:

- IntellectualPropertyRights:BasicConcepts,MMSKarki,Atlantic,2009.
- IntellectualPropertyRights,Pandey,Neeraj, Dharani,Khushdeep.
- IntellectualPropertyRights inIndia:GeneralIsuuesandImplications,Dr.PrankrishnaPal,RegalSeries.
- IntellectualProperty,W.R.Cornish,Sweet& Maxwell,London,2012.
- Principles ofIntellectualProperty,N.S.Gopalakrishnan&T.G.Agitha,EasternBook Company,Lucknow,2009.

Mapping of COs and Pos:

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO12
CO1	3	-	3	-	-	3	3	-	-	3	3	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5GA72**
Course Name : **HUMAN RESOURCE MANAGEMENT (OPEN ELECTIVE)**
Course prerequisites : NIL.
Course Objectives :

- The course is designed broadly to promote understanding of procurement, development, maintenance, evaluation and overall effective utilization of manpower.

Expected Outcomes :

1. After completion of the course the student will be able to understand all functions of human resource management.

UnitI

INTRODUCTION TO HUMAN RESOURCE MANAGEMENT: Definition, Introduction, Nature of HRM, Scope of HRM, Functions of HRM-Managerial Functions, Operative Functions, Role of HRM. Personnel Management and HRM, Competitive Challenges influencing HRM, Ethical Aspects of HRM.

UnitII

HUMANRESOURCE PLANNING: Introduction to Human Resource Planning(HRP), Nature of HRP, Need and Importance of HRP in Organizations, Factors Affecting HRP, HRP Process, Barriers to Human HRP. Human Resource Information System**. Job Analysis and Job Design**–Definition, Steps in Job Analysis, Methods for Collecting Job Analysis Data, Job Description, Job Specification, Job Design- Methods of Job Design.

UnitIII

PROCUREMENT OF MAN POWER: Recruitment-Meaning and Definition, Process of Recruitment, Factor Affecting Recruitment, Sources of Recruitment, Methods of Recruitment. **Selection**–Introduction, Selection Procedure, Selection Decision Outcomes. Placement and Orientation.

UnitIV

DEVELOPMENT OF MAN POWER: Employee Training–Concept, Need for Employee Training, Process of Employee Training, Methods of Employee Training, Advantages and disadvantages. **Executive Development**– Objectives,

Importance, Factors Influencing Executive Development, Process, Methods of Executive Development, Career Planning and Development.

UnitV

COMPENSATING, MAINTAINING AND EVALUATING THE MAN POWER: Compensation- Objectives, components of paystructure in India, Wage Policy in India -Minimum Wage, Fair Wage and Living Wage. **Discipline and Grievance Procedures**- Disciplinary Procedure, Grievance Handling Procedure, importance and approaches of Industrial Relations. Collective Bargaining Process. **Performance Appraisal -** Definition, Purpose of appraisal, Procedures and Techniques including 360degree Performance Appraisal, Job Evaluation.

Reference Books:

1. NoeA.RaymondJohnHollenbeck,BarryGerhartandPatrickWright-HumanResourceManagement,(TataMcGrawHill.).
2. IanBeardwell&LenHolden-HumanResourceManagement,(MacmillanIndiaLtd.).
3. AswathappaK-HumanResourceandPersonnelManagement(TataMcGrawHill,5thEd.).
4. RaoVSP –HumanResourceManagement, TextandCases (Excel Books, 2nd Ed.).
5. Ivansevich–HumanResourceManagement(TataMcGrawHill,10thEd.).
6. Dessler–HumanResourceManagement(PrenticeHall,10thEd.).
7. Bernardi–HumanResourceManagement(TataMcGrawHill,4thEd.).
8. HumanResourceManagement,T.NChhabra,DhanpatRai&Sons PvtLtd.

Mapping of COs and Pos:

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO12
CO1	1	-	3	-	1	3	-	1	2	1	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test..

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G574**
Course Name : **TRIBOLOGY**
(PROFESSIONAL ELECTIVE – I)
Course prerequisites : Engineering Mechanics, Design of Machine Elements
Course Objectives :

- Students should be able to understand the effect and importance of friction between different surfaces and should know to calculate the friction.
- Students must be able to know the phenomenon of wear between surfaces in contact and its implications.
- Students should be able to understand the principles, methods, purpose and selection of lubricants for the reduction of friction.
- Students should be able to understand the lubrication theory and the flow of lubricants with different applications.
- Students should know the material selection for different types of bearings could be understand

Expected Outcomes : Student will be able to:

1. Understand the characteristics of engineering surfaces, sources of friction, friction
2. Characteristics of metals and non metals and friction measurements.
3. Students can understand the properties of different lubricants used for various applications
4. Students are able to identify the lubrication modes such as hydrodynamic lubrication and hydrostatic lubrication
5. Students are able to know the selection of materials for various applications.

Unit I

STUDY OF VARIOUS PARAMETERS: Viscosity, flow of fluids, viscosity and its variation -absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used.

BEARING MATERIALS: General requirements of bearing materials, types of bearing materials, Selection of Bearing materials for various applications.

Unit II

HYDROSTATIC LUBRICATION: Hydrostatic step bearing, application to pivoted pad thrust bearing and other applications, hydrostatic lifts, hydrostatic squeeze films and its application to journal bearing.

Study of current concepts of boundary friction and dry friction. Columb's laws of friction, theories of friction

Unit III

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

Unit IV

FRICTION AND POWER LOSSES IN JOURNAL BEARINGS: Calibration of friction loss friction in concentric bearings, bearing modulus, Sommerfield number, heat balance, practical consideration of journal bearing design considerations.

Unit V

AIR LUBRICATED BEARING: Advantages and disadvantages application to Hydrodynamic journal bearings, hydrodynamic thrust bearings. Hydrostatic thrust bearings. Hydrostatic bearing Analysis including compressibility effect.

TYPES OF BEARING OIL PADS: Hydrostatic bearing wick oiled bearings, oil rings, pressure feed bearing, partial bearings -externally pressurized bearings.

Text Books:

1. Suhas V. Patankar, *Numerical heat transfer and fluid flow.* Butter-Worth Publ.
2. John. D. Anderson, *Computational fluid dynamics, Basics with applications*.McGraw Hill.

Reference Books:

1. Niyogi, *Computational Fluid Flow and Heat Transfer.*Pearson Publ.
2. Tapan K. Sengupta, *Fundamentals of Computational Fluid Dynamics*. Universities Press.
3. Jiyuan and Others, *Computational Fluid Dynamics*. Elsevier, 2008.

Mapping of COs and Pos:

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	-	3	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	2	-	-	-	-	-	-
CO4	3	3	-	-	-	2	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test. .

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G575**

Course Name : **ADVANCED MANUFACTURING SYSTEMS (PROFESSIONAL ELECTIVE – I)**

Course prerequisites : Manufacturing Technology

Course Objectives :

- To enable the students to the nature and scope of various advanced manufacturing systems which are in present manufacturing scenario.
- To learn the fundamental techniques of integrating the manufacturing system with automation simultaneously reducing the effort of human intervention.

Expected Outcomes :

1. The student will be able to analyze the difference for conventional manufacturing system to advanced manufacturing system. The role of Computer integrated manufacturing, business functions integration etc., can be learned.
2. The student will be aware of applying the various manufacturing information systems necessary in the field of manufacturing.
3. The student will be aware of the lean manufacturing system and agile manufacturing systems with traditional manufacturing systems.
4. The student will be able integrate the intelligent software techniques in scheduling the machines in the flexible manufacturing environment; will have knowledge of economically justifying the FMS system.
5. The student will be analyze the importance of Artificial intelligence in the field of manufacturing system and able to understand various case studies involved in the past and present manufacturing systems.

Unit I

INTRODUCTION TO MANUFACTURING SYSTEM: Introduction – Manufacturing Strategies – Principles and types of manufacturing systems - meeting the competitiveness in manufacturing – components of manufacturing system -Limitations of traditional manufacturing systems.

Unit II

MANUFACTURING SUPPORT SYSTEM: Concurrent engineering (elementary treatment) – aggregate production planning – master production schedule – Just-in-time production systems - Principles of JIT – pull system and push system of production control – P kanbans and K kanbans (elementary

treatment) – cellular manufacturing – composite part concept – machine cell design – quantitative analysis in cellular manufacturing – rank order clustering technique.

Unit III

LEAN PRODUCTION AND AGILE MANUFACTURING : Introduction to lean manufacturing – basic elements of lean manufacturing - comparison of mass production and lean production– Principles of Lean Manufacturing – Introduction to agile manufacturing – principles of agile manufacturing – market forces and agility – reorganizing the production system for agility in areas of product design, marketing and production operations.

Unit IV

FLEXIBLE MANUFACTURING SYSTEMS: Introduction - Flexible Manufacturing Systems - FMC - Elements of FMS - Layout of FMS - Advantages and difficulties of FMS - Economic justification of FMS - Justifying flexibility - Computer Control of FMS.

Automated Material Handling - conveyors, Automated Guided Vehicles - Role of robots in material handling - Automated storage systems - AS/RS - carousel storage system. - WIP storage systems - Flexible assembly systems

Unit V

EXPERT SYSTEM IN FMS: Introduction to Expert systems in FMS – AI in FMS - LISP and other programming languages- introduction to LISP and PROLOG – Decision Support System – Knowledge based system – Machine Vision - Factory of the future - Case studies on FMS.

Text Books:

1. M.P. Groover, Automation, Production systems & Computer Integrated Manufacturing, PHI.
2. P. Radhakrishna and V. Raju, CAD, CAM & CIM, New Age, International Publisher.
3. BikashBhadury, Manufacturing Systems Engineering: An Introductory Text, Macmillan.

Reference Books:

1. Dan W Patterson, 'Introduction to Artificial intelligence and Expert systems', Prentice Hall of India Pvt. Ltd, 2001.
2. Joseph Talavage and Roger G. Hannam, “Flexible Manufacturing Systems in Practice”, Marcel dekkerinc, 1998.
3. Luca G.Sartori, “Manufacturing Information Systems”, Addison-Wesley Publishing Company, 1988
4. Kerr.R, “Knowledge based Manufacturing Management”, Addison-Wesley, 1991.

Mapping of COs and Pos:

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}	PO_{11}	PO12
CO1	1	3	-	-	-	-	-	-	-	-	3	2
CO2	1	3	-	-	-	-	-	-	-	-	3	2
CO3	1	3	-	-	-	-	-	-	-	-	3	2
CO4	-	3	-	-	3	-	-	-	-	-	3	2
CO5	-	3	-	-	3	-	-	-	-	-	3	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G576**

Course Name : **AUTOMATION AND ROBOTICS** (PROFESSIONAL ELECTIVE – I)

Course prerequisites : Engineering Mathematics, Industrial Management, Basic Electronics

Course Objectives :

- To acquire basic knowledge on automation and automated flow lines in automatic manufacturing systems.
- To learn about the modern computerized line balancing methods and other ways to improve the assembly line balancing in industries assembly plant.
- To learn about the robotics and fundamentals of robots with their needs in present trend.
- To understand robot kinematics and robot dynamics, able to acquire knowledge on importance of trajectory planning in robots.
- To learn about the sensors, actuators and robot programming methods used in robots, and the applications of robots.

Expected Outcomes : Students will be able to:

1. Understand and apply the knowledge on automation and the automated flow lines in real working environment.
2. Learn the importance of line balancing methods and are able to design the assembly work stations in industrial assembly plants.
3. Understand the robotics and the fundamental concepts of robots.
4. Learn concept of robot kinematics, dynamics and trajectory planning methods and are able to apply these concept in academic research.
5. Understand the sensors, actuators and robot programming methods used in robots and can develop a suitable program and create the solutions for contemporary issues.

UNIT I

INTRODUCTION TO AUTOMATION: Need , Types, Basic elements of an automated system, levels of automation, hardware components for automation and process control, automation principles.

Automated Flow Lines: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage.

UNIT II

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

UNIT III

INTRODUCTION TO INDUSTRIAL ROBOTS: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

UNIT IV

MANIPULATOR KINEMATICS: Homogeneous transformations as applicable to rotation and translation - D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformation, Jacobians. Lagrange – Euler

Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion.

UNIT V

ROBOT ACTUATORS AND FEEDBACK COMPONENTS: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison Position sensors – potentiometers, resolvers, encoders – Velocity sensors, tactile sensors, Proximity sensors.

Robot programming: Types – features of languages and software packages.

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

Text books:

1. M.P.Groover, *Automation, Production systems and CIM*. Pearson Edu.
2. M.P. Groover, *Industrial Robotics*. TMH.
3. *Saeed B Niku, Introduction to robotics : analysis, control, applications*

Reference books:

1. Fu KS, *Robotics*. McGraw Hill.
2. P. Coiffet and M.Chaironze, *An Introduction to Robot Technology.* Kogam Page Ltd. London, 1983.
3. Richard D.Klafter, *Robotics Engineering.* Prentice Hall.
4. Ashitave Ghosal, *Robotics, fundamental Concepts and analysis*. Oxford Press, 2006.
5. Mittal RK & Nagrath IJ, *Robotics and Control.* TMH.

6. John J. Craig, *Introduction to Robotics.* Pearson Edu.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	3	3	-	1	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	3	3	3	-	1	-	-	-	-	-	-	2
CO5	3	3	-	-	-	-	3	-	-	-	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip tests

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G577**

Course Name : **UNCONVENTIONAL MACHINING PROCESS** (PROFESSIONAL ELECTIVE – II)

Course prerequisites : Engineering Mathematics, Industrial Management

Course Objectives :

- The main objective of this subject is to provide students with an understanding of the latest technologies being used in manufacturing industries as part of modernization of industries.
- The students shall also understand and appreciate the importance of basic principles of Manufacturing Systems and also they will know about the differences between conventional and un-conventional machining process with the help of various advanced manufacturing techniques like USM, AJM, ECM, CM, EDM, PAM, EBM, LBM & other flow surface finishing Process.

Expected Outcomes : Students will be able to:

1. Understand the knowledge on need for unconventional machining process and can perform experiments on USM process and are able to apply these concepts in academic research.
2. Learn the working of AJM, WAJM and WJM, can perform experiments on those processes and are able to apply these concepts in academic research.
3. Understand the fundamental concepts of CM, ECM process and can perform experiments on those processes and are able to apply these concepts in academic research.
4. Understand the fundamental concepts of EDM and WEDM process and can perform experiments on those processes and are able to apply these concepts in academic research.
5. Understand the fundamental concepts of LBM, PAM and other flow finishing process and can perform experiments on those processes and are able to apply these concepts in academic research.

UNIT I

INTRODUCTION: Need for non-traditional machining methods- Classification of modern machining processes – considerations in process selection of Materials and Applications. Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development

Unit II

MECHANICAL PROCESSES: Abrasive jet machining, Water jet machining and abrasive water jet machining Basic principles, equipment's, process variables, mechanics of metal removal, MRR, application and limitations.

Unit III

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

Unit IV

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

Unit V

THERMAL METAL REMOVAL PROCESSES -II : Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes –General Principle and application of laser beam machining – thermal features, cutting speed and accuracy of cut. Application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

Text Books:

1. M. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi (2002) ISBN 81-7764-294-4.

Reference Books:

1. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York (1987)
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi (1980).

3. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London (1998) 42 INDUSTRIAL ROBOTICS 3 0

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	3	-	-	-	-	-	-	-	2
CO2	3	3	3	3	1	-	-	-	-	-	-	2
CO3	3	2	-	3	-	-	-	-	-	-	-	2
CO4	3	3	3	3	1	-	-	-	-	-	-	2
CO5	3	3	-	3	-	-	3	-	-	-	-	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip tests

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G578**

Course Name : **GAS TURBINES AND JET PROPULSION**
(PROFESSIONAL ELECTIVE – II)

Course prerequisites :Physics, Engineering Mathematics, Thermodynamics, Fluid mechanics..

Course Objectives :

- To establish understanding of the fundamental concepts of Gas turbines.
- To become familiar with the thermodynamic cycles of jet engines.
- To gain in depth understanding of the working principle of Ramjet engine, serqui jet, pulse jet engine.
- To make the students know of the working of non air breathing engines and propellants used in rocket engine
- To understand the concept of rocket technology and its propulsion systems.

Expected Outcome **:** Students will be able to

- Evaluate the performance of different gas turbine cycles .
- Gain knowledge of propulsion systems and show their ability to carry out a cyclic analysis of Jet propulsion systems.
- Determine the applicability of a given propeller system for a given aircraft.
- Gain information of different types of rocket propulsion systems and the applications for each.
- Explain the advancements in rocket technology.

Unit I

GAS TURBINES: Gas turbine operating cycles, cycle work ratio, optimum pressure ratio , gas turbine applications, gas turbine advantages & disadvantages, energy flow & back work, deviation from ideal cycle, means of improving the efficiency and the specific output of simple cycle, gas turbine with regeneration, thermal efficiency of gas turbine with & without regenerator, inter cooling & reheating, related problems.

Unit II

JET PROPULSION: Historical sketch- reaction principle- essential features of propulsion devices- thermal jet engines, classification of – energy flow, thrust, thrust power and propulsion efficiency- need for thermal jet engines and applications. turboprop and turbojet – thermodynamic cycles and principles of

operation – performance evaluation – thrust augmentation and thrust reversal – contrasting with piston engine propeller plant.

Unit III

Ram jet- Thermo dynamic cycle, plant lay out, essential components – principle of operation – performance evaluation – comparison among atmospheric thermal jet engines- serqui jet and pulse jet, elementary treatment

Unit IV

Rocket Engines: Need for, applications- basic principle of operation and parameters of performance – classification, solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems.

Unit V

Rocket Technology: Flight mechanics, application thrust profiles, acceleration-staging of rockets, need for – feed systems, injectors and expansion nozzles – rocket transfer and ablative cooling.

Testing & instrumentation - Need for Cryogenics – Advanced propulsion systems, elementary treatment of Electrical nuclear and Plasma Arc Propulsion.

Text Books:

1. Gas Turbines , V. Ganesan TMGH, 3rd edition,01-april-2010
2. Gas Dynamics & Jet Propulsion, Dr. S.L. Somasundaram, New age international (p) limited,01-jan-1996

Reference Books:

1. Gas turbines , cohen , Rogers &SarvanaMuttoo , Addision Wiley & longman,1996
2. Thermodynamics of propulsion, Hill & Peterson.
3. Rocket Propulsion , Sutton.
4. Element of Gas Turbines propulsion , Jack D Matingly, MGH

Mapping of COs and Pos:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	3	-	-	-	-	3
CO2	3	3	-	-	-	-	3	-	-	-	-	3
CO3	3	3	-	-	-	-	3	-	-	-	-	3
CO4	3	3	-	-	-	-	3	-	-	-	-	3
CO5	3	3	-	-	-	-	3	-	1	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip tests.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G579**

Course Name : **RAPID PROROTYPING** (PROFESSIONAL ELECTIVE – II)

Course prerequisites : Manufacturing Techniques, CAD/CAM

Course Objectives :

- Generating a good understanding of RP history, its development and applications.
- To impart knowledge on different types of RP systems, i.e., the process, advantages, limitations and applications.
- To expose the students to different types of materials used in RP systems to make best use of various RP machines.

Expected Outcomes : Student will be able to:

1. Will illustrate the importance of prototype and product development in manufacturing with advances in design and manufacturing
2. Insight into modern rapid prototyping techniques such as SLS, FDM, SGC, LOM, SLS and LENS
3. Analyze the importance if Rapid tooling in manufacturing process

Unit I

INTRODUCTION: Need for the compression in product development, History of RP system, Applications, Growth of RP industry and classification of RP system, applications.

Unit II

STEREO LITHOGRAPHY SYSTEM: Principle, Process details, machine details, Applications.

FUSION DECOMPOSITION MODELING: Principle, Process details, Applications.

Unit III

SOLID GROUND CURING: Principle of operation, Machine details, Applications.

LAMINATED OBJECT MANUFACTURING: Principle of Operation, LOM materials, Process details, Applications.

Unit IV

LASER SINTERING: Introduction to LASER, LASER Sintering process, process details, Applications.

CONCEPTS MODELERS: Principle, Thermal jet printer, Sander's model maker, 3-D printer.

Unit V

LASER ENGINEERING NET SHAPING (LENS):RAPID TOOLING: Indirect Rapid tooling, Silicon rubber tooling, Direct Rapid Tooling, applications.

Text Books:

1. Rapid Prototyping Technology, Kenneth G. Cooper, Marcel Dekker,INC.
2. Rapid prototyping: Principles and Applications - Chua C.K., Leong K.F. and LIM C.S, World Scientific publications , Third Edition, 2010.
3. Rapid Manufacturing, Flham D.T & Dinjoy S.S, Verlog London 2001.
4. Frank W. Liou, Rapid Prototyping & engineering applications, CRC Press, ISBN 978-0-8493-3409-2.
5. Rapid Prototyping theory & practice, Manufacturing System Engineering Series, Ali K.Kamarani, Springer Verlag.

Mapping of COs and Pos:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	2	2	-	-	2	-	-	-
CO2	2	-	3	-	2	2	-	-	2	-	-	-
CO3	2	-	3	-	2	2	-	-	2	-	-	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments and slip test.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester	**L**	**T**	**P**
	0	**-**	**3**

Course Code : **5G57A**

Course Name : **INSTRUMENTATION LAB AND OPTIMIZATION LAB WITH MATLAB SOFTWARE**

Course prerequisites : Instrumentation & Control Systems, C Language

Course Objectives :

- To understand the working of pressure gauge
- To know the principle of different temperature measuring instruments
- To understand the working principle of LVDT
- To know the working of strain gauge
- To know the principle of different thermocouple for temperature measurement
- To Calibrate Capacitive Transducer for Angular Measurement.
- To calibrate Resistance Temperature Detector for Temperature Measurement.
- To Study and Calibration of a Rotometer for flow measurement
- To study and Calibrate of Photo and Magnetic Speed Pickups for the measurement of speed.
- To familiarize the students with MATLAB interface, using MATLAB as sophisticated calculator with its syntax and semantics.
- Learn how to analyze and solve the engineering problems using programming techniques

Expected Outcomes :

1. An ability to know pressure gauge functions
2. An ability to understand temperature measuring instruments
3. An ability to understand LVDT working
4. An ability to understand the working of strain gauge
5. An ability to understand the principle of thermocouples
6. An ability to know the working of Capacitive Transducer for Angular Measurement.
7. An ability to calibrate Resistance Temperature Detector for Temperature Measurement.
8. An ability to Calibration of a Rotometer for flow measurement
9. An ability to know Photo and Magnetic Speed Pickups for the measurement of speed
10. Analyze the use of numerical methods in modern scientific computing and finite precision computation.
11. An ability to express programming techniques for solving engineering problems.

SECTION A: INSTRUMENTATION LAB

1. Calibration of Pressure Gauges.
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.

6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotometer for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of Mcleod gauge for low pressure.
12. Study of anemometer

SECTION B: OPTIMIZATION LAB WITH MATLAB SOFTWARE

1. An introduction to MATLAB
2. Programming in MATLAB – I (*logical operators, functions and script files*)
3. Programming in MATLAB – II (*conditional statements and loops*)
4. MATLAB for Optimization (*linear programming*)
5. Optimization using MATLAB toolboxes

Note: Use Matlab online Help Manual to solve the above problems.

Mapping of COs and Pos:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	3	3	-	-	-	-	-	3	-
CO2	-	3	-	3	3	-	-	-	-	-	3	-
CO3	-	3	-	3	3	-	-	-	-	-	3	-
CO4	-	3	-	3	3	-	-	-	-	-	3	-
CO5	-	3	-	3	3	-	-	-	-	-	3	-
CO6	-	3	-	3	3	-	-	-	-	-	3	-
CO7	-	3	-	3	3	-	-	-	-	-	3	-
CO8	-	3	-	3	3	-	-	-	-	-	3	-
CO9	-	3	-	3	3	-	-	-	-	-	3	-
CO10	3	2	3	2	3	-	-	-	1	-	1	2
CO11	3	2	3	2	3	-	-	-	-	-	1	2

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Day to Day Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. I Semester

L	T	P
0	-	3

Course Code : **5G57B**

Course Name **: CAD/CAM LAB**

Course prerequisites : Engineering Graphics, Basics in Mathematics, Engineering Mechanics, Basic Thermodynamics, Machine Tools, CAD / CAM

Course Objectives :

- To introduce the basics in modeling software.
- To get the knowledge on Analysis Package.
- To enable the student to develop and to write the part programs for CNC Machines.

Expected Outcomes : Student will be able to

1. Drafting of the complex geometries of machine components.
2. Develop a part model to visualize the components.
3. Analyze the Structural and Thermal analysis on the various engineering structures or components.
4. Create NC code and automated tool paths for a given engineering component and machine the components.

I. PART MODELING

1. Drafting
2. Part Modeling
3. Assembly

II. ANALYSIS

1. Structural analysis
2. Thermal analysis

III. CAM

1. Developing CNC code by using CAM package
2. Machining of simple components on CNC Lathe.
3. Machining of simple components on CNC Mill.

Note: Can use any convenient software package for Drafting, Modeling, Analysis and Machining

Mapping of COs and Pos:

Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	-	-	3	3	-	3
CO2	3	3	3	3	3	3	-	-	3	3	-	3
CO3	3	3	3	3	3	3	-	-	3	3	-	3
CO4	3	3	3	-	3	-	-	-	3	3	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 10% of marks for Internal Evaluation.
3. 20% of marks for Day to Day Evaluation.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G581**
Course Name : **TURBO-MACHINERY** (PROFESSIONAL ELECTIVE-III)
Course prerequisites : Basic knowledge in Fluid Mechanics & Hydraulic Machines

Course Objectives:

- To make the student to understand the basic concepts of turbo machinery.
- To make the student to get exposed to working methodology, its performance characteristics of centrifugal fans and blowers.
- To make the student to understand the working, performance evaluation of different compressors.
- To make the student understand different types of turbine and its performance.

Expected Outcomes:

1. Student can able to get a basic idea on the concepts of turbo machinery.
2. Student can understand the differences between the fans and blowers and their performance characteristics.
3. Student can able to get the knowledge of centrifugal compressor working and ability to calculate its performance characteristics.
4. Student can able to get the knowledge of axial flow compressor working and ability to calculate its performance characteristics.
5. Student can able to understand axial and radial flow turbines working ability and calculate its performance characteristics.

Unit I

Principles: Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

Unit II

Centrifugal Fans and Blowers: Types, stage and design parameters, flow analysis in impeller blades, volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

Unit III

Centrifugal Compressor: Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

Unit IV

Axial Flow Compressor: Stage velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, work done factor, simple stage design problems and performance characteristics.

Unit V

Axial and Radial Flow Turbines: Stage velocity diagrams, reaction stages, losses and coefficients blade design principles, testing and performance characteristics.

Text Book:

Yahya, S.H., "Turbines, Compressor and Fans ", Tata McGraw Hill Publishing Company.

References:

1. Bruneck, Fans, Pergamom Press.Earl Logan, Jr., " Hand book of Turbo machinery ", Marcel Dekker Inc.
2. Dixon, S.I., "Fluid Mechanics and Thermodynamics of Turbo machinery ", Pergamom.
3. Shepherd, D.G., Principles of Turbo machinery.
4. Stepanff, A.J., "Blowers and Pumps ", John Wiley and Sons Inc.
5. Ganesan .V, " Gas Turbines ", Tata McGraw Hill Pub. Co.

Mapping of COs and POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3
CO3	3	3	3	3	3	-	-	-	-	-	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3
CO5	3	3	-	-	-	-	-	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by conducting 2 slip test & 3 assignments..

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G582**
Course Name : **COMPUTATIONAL FLUID DYNAMICS**
(PROFESSIONAL ELECTIVE-III)
Course prerequisites : Thermal Engineering, Finite Element Method

Course Objectives:

- To develop an understanding of introductory concepts in computational fluid dynamics with emphasis on the numerical solution of ordinary and partial differential equations.
- To get the solution of ODEs by numerical integration; finite difference and finite volume methods for parabolic, elliptic, and hyperbolic PDEs (techniques for single and multi-dimensional problems); numerical linear algebra.
- To implement and utilize various numerical methods and basic mathematical analysis for canonical problems in fluid dynamics.
- To develop methodologies which facilitate the application of the subject to practical problems.

Expected Outcomes: Students are able to

1. Develop mathematical models for flow phenomena.
2. Analyze mathematical and computational methods for fluid flow and heat transfer simulations.
3. Solve computational problems related to fluid flows and heat transfer
4. Evaluate the grid sensitivity and analyze the accuracy of a numerical solution.
5. Evaluate flow parameters in internal and external flows.
6. Solve fluid flow and heat transfer problems through numerical solutions.

Unit I

GOVERNING EQUATIONS: Introduction – Various applications, Governing equations, continuity, momentum, energy equations, boundary conditions – Conservation and Non conservation form

Unit II

MATHEMATICAL BEHAVIOUR OF PARTIAL DIFFERENTIAL EQUATIONS: Mathematical Behaviour of Partial differential equations – Hyperbolic, Parabolic, Elliptic equations, Well posed problems, Difference equations, Explicit and Implicit approach, Errors and analysis of stability

Unit III

GRID GENERATION: Grid generation: general transformation of the equations, Matrices and Jacobians - Stretched and compressed grids - Boundary fitted coordinate systems - Modern developments in grid generation – Finite volume mesh generation, unstructured meshes and Cartesian meshes.

Unit IV

SOLUTION TECHNIQUES: Simple CFD Techniques: The Lax-Wendroff Technique - MacCormmack'sTechinique - The relaxation technique and its use with low speed invicid flow - Artificial viscosity - Alternating Direction Implicit (ADI) technique - Pressure correction techniques.

Unit V

SIMPLE TECHNIQUES: Numerical solutions of quasi-one dimensional nozzle flows, numerical solution of a two-dimensional super-sonic flow: Prandtl-Meyer Expansion wave

Text Books:

1. Anderson, J. D., *Computational Fluid Dynamics*, McGraw Hill International, New York, 1995.
2. Flecher,C.A., *Computational Techniques for Fluid Dynamics*, Vol. I to III, Springer-Verlag Students are publications, Berlin, 1998.

Reference Books:

1. Versteeg, H. K. and Malalasekera, W., *An Introduction to Computational Fluid Dynamics and theFinite Volume Method*, Pearson Education limited, 2008
2. Patankar, S. V., *Numerical Heat Transfer and Fluid Flow*, CRC press reprint 2017, .
3. Hirsch and Charles, *Numerical Computation of Internal and External Flow*, Butterworth and Heinemann publishers, 2nd edition, 2007.

Mapping of COs and Pos

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	-	3	-	-	3
CO2	3	3	3	3	3	3	3	-	3	-	-	3
CO3	3	3	3	3	3	3	3	-	3	-	-	3
CO4	3	3	3	3	3	3	3	-	3	-	-	3
CO5	3	3	3	3	3	3	3	-	3	-	-	3
CO6	3	3	3	3	3	3	3	1	3	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by conducting 2 slip test & 3 assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G583**

Course Name : **NON CONVENTIONAL SOURCES OF ENERGY**
(PROFESSIONAL ELECTIVE-III)

Course prerequisites : Thermal Engineering, Engineering Mathematics.

Course Objectives :

- To acquire sufficient knowledge on various types of renewable energy sources.
- Obtain basic principles, storage and applications on Solar Energy.
- To get knowledge on Sources and potentials of wind energy.
- To get awareness on bio-mass and bio-gas utilization.
- To get the working knowledge of geothermal energy, ocean energy and tidal & wave energy.
- An ability to get awareness on direct energy conversion.

Expected Outcomes : Student will be able to:

1. Create awareness on role and potential of new and renewable source and basics of solar energy.
2. Acquire the knowledge on different types of collectors and storage systems of solar energy and their applications.
3. Achieve sufficient knowledge on Wind energy and Bio-mass energy.
4. Familiarize the student with the Geothermal and Ocean energy concepts and their potentiality
5. Gain the knowledge on direct energy conversion.

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation , potential in India

UNIT – II

SOLAR ENERGY COLLECTORS: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT – III

WIND ENERGY: Sources and potential in India, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects, potential in India.

UNIT – IV

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics, potential in India.

UNIT – V

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions

Text Books:

1. Tiwari and MK.Ghosal, Renewable energy resources: Basic principles and applications, Narosa publications 2005.
2. G.D. Rai, Non-Conventional Energy Sources, khanna publications, 2011

References:

1. Twidell&Weir, Renewable Energy Sources, Routledge , 3rd Ed.2015
2. Non Conventional Energy Resources, B.H.Khan, McGrawHIll, 2015
3. B.S.Magal Frank Kreith & J.F.Kreith, Solar Power Engineering, TMH, 1829
4. Solanki, Renewable energy sources and emerging Technologies. PHI,2008
5. Ashok V Desai, Non-Conventional Energy. New Age int.(P) ltd. 2011
6. K.M. Mittal, Non-Conventional Energy Systems. Wheeler publishers, New Delhi,2003

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	3	3	-	-	-	-	3
CO2	3	-	3	-	1	3	3	-	-	-	-	3
CO3	3	2	3	-	-	3	3	-	-	-	-	3
CO4	3	-	3	-	-	3	3	-	-	-	-	3
CO5	3	-	3	-	-	3	3	-	-	-	-	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by (assignments, slip test)

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET
(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. II Semester	**L**	**T**	**P**
	3	**1**	**0**

Course Code : **5G584**

Course Name : **POWER PLANT ENGINEERING** (PROFESSIONAL ELECTIVE-IV)

Course prerequisites: Basics Thermodynamics, Applied Thermodynamics

Course Objectives:

- To understand the student present day energy demand.
- An ability to understand the working and combustion phenomenon in steam power plant.
- An ability to gain knowledge on the concept and the working of diesel power plants and gas turbines.
- To understand the function and operation of the basic components of a hydro-electric power plant & nuclear power station.
- An ability to learn the concept of non-conventional sources and factors affecting the site selection for a power plant and concept of base load plant and peak load plant.

Expected Course Outcomes: Student will be able to:

1. List out various energy sources and explain working of layout and handling systems involved in steam power plant,
2. Identify and explain different combustion process, purification methods and importance of cooling towers in steam power plant.
3. Differentiate the working of diesel plant and gas turbine plant and its auxiliaries.
4. Explain the difference between hydraulic power plant and nuclear power stations in terms power generation
5. Explain various sources of power received from non-conventional sources and gaining a sound knowledge on power plant economics.

Unit I

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

STEAM POWER PLANT: Plant Layout, Working of different Circuits, Fuel and handling equipment's, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Unit II

STEAM POWER PLANT -COMBUSTION PROCESS: Properties of coal – overfeed and underfeed fuel beds, travelling grate stokers, spreader stokers,

retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

Unit III

INTERNAL COMBUSTION ENGINE PLANT-DIESEL POWER PLANT: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

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

Unit IV

HYDRO ELECTRIC POWER PLANT: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

HYDRO PROJECTS AND PLANT: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

NUCLEAR POWER STATION: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation- radioactive waste disposal.

Unit V

POWER FROM NON-CONVENTIONAL SOURCES: Utilization of Solar-Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy.

POWER PLANT ECONOMICS AND ENVIRONMENTAL CONSIDERATIONS: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

Text Books:

1. P.K.Nag, *Power Plant Engineering.* TMH, 4 th Ed.2014
2. P.C.Sharma, Power *Plant Engineering*. S.K.Kataria& sons ,2014

Reference Books:

1. Rajput. R.K., *A Text Book of Power Plant Engineering*. Laxmi Publ, 2015, 5th Ed.

2. Hegde R.K. *Power Plant Engineering. Person* Publ,2015
3. Arora and S. Domkundwar.*A Course in Power Plant Engineering*, DhanpatRai& co (p) Ltd, 6 th Ed.2011.
4. C. Elanchezian and L.Sravana Kumar, *Power Plant Engineering*. I.K. books,2010
5. A B Gill, Power plant Performance, Butterworth and Co, Ltd.2016.

Mapping of COs and Pos

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	3	2	-	-	-	-	2
CO2	3	2	-	-	-	3	2	-	-	-	-	-
CO3	3	-	-	-	-	3	-	-	-	-	-	-
CO4	3	-	-	-	-	3	-	-	-	-	-	2
CO5	3	2	-	-	-	3	-	-	-	-	3	2

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Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES::RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

R15 Regulations Detailed Syllabus

IV Year B. Tech. II Semester	**L**	**T**	**P**
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Course Code : **5G585**

Course Name : **PRODUCTION AND OPERATIONS MANAGEMENT**
(PROFESSIONAL ELECTIVE-IV)

Course prerequisites : Industrial Management, Operations Research.

Course Objectives :

- To make the students understand the functions of production planning & control, generating of new products, issues in product design and strategies of aggregate planning.
- To provide the knowledge on principles of forecasting, forecasting methods, types and its accuracy.
- To provide the knowledge on facilities location, various types layouts and assembly line balancing.
- To provide the knowledge on lean management, concepts of JIT, six sigma, quality control, MRP,ERP and LOB.
- To make the students understand the concept of inventory management and scheduling techniques.

Expected Outcomes : Student will be able to:

1. Comprehend the concepts on Production planning & control operations and its functions, productivity and productivity measurements, design of goods and services.
2. Understand where the plant is to be located based on facilities available and what are the important factors affecting the facilities location of a plant, and plant layout. And also able to understand plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time.
3. Understand the aggregate planning and various aggregate planning strategies using OR models. And also students will know about the inventory management and its types, then the control systems.
4. Understand the scheduling policies, flow shop and job shop scheduling techniques and concepts of Inventory, Classification, Functions, its associated costs etc., and also able to recognize the importance of Inventory control to ensure their availability with minimum capital lock up. Student will also know about the material requirement planning and its types, enterprise resource planning and line of balance.
5. Understand the how philosophy of lean management applied to develop lean enterprise and basic concepts JIT, Six sigma control etc.

UNIT – I

PRODUCTION: Products – types – design of goods & services – Functions of Production & Operations Management – Production Vs Productivity – Productivity measurement – Product design & analysis – new product development and its concepts.

FORECASTING: Importance of forecasting – Types of forecasting, their uses – General Principles of forecasting – Forecasting techniques – qualitative methods and quantitative methods – accuracy of forecasting methods.

UNIT – II

Factors affecting facilities location, mathematical models for facilities, location, Types of facilities- layout: product layout, process layout, group technology layout, Assembly line balancing, computerized layout algorithms: ALDEP, CRAFT and CORELAP.

UNIT – III

AGGREGATES PLANNING: Strategies for aggregates planning, aggregate planning using O.R. Models, Chase planning, Expediting, controlling aspects.

INVENTORY MANAGEMENT: Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems-(S, s) Policy.

UNIT – IV

SCHEDULING POLICIES: Techniques, flow shop and job shop Scheduling techniques.

MRP: Lot sizing techniques in MRP, introduction to ERP and types, LOB (Line of Balance).

UNIT – V

Lean Management, Philosophy and creation of lean enterprise – JIT concepts – Kanban System – Elements of total quality management – 14 principles – Six Sigma Quality Control.

Text Books:

1. Baffa & Rakesh Sarin, Modern Production, Operations Management.
2. B. Mahadevan, Operation Management. Pearson Edu.
3. Adam & Ebert, Production & Operations Management: Concepts, Models and Behavior. PHI, 5th Ed.

References:

1. S.N. Chary, Operations Management. TMH.
2. Martin K. Starr and David W. Miller. Inventory Control Theory and practice.
3. John E. Biegel, Production Control A Quantitative Approach.
4. Kanishka Bedi, Production & Operations Management. Oxford Univ Press.
5. K.Aswathappa, K.Shridhara bhat , Production and operations management, Himalaya publishing house.

Mapping of COs and Pos:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	3	-	-	-	3	-	3	-
CO2	3	3	3	-	3	-	-	-	3	-	3	-
CO3	3	3	3	-	-	-	-	-	3	-	3	-
CO4	3	3	3	1	3	-	-	-	3	-	3	-
CO5	-	3	3	-	3	1	1	-	3	1	3	-

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments & slip tests.

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R15 Regulations Detailed Syllabus

IV Year B. Tech. II Semester

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Course Code : **5G586**

Course Name : **SUPPLY CHAIN MANAGEMENT**
(PROFESSIONAL ELECTIVE – IV)

Course prerequisites : Industrial Management, Operations Research

Course Objectives :

- To get the knowledge on basic concepts of supply chain management, decision phases, process view and its strategies.
- To learn the concepts of distribution networks and supply chain network
- To acquire the skill of planning, managing safety stock in a supply chain, transportation and pricing of products.
- To know the concept of sourcing, Bullwhip effect
- To get the awareness of IT and E-business in a SCM.

Expected Outcomes : Student will be able to:

1. Understand the concepts on supply chain stages and decision phases of supply chain, supply chain flows with different strategies, supply chain network and frame work for design decisions.
2. Understand about different models for facility location and capacity allocation with analytical problems.
3. Understand how to manage cycle inventory and safety inventory determination, along this student will know about the managerial levers to improve supply chain profitability.
4. Understand the role of transportation, factors affecting transportation decisions and international transportation characteristics.
5. Understand the bullwhip effect in coordination the supply chain, obstacles to coordinate and managerial levers to achieve coordination.
6. Understand the role of IT supply chain, supply chain IT framework, CRM, Internal SCM, SRM and the role of e-business in supply chain.

Unit I

BUILDING A STRATEGIC FRAME WORK TO ANALYSE SUPPLY CHAINS and DESIGNING THE SUPPLY CHAIN NETWORK: Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains.Competitive and supply chain strategies.Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.

Unit II

FACILITY LOCATION AND CAPACITY ALLOCATION: Models for facility location and capacity allocation. Analytical problems

PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN: Managing multi-echelon cycle inventory, safety inventory determination. Optimum level of product availability. Managerial levers to improve supply chain profitability.

Unit III

SOURCING, TRANSPORTATION AND PRICING OF PRODUCTS: Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration.

Role of transportation, Factors affecting transportation decisions.Modes of transportation and their performance characteristics.International transportation.Analytical problems. Role Revenue Management in the supply chain.

Unit IV

MANAGING BULLWHIP EFFECT: Co-ordination in a supply chain - Bullwhip effect.Obstacles to coordination. Managerial levers to achieve co-ordination.

Unit V

TECHNOLOGY IN THE SUPPLY CHAIN: The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain.

Text Book:

1. Sunil Chopra & Peter Meindl; *Supply Chain Management-Strategy, Planning & Operation*. Pearson Edu. Asia, 2001, ISBN: 81-7808-272-1.

Reference Books:

1. Robert B Handfield, Ernest L Nichols, Jr., *Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems*. Pearson Edu. Inc, 2002, ISBN: 81-297-0113-8.
2. Jeremy F Shapiro, Duxbury; *Modelling the Supply Chain.* Thomson Learning, 2002, ISBN 0-534-37363.
3. David Simchi Levi, Philip Kaminsky & Edith Simchi Levi; *Designing & Managing the Supply Chain.* Mc Graw Hill.
4. Dr. Dale S. Rogers, Dr. Ronald S. Tibben-Lembke, *Going Backwards Reverse Logistics Trends and Practices*. University of Nevada, Reno, Center for Logistics Management.

Mapping of co's with po's

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	3	-	-	3	-	3	3	3
CO2	3	-	3	3	3	-	-	3	-	3	3	3
CO3	3	3	-	3	3	-	-	3	-	3	-	3
CO4	3	3	-	3	3	-	-	3	-	3	-	3
CO5	3	-	3	-	3	-	-	-	-	3	3	3
CO6	-	-	3	-	3	1	-	-	-	3	3	3

Mode of Evaluation:

1. 70% of marks for External Evaluation.
2. 20% of marks for Internal Evaluation.
3. 10% of marks for Continuous Evaluation by assignments.