ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

ACADEMIC REGULATIONS (R19), COURSE STRUCTURE AND SYLLABI

For the students admitted to

B. Tech., Regular Four Year Degree Programme from the Academic Year 2019-20

and

B. Tech., Lateral Entry Scheme from the Academic Year 2020-21

VISION AND MISSION OF THE INSTITUTION

Vision

We impart futuristic technical education and instil 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.

ACADEMIC RULES AND REGULATIONS OF FOUR-YEAR B. TECH REGULAR DEGREE PROGRAMME

APPLICABLE FOR THE STUDENT BATCHES ADMITTED FROM THE ACADEMIC YEAR 2019-20

APPLICABLE FOR THE STUDENTS (Lateral Entry) ADMITTED FROM THE ACADEMIC YEAR 2020-21

CONTENTS

1. PREAMBLE

Annamacharya Institute of Technology and Sciences (Autonomous), Rajampet, relentlessly aims to achieve academic excellence by implementing new initiatives in teaching-learning and evaluation processes. Based on the directions of the University Grants Commission (UGC), New Delhi, All India Council for Technical Education (AICTE), New Delhi and Jawaharlal Nehru Technological University Anantapur (JNTUA) Anantapuramu, the institute adopted AICTE and APSCHE model curriculum, with minor modifications to match the needs, expectations, and skillsets of students of the region, in both the under- graduate and post-graduate programmes offered from the academic year 2019-20.

2. APPLICATION AND COMMENCEMENT

- The regulations are quite comprehensive and include definitions of key terms, semester system, credit system, grading system and other relevant details.
- The regulations detailed herein shall apply to all the regular under-graduate programmes offered by the Institute.
- The regulations shall be applicable and come into force to the student batches admitted from the academic year 2019-20 and Lateral Entry students admitted from the academic year 2020-21
- The Institute may revise, amend or change the regulations, scheme of examinations and syllabi, from time to time, if found necessary and on approval by the Academic Council of the Institute, keeping the recommendations of the BoS in view.
- Any or all such amendments shall be effective from such date and to such batches of students including those already undergoing the programme, as may be approved through Academic Council of the Institute.
- These regulations shall be called R19 Regulations.

3. ELIGIBILITY FOR ADMISSION

3.1 ADMISSION INTO ENGINEERING UNDER GRADUATION PROGRAMMES (REGULAR)

The eligibility criteria for admission into engineering under graduate programmes offered at AITS shall be as prescribed by the Government of Andhra Pradesh. The criteria are given below:

- The candidate shall be an Indian National / NRI.
- The candidate should have completed 16 years of age as on 31st December of the academic year for which the admissions are being conducted.
- The candidate should have passed the qualifying examination (10+2) or equivalent as on the date of admission recognized by Board of Intermediate, Andhra Pradesh.
- Seats in each programme in the Institute are classified into two categories i.e., **Category – A** and **Category – B** as per the GOs of Andhra Pradesh.

Category – A Seats

These seats shall be filled through counselling as per the rank secured by a candidate in the Common Entrance Test (EAMCET) conducted by the Government of Andhra Pradesh and as per other admission criteria laid down in the GOs.

Category – B Seats

These seats shall be filled by the Institute as per the GOs issued by the Government of Andhra

Pradesh from time to time

3.2 ADMISSION INTO SECOND YEAR (Lateral Entry Scheme)

A candidate shall be admitted into the third semester (II year I semester) based on the rank secured by the candidate in the Engineering Common Entrance Test (ECET) by the Government of Andhra Pradesh and as per other admission criteria laid down in the GOs.

4. Medium of Instruction

The medium of instruction shall be **English** for all the courses including their content delivery and examinations, seminars, presentations and project evaluation as prescribed in the programme curriculum.

5. B.TECH. PROGRAMME STRUCTURE

The structure of the B.Tech. Programmes on offer at AITS are based on the **Choice Based Credit System (CBCS)** as defined by the UGC and the curriculum / course structure as suggested by the AICTE in its Model Curriculum.

Semester Scheme

- The B. Tech Programmes offered at AITS follow **semester scheme** pattern.

- The duration of a B. Tech. Programme shall be of **4 academic** years for 4 year B. Tech programmes **and 3 academic years** for 3 year B. Tech programmes in lateral entry scheme**.**

- Each academic year shall have **2 semesters** i.e., odd and even semesters and shall be counted as first semester, second semester, and third semester and so on up to eighth semester.

- Each semester shall consist of **16 weeks** of academic work excluding internal examinations.

- Each semester is structured to provide credits totalling to **160 credits** for the entire B.Tech. Programme.

- Each semester shall have **Continuous Internal Evaluation (CIE)** and **Semester End Examination (SEE)** for both Theory and Lab courses.

- Each student is required to secure a total of **160 credits with a CGPA ≥ 5** for the completion of the UG programme and the award of the B.Tech. Degree.

- A student after securing admission into a 4 year B.Tech Programme at AITS shall pursue and acquire the B.Tech. degree in a **minimum period of four academic years i.e., 8 semesters** and a **maximum period of eight academic years i.e., 16 semesters** starting from the date of commencement of I year I semester,

failing which the student shall forfeit the seat in B.Tech. Programme.

- A student after securing admission into a 3 year B. Tech Programme (Lateral Entry) at AITS shall pursue and acquire the B.Tech. Degree in a **minimum period of three academic years i.e., 6 semesters** and a **maximum period of six academic years i.e., 12 semesters** starting from the date of commencement of II year I semester, failing which the student shall forfeit the seat in B.Tech. programme

6. PROGRAMMES OFFERED BY THE INSTITUTE

The following B. Tech. programmes are offered as specializations by the Institute from 2019-2020.

SNo	Name of the Program	Programme Code
1	Civil Engineering	01
2	Electrical and Electronics Engineering	02
3	Mechanical Engineering	03
4	Electronics and Communication Engineering	04
5	Computer Sciences and Engineering	05

7. COURSES AND CREDIT STRUCTURE

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

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

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

Each course is assigned certain number of credits based on following criterion

Type of Class	Semester	
	Periods per Week	Credits
Theory (Lecture/Tutorial)	01	01
	02	02
	03	03
	04	04
Practical	02	01
	03	1.5
	04	02
Innovation/Socially Relevant Project/Entrepreneurship/Internship	N/A	02
Project Work Stage 1	04	02
Project Work Stage 2	12	08

Every course of the B. Tech. programme shall be offered by a specific section / department. The unique codes of the section / department offering the courses are given in the Table.

Course offering Department	Code
Basic Science Courses	C
Humanities Courses	
Management Courses	E
Civil Engineering	1
Electrical and Electronics Engineering	2
Mechanical Engineering	3
Electronics & Communication Engineering	4
Computer Science & Engineering	5

Every B. Tech. Programme of study shall be designed to have theory and laboratory courses. In addition, a student shall carry out internship, project, socially relevant project, and other mandatory courses as prescribed in the curriculum of the Programmes.

7.1 Types of Courses:

TYPE OF COURSES	COURSE CATEGORY	DEPARTMENT				
		CIV	EEE	ME	ECE	CSE
Foundation	Engineering Sciences (ES)	23.5	22.5	22.5	24	23
	Basic Sciences (BS)	25	25	25	25	25
	Humanities & Social Sciences and Management (HS)	10	10	10	10	10
Core	Professional Core (PC)	59.5	60.5	60.5	59	60
Project	Project (PW)	10	10	10	10	10
	Internship	2	2	2	2	2
Elective courses	Professional Elective (PE)	18	18	18	18	18
	Open Elective (OE) (including one MOOCs)	12	12	12	12	12
Mandatory Courses	Mandatory (MC)	-	-	-	-	-
	Total Credits	160	160	160	160	160

7.1.1 Foundation Courses

Engineering Science courses, Basic Science Courses and Humanities courses are termed as Foundation Courses and are mostly offered at I and II Year.

7.1.2 Professional Core Courses

Professional Core Course is to be completed by all students of respective programme before they can move

on to the next semester.

7.1.3 Professional Core Electives

University Grants Commission has come up with the Choice Based Credit System (CBCS) in which the students have a choice to choose from the prescribed courses, which are referred as Professional elective and Open Elective courses.

Students have to register for a total of 6 professional core electives courses (PE-1 to PE-6) from the list of track-wise professional elective course as prescribed in the course structure of the programme. The following points are considered for a Professional Elective Course.

- Maximum strength of a class /section for each semester shall be 72.
- A course may be offered to the students, only if a minimum of 24 students (1/3 of the section strength) opt for it.
- The selection of course based on the choice for students shall be on 'first come first serve' through on line and off line registration.
- The Head of the department or concerned shall decide, whether or not to offer such course keeping in view the resources available in the department offering the course.

7.1.4 Open Electives

Choice Based Credit System (CBCS) is promoted in such a way that different open elective courses should be offered by every department in engineering to other departments. This interdisciplinary of learning open elective courses by other department students will have learning awareness and job-oriented benefits. Students require the opportunity to choose any open elective course from different departments and apply their knowledge to acquire jobs in that field of course. Learning and employment benefits are not only through their own course subjects but also through open elective courses.

Every student shall earn prescribed credits by choosing one of the open elective courses from the list of Open Electives given in the Curriculum. Further students from a particular program/branch can opt for one Open Elective (OE1) offered by their concerned department. However, two Open Electives are inter-disciplinary and shall be offered by other branches.

One open elective is to be chosen from the repository of **inter-disciplinary MOOCs** courses offered by NPTEL or any other recognized Institutions/Organization. Students shall consult their class mentors before opting for an open elective course (MOOCs)

The following guidelines are pertaining to Open Elective Courses.

- Maximum strength of a class /section for each semester shall be 72.
- A course may be offered to the students, only if a minimum of 24 students (1/3 of the section strength) opt for it. The minimum number of students is required to register the course to offer opted

course in the department.

- The selection of course based on the choice for students shall be on 'first come first serve' through on line and off line registration.

- The Head of the department or concerned shall decide, whether or not to offer such course keeping in view the resources available in the department offering the course.

7.1.5 Massive Open Online Courses as Open Elective

- MOOCs (Massive Open Online Courses) are introduced to meet with the global requirements and to inculcate the habit of self-learning and in compliance with the UGC guidelines

- A Student shall opt for a MOOC available on several online platforms such as NPTEL, Swayam etc, as an Open Elective.

- Concerned departments **shall declare the list of inter-disciplinary** courses that a student can pursue through MOOCs at the beginning of the corresponding semester.

- Students interested in pursuing MOOCs shall register for the course and submit this information at their department office at the start of the corresponding semester.

- Course content for the selected MOOCs shall be drawn from the respective MOOCs offering Portal.

- Course progress shall be monitored by the Mentors designated by the HoD.

- Grade obtained through the evaluation of the MOOC shall be considered for the CGPA calculation.

- Three credits shall be awarded to the student upon successful completion of MOOC.

- In case a student fails to complete the MOOCs he/she shall re-register for the same with the same provider, already offered that course. In case that provider discontinues to offer the course, Institution shall conduct an offline examination in the same format, which student already appeared in online examination, as per the MOOC syllabus.

7.1.6 Value Added Courses

- Value-added courses / certificate courses offered by Departments or through joint ventures with various industries / organizations to provide ample scope for the students to keep up with the latest technologies pertaining to their chosen field of studies.

- A four or five value added Programmes shall be proposed by the departments one week before the commencement of classes.

- The students are given liberty to choose the list of Value-added courses given as per their interest.

- Students interested in pursuing value added courses shall register for the courses, paying the stipulated fees, at the department office at the beginning of the semester against the courses that are announced by the department.

- Course progress shall be monitored by the course coordinator designated by the HoD.

- Result of value-added courses shall be declared with **"Satisfactory" or "Not Satisfactory"** performance

- Grade obtained through value added course shall not be considered for the CGPA calculation.

- A student shall complete at least TWO Value-added courses in order to be eligible for the award of the degree.

- Value added courses offered by Department / Institution are only valid.

- Value added courses are conducted beyond the working hours/on holidays.

- The duration of the value-added course should not be less than 40 learning hours.

7.1.7 Mandatory Courses

- A student shall pursue mandatory courses as specified in the course structure of the B.Tech. Programme.

- These courses are among the compulsory courses and do not carry any credits.

- A student has to secure 40 marks out of 100 in the Internal Examination, shall be necessary requirement for the student to qualify for the **award of Degree**.

- Result of mandatory courses shall be declared with **"Pass"** or **"Fail"** performance in the Comprehensive Marks Memo.

- No marks or letter grade shall be allotted.

- Attendance in the mandatory course shall be considered while calculating aggregate attendance.

8. Evaluation Process

The performance of a student in each semester shall be evaluated course-wise with a maximum of 100 marks for both Theory and Lab Course.

- For a Theory course, the distribution shall be 30 marks for Internal Evaluation and 70 marks for End-Examinations. The distribution is detailed in 8.1.1.

- For a Lab course, the distribution shall be 30 marks for Internal Evaluation and 70 marks End-Examinations. The distribution is detailed in 8.1.2

- Project stage-I, Socially-relevant project / Internship / Entrepreneurship activity shall be evaluated for 50 marks based on the Presentation/report submitted by the student.

- Project stage-II shall be evaluated for 200 marks. Mandatory courses with no credits shall be evaluated for 100 marks.

8.1 Internal Evaluation

8.1.1 Theory Internal Examinations

For a Theory Course, 30 marks are allotted for Internal Evaluation. Two mid-term examinations (Theory Internal Examinations) shall be conducted for a Theory Course during a semester and they shall be evaluated

for 20 marks. Remaining 10 marks is for continuous evaluation which includes weekly/ 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.

First midterm examination shall be conducted as per the syllabus of I & II units. The second midterm examination shall be conducted as per the syllabus of III, IV and V units.

The question paper shall be of subjective type in which four questions with an internal choice are to be answered. 80 % weightage for the best performance and 20 % for other shall be considered.

For Example:

Marks obtained in I mid-term examination: 19

Marks obtained in II mid-term examination: 10

Final Internal Marks: (19x0.8) + (10x0.2) = 17.2

If the student is absent for any one midterm examination, the final internal marks shall be arrived at by considering 80% weight age to the marks secured by the student in the appeared examination and zero to the other.

For Example:

Marks obtained in first mid: 0 (Absent); Marks obtained in second mid: 18

Final Internal Marks: (18x0.8) + (0x0.2) = 14.4

For Lab Course, there shall be a continuous internal evaluation during the semester for 30 marks. Out of the 30 marks, day-to-day performance of the student in the laboratory shall be evaluated for 20 marks by the concerned laboratory teacher based on experimental correctness/record/viva.

Two Lab Internal examinations shall be conducted for 10 marks by the concerned teacher. Performance of one best out of two tests to be considered.

Note: For some courses namely, Engineering Graphics - I & II and Engineering Graphics & Design, the distribution of internal evaluation and external evaluation marks shall be 30 and 70 respectively.

Of the 30 internal evaluation marks, day-to-day performance of the student shall be evaluated for 20 marks and Mid-term examination carries 10 marks. Day-to-day work shall be evaluated (10 marks for PART-A and 10 marks for PART-B) by the teacher concerned based on the exercises/submissions prepared in the class. Two midterm examinations shall be conducted in a semester for a duration of 2 hours each for 10 marks with a weightage of 80% for better of the two and 20% for the other. The sum of day-to-day evaluation and the midterm examination marks will be the final internal evaluation 30 marks for the subject. End examination shall be from Part-A only for 70 marks.

8.1.3 Internal Evaluation of Mandatory Courses

Mandatory courses are offered with no credits. However, a student has to complete Mandatory Courses in order to be eligible for the award of the Degree. There shall be an Internal Examination for 100 marks. A student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examination. In case, the student fails, a supplementary examination shall be conducted.

8.1.4 Make-up Internal Evaluation

The student who has missed both the Theory Internal examinations will be permitted to appear for a Make-up Internal examination in the event of his/her producing satisfactory evidences of medical ailment. One Make-up internal test shall be conducted immediately after the II Mid-term examination in the same semester, covering the total syllabus of FIVE Units in the respective course.

This Make-up examination will be given a weightage of 80%. Make-up tests shall be conducted outside the working hours and there can be even two such examinations on a day.

Student absent for I mid examinations with valid reasons he/ she should produce a supporting document to the department within a week after completion of last mid examination. And the same student absent for same subject in II mid examination, he/ she should produce a supporting document to the department immediately in order to giving the provision for makeup examination.

Make-up internal examinations are not for improvement of marks in Theory Internal examinations. There shall be no make-up internal examinations for a Lab course

8.2 End Evaluation

8.2.1 Theory End Evaluation

As specified in 8.0, Theory End Evaluation is done for 70 marks. End examination of theory subjects shall be conducted at the end of semester. There shall be Regular and Supplementary End Examinations. Theory End Examination shall be conducted for 70 marks and is of 3 hours duration. The question paper shall be of subjective type with 5 questions, one question from each unit, with internal choice. All questions carry equal marks of 14 each.

8.2.2 Lab End Examination

As specified in 8.0, Lab End Evaluation is done for 70 marks, in the form a Lab End Examination that shall be conducted for 3 hours in respective Laboratory. Each lab course will have its own evaluation procedure and weightage.

8.2.3 Supplementary Theory/Lab End Examinations

- Supplementary examination shall be conducted along with regular semester end examinations.
- During Semester End Examinations of even semester, supplementary examinations of odd semester shall be conducted and during semester end examinations of odd semester, supplementary

examinations of even semester shall be conducted.

- The same schedule is applicable to Supplementary Lab End Examinations. Supplementary examination shall be conducted along with the next batch of students or separately.

- Advanced supplementary shall be conducted only for Final Year II semester Students in view of their higher education pursuits and placement opportunities.

- 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 the next batch of students is not available, a separate supplementary examination will be conducted.

8.2.4 Challenge Evaluation, Revaluation and Recounting

Students may visit Examination Section Webpage for Norms and Procedures for Challenge Evaluation, Revaluation and Recounting of Answer Scripts. (Refer to Appendix II)

9.0 Internship and Project Evaluation

9.1 Innovative project / Socially relevant project / Entrepreneurship / Internship (Industry / Govt. / NGO / MSME / Online)

Innovative project / Socially relevant project / Entrepreneurship / Internship (Industry / Govt. / NGO / MSME / Online) activity carries 2 credits. A student can take part in any one of the activities during 6th Semester or during the summer break between 6th and 7th semester.

The student shall submit a certificate in support of his/her participation/activity to the Head of the Department. Such certificate shall be considered for the award of 2 credits by a departmental committee consisting of Head of the Department along with two senior faculty members of the Department. If a student fails to submit Certificate of participation, he will be declared FAIL in this activity, till any such certificate is submitted to the Head of Department or any such activity is undertaken by the student.

Innovative Project: A solution of practical consequence to an existing problem which

- lacks a feasible solution or a solution of practical consequence which is capable of replacing a solution to an existing problem which satisfy one or a few of these properties, easily implementable/sustainable/environmentally friendly/cheaper/outreach to remote locations inaccessible by the current solution

- solves the problem creates by the current solution/Industrial applicable solution

- minimises the attrition rate of the instruments (eg solar lamps in remote locations, which can be easily assembled in the remote location).

A part of the solution to an existing problem satisfying the above conditions. An activity rendering added benefits to a current usage of a product.

Socially Relevant Project: A student can pursue a socially relevant project/internship to solve pressing problems of the society. These innovative projects shall contribute to the national development goals and priorities. Topics/ representative activities can be found on Departmental Webpage/Curriculum/Head of the Department. Innovative Project / Socially relevant project can be taken up by an individual student or by a team of 5 students.

Entrepreneurship: Entrepreneurship activities (start-up ideas) are encouraged to trigger an entrepreneurial culture and inculcate entrepreneurial values and influence the mind-set of engineering students towards entrepreneurship. Entrepreneurship activity shall be evaluated upon submission of a detailed report by the student and if found satisfactory the student shall be awarded 2 credits and the entrepreneurial idea shall be incubated in Institute Innovation Cell to help entrepreneurs navigate the transition from ideas to successful businesses. (Entrepreneurship activity is a certification course/programme)

Internship (Industry / Govt / NGO / MSME / Online)

During the summer vacation during 6th semester, students are ready for industrial experience. Therefore, they may choose to undergo Internship with industry related activities. Students may choose either to work on entrepreneurial activities resulting in start-up or undergo internship with industry/ NGOs/ Government organizations/ Micro/ Small/ Medium enterprises to make them ready for the industry. The student shall submit a certificate in support of his/her participation to the Head of the Department. Such certificate shall be evaluated for the award of 2 credits by committee consisting of Head of the Department along with two senior faculty members of the Department. The duration of the participation and guidelines for the activity shall be decided by the respective Head of the Department.

Detailed guidelines are given in Appendix I.

9.2 Project Work Stage I

Project Stage I consists of a presentation of **Abstract of the main project** in the 7th Semester. After selecting specific topic, the student shall collect the information and prepare a report, showing his/her understanding of the topic and submit the same to the department before presentation. Project shall be evaluated for a total of 200 marks. Out of which, project work stage–I shall be evaluated for 50 marks at the end of 7th semester for the award of 2 credits in **7th Semester** and project stage-II for 150 marks in 8th semester.

The technical presentation/report shall be evaluated by a committee consisting of Head of the Department along with two senior faculty members of the Department. A student shall acquire 2 credits assigned, if his report for Stage I is declared Satisfactory by the committee based on Rubrics set by the Department for evaluation.

If a student fails in Project work stage-I, a re-examination shall be conducted within a month. In case he/she fails in the re-examination also, he/she shall not be permitted register for Project Stage-II.

9.3 Project Work Stage II

Out of a total of 150 marks for the **Project work stage –II**, The internal evaluation shall be carried for 50 marks done by a committee consisting of HOD, Project Supervisor and senior faculty member of the department and the remaining 100 marks shall be awarded by a committee consisting of HOD, project Supervisor and an External Examiner nominated by the Principal or Dean Academics.

Project work shall start in 7th semester and shall continue in the 8th semester. A student shall acquire 8 credits assigned to project work. The evaluation of project work shall be conducted at the end of **the 8th semester.** The internal evaluation shall be done on the basis of two seminars conducted in a semester as per the academic calendar and stipulated rubrics. In case, if a student fails in Project work, a re-examination shall be conducted within a month. In case he/she fails in the re-examination also, he/she shall not be permitted register for Project work. Further such students shall re-appear as and when next year 8th semester supplementary examinations are conducted.

10. ATTENDANCE REQUIREMENTS AND DETENTION POLICY

- A student shall maintain a minimum required attendance of 75% in AGGREGATE.

- Shortage of attendance up to 10% i.e., attendance between 65% to 75% in aggregate, may be condoned by the Institute Academic Committee based on the rules prescribed by the Academic Council of the Institute from time to time.

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

- Shortage of attendance below 65 % shall in no case be condoned. 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.

- Students whose shortage of attendance is not condoned OR who have not paid the stipulated fee OR who have not cleared any other due to the Institute in any semester are not eligible to write the Semester End Examination (SEE).

- Students, who do not meet the minimum required attendance of 65% in a semester, shall be detained in that semester and their registration for that semester shall stand cancelled. They shall not be promoted to the next semester.

- Students detained in a semester shall seek re-admission into that semester as and when offered.

- Academic regulations applicable to the semester in which re-admission is sought shall be applicable to the re-admitted student.

- In case, there are any professional electives and /or open electives, the same may also be re- registered, if offered. However, if those electives are not offered in the later semesters, then alternate electives may be chosen from the same set of elective courses offered under that category.

  Any student against whom any disciplinary action is pending shall not be permitted to attend semester end examination (SEE) in that semester.

11. Minimum Academic Requirements and Award of the Degree

The following Academic Requirements have to be satisfied in addition to the attendance requirements mentioned in section 10.

11.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory and lab courses, and project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the total of the internal and end examination marks taken together. In case of mandatory courses, he/she shall secure 40% of the total marks.

11.2 A student admitted in 4 year B. Tech programme, shall be promoted from 4th to 5th Semester only if he/she 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. A student admitted in 3 year B. Tech programme, shall be promoted from 4th to 5th Semester only if he/she fulfills the academic requirements of securing a minimum of 50 % credits from II year I and II-Semesters examinations conducted till that time.

11.3. A student admitted in 4 year B. Tech programme, shall be promoted from 6th to 7th Semester only if he/she fulfills the academic requirements of securing a minimum of 50% credits from I year I & II-Semesters, II year I & II-Semesters and III year I & II-Semesters examinations conducted till that time.

A student admitted in 3 year B. Tech programme, shall be promoted from 6th to 7th Semester only if he/she fulfills the academic requirements of securing a minimum of 50% credits from II year I & II-Semesters and III year I & II-Semesters examinations conducted till that time. And in case a student is detained for want of credits for particular academic year by sections 11.2 and 11.3 above, the student may make up the credits through supplementary examinations and only after securing the required credits he/she shall be permitted to join in the 5th semester or 7th semester as the case may be.

11.4 A student shall register and put up minimum academic requirement of all 160 credits and earn all 160 credits for the award of B. Tech degree

11.5 A student shall be qualified in two certificate courses (value-added courses) of 40 hours duration each during his/her course of study. Please refer to Value-added Courses description.

11.6 Students who fail to earn 160 credits as indicated in the course structure within eight academic years from the year of their admission shall forfeit their seat in B. Tech. course and their admission shall stand cancelled.

12. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The performances of students in each of the courses in the Programme are expressed in terms of letter grades based on an absolute grading system. We use 10-point grading system with letter grades. They are given in the following table.

Marks Obtained	Letter Grade	Description	Grade Points (GP)
≥90	S	Superior	10
≥80 and ≤89.99	E	Excellent	9
≥70 and ≤79.99	A	Very Good	8
≥60 and ≤69.99	B	Good	7
≥50 and ≤59.99	C	Average	6
≥40 and ≤49.99	D	Pass	5
≤40	F	Fail	--
Absent in the exam(s)	AB	Absent	--

A student is eligible for the award of the B.Tech. Degree with the class as mentioned in the following table

CGPA	Class
≥7.5	First class with Distinction
≥6.5 and <7.5	First Class
≥5.5 and <6.5	Second Class
≥5.0 and <5.5	Pass

For mandatory courses, student shall be awarded "pass" or "fail "without any credit. This shall not be counted for the computation of SGPA/CGPA

12.1 Computation of SGPA

The performance of each student at the end of each semester shall be indicated in terms of SGPA. The SGPA shall be calculated as follows:

$$SGPA = \frac{Total\ earned\ weighted\ grade\ points\ in\ a\ semester}{Total\ credits\ in\ a\ semester}$$

$$SGPA = \frac{\sum_{i=1}^{p} C_{i.}.G_i}{\sum_{i=1}^{p} C_i}$$

Where

$C_{i.}$ = Number of credits allotted to a particular curse 'i'

G_i = Grade point corresponding to the letter grade awarded to the course i

$i = 1,2,....$p represent the number of courses in a particular semester.

Note: SGPA is calculated and awarded to those students who pass all the courses in a semester.

12.2 Computation of CGPA

The performance of a student shall be obtained by calculating Cumulative Grade Point Average (CGPA), which is weighted average of the grade points obtained on all courses during the course of study

$$CGPA = \frac{Total\ earned\ weighted\ grade\ points\ for\ the\ entire\ programme}{Total\ credits\ for\ the\ entire\ program}$$

$$CGPA = \frac{\sum_{j=1}^{m} C_{j.}\ G_j}{\sum_{j=1}^{m} C_j}$$

Where

$C_{j.}$ = Number of credits allotted to a particular semester 'j'

G_j = Grade point corresponding to the letter grade awarded to the semester j

$j = 1,2,....m$ represent the number of semester of the entire programme.

12.3 Grade Card

The grade card issued shall contain the following

- The credits for each course offered in that semester

- The letter grade and grade point awarded in each course

- The SGPA and CGPA

- Total number of credits earned by the student up to the end of that semester

Example: - Computation /calculation of SGPA

Course name	Credits (C)	Letter grade	Grade point (GP)	Credit point (CP=C*GP)
Course 1	4	A	9	4x9=36
Course 2	3	S	10	3*10=30
Course 3	2.5	S	10	2.5*10=25
Course 4	1.5	C	6	1.5*6=9
Course 5	1	D	5	1*5=5
Total	12			105

Therefore, SGPA= $\frac{105}{12}$ 8.75

Example Illustration of CGPA

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5
Credit: 20 SGPA : 8.75	Credit : 20 SGPA : 8.25	Credit : 22 SGPA : 7.89	Credit: 23 SGPA : 8.21	Credit : 22 SGPA : 7.86

Thus, CGPA = $\frac{20*8.75+20*8.75+22*7.89+23*8.21+22*7.86}{107} = 8.34$

Similarly, compute CGPA obtained at the end of 8th semester shall be the final CGPA secured by the student for the entire programme.

12.4 Conversion of SGPA into percentage

In case of a specific query by students/employers regarding Semester Grade Point Average (SGPA)/ Cumulative Grade Point Average (CGPA) into percentage, the following formulae will be adopted for notional conversion of CGPA into percentage.

Percentage = 9.5 * CGPA

13. 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.

14. Transitory Regulations

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

15. 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

16. Minimum Instruction Days for a Semester

The minimum instruction days including exams for each semester shall be 16 weeks.

17. Student transfers

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the affiliating University from time to time.

18. Announcement of results

- Results review committee comprising of University nominee, Principal, Dean Academics, Chairmen of various boards of studies, Controller of Examinations and Deputy Controller of Examinations will monitor the results and gives the permission for announcement of results.

- After review meeting results are loaded in to Institution website from which students can access their results by entering Hall Ticket number. And also results in form of hard copy are available with respective Heads of the departments.

19. General Instructions:

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

- Malpractices rules-nature and punishments are appended.

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

- In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal/ Governing body is final.

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

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

Appendix-I: Internship Guidelines

The Head of the Department will arrange internship for students in industries/organization after fifth semester or as per AICTE/ affiliating University guidelines. Institutions may also device online system for arranging &managing internships. The general procedure for arranging internship is given below:

Step 1: Request Letter/ Email from the office of HOD of the department should go to industry to allot various slots of 4-6 weeks during summer vacation as internship periods for the students. Students request letter/profile/ interest areas may be submitted to industries for their willingness for providing the training.

Step 2: Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email. In case the students arrange the training themselves the confirmation letter will be submitted by the students in the office of Training & Placement through concerned department. Based on the number of slots agreed to by the Industry.

Step 3: Students on joining Training at the concerned Industry / Organization, submit the Joining Report/ Letters / Email.

Step 4: Students undergo industrial training at the concerned Industry / Organization. In-between Faculty Member(s) evaluate(s) the performance of students once/twice by visiting the Industry/Organization and Evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers.

Step 5: Students will submit training report after completion of internship.

Step 6: Training Certificate to be obtained from industry.

Step 7: List of students who have completed their internship successfully will be issued by concerned Department.

For more details refer:

https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

Appendix II: Norms and Procedures for Challenge Evaluation/Revaluation/Recounting

Revaluation / Recounting:

- The students who wishes to apply for Revaluation/Recounting of his/her answer-books(s) must submit his/her application on the prescribed from together with the requisite fee to the Controller of Examinations before expiry of 15 days excluding the date of the declaration of his/her examination result. Application not received in the prescribed form or by the due date or without the requisite fee shall be rejected.

- After Recounting / Revaluation, records are updated with changes if any and the student will be issued a revised memorandum of marks. If there are no changes, the student shall be intimated the same through a notice.

- No Revaluation / Recounting for Laboratory Examination.

- The students are informed to be more careful in furnishing the information while applying for Recounting / Revaluation. The applications with insufficient information will be summarily rejected and the student has to forfeit the amount paid in this connection.

Challenge valuation:

- Applications are invited from the students, who wish to apply for Challenge Valuation in the subjects of the B.Tech Regular and Supplementary examinations

- The student will apply for Challenge valuation in a specified application and should be routed through the HOD concerned.

- The students who have applied for the revaluation for a paper(s) of an examination are only eligible for the Challenge Valuation of that paper(s) of that examination.

- A Fee of Rs. 10000/- (Ten Thousand Rupees Only) for each paper is to be paid within the last date for challenge valuation.

- A Xerox copy of the answer script will be provided to the student on receipt of the payment of fee and date and time of the valuation will be informed to the student, so that valuation will be done in the presence of the teacher attended in support of the student nominated by the HOD concerned.

- The HOD concerned will nominate a teacher of the concerned subject to observe the valuation in support of the student. This will be done on the request of the student.

- If the marks obtained in the challenge valuation are more than or equal to 15% of the maximum marks with respect to the original marks obtained in the first valuation, then the marks obtained in the Challenge valuation will be awarded to the student and the institute will pay back Rs 9,000 (Nine thousands rupees only) to the student. If the student status changes from fail to pass, an amount of Rs. 5000 will be refunded to the student. Otherwise there will not be any change in the result of the student and original marks will be retained and the student will forfeit the fee paid.

- No Challenge valuation for Laboratory Examination

APPENDIX III: Rules for Disciplinary Action for Malpractices / Improper Conduct in Examinations

Malpractices identified by squad or special invigilators or invigilators
Punishments shall be given to the students as per the above guidelines. The case is to be referred to the malpractice committee.

Malpractice committee
1. The Principal, Chairman
2. Dean, Academics, Member
3. Invigilator, Member
4. Subject expert, Member
5. Concerned Head of the Department, Member
6. Controller of Examinations, Member Secretary

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

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
7.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred for four consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all University examinations, if his

		involvement is established. Otherwise, the candidate is debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject only.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant — Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of student of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. If the candidate physically assaults the invigilator/officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
10.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the

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

Activities (Non-Credit) as per AICTE Guidelines
List of Activities

1. Physical and Health

    1.1 Physical Activities: (a) Games and Sports, (b) Gardening (c) Tree Plantation (d) Yoga:

    1.2 NCC/NSS: Standard procedure

2. Culture

    2.1 Learning an art form: music, dance, theatre, painting, and other art forms

    2.2 Heritage: Visit to museum, archaeology sites, cultural walks, tours, local traditions

    2.3 Intangible Cultural Heritage: Festivals, Food ways, Local Games

3. Literature & Media

    3.1 Literature, Cinema and Media: workshop, reading multiple news sources, analyse ads

    3.2 Group reading: Group sits and each person reads aloud (if possible, with proper modulation) taking turns. This if done properly for an hour one may complete 30-40 pages in an hour

4. Social Service

    4.1 Social Awareness: Artisans-relates to engg., visit to hospitals, orphanages, police station, courts, trauma centres, consumer forums

    4.2 Social Service: teach in neighbourhood, adopt an underprivileged school, village stay / visit (NSS), cleanliness drive, and skill transfer

5. Self-Development

    5.1 Spiritual, Mindfulness & Meditation

    5.2 Religion and Inter-faith: Reading of books on religious texts of different faiths by famous authors, organizing lecture on interfaith issues covering philosophies and chronology and contemporary situations world over at a given time

    5.3 Human Values

    5.4 Behavioural and Interpersonal skills: Motivational lectures, Group Discussions/activities, Case Study, Games/Stimulation Exercises, Role-Playing, Mindfulness training.

    5.5 Lectures: Areas could be from science, engineering, social sciences, arts or even politics.

6. Nature

    6.1 Nature Club: bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity

    6.2 Environment Protection (non-credit course)

7. Innovation

    7.1 Project based – Sc. Tech., Social, Design & Innovation: (a) Exposure to social problems (which are amenable to technological solutions) (b) Design & Innovation (to address above problems)

First 3-weeks – Induction Program will have Physical activities (*), Learning an art form (*), Literature & Cinema, Social Awareness (*) Lectures, Visits to local areas, Universal Human Values (*)

(*) It is the core part of Induction Program (Besides Familiarization to the College, Department and Branch career opportunities)

After first 3 weeks (1st semester)

Based on student interest – the above may be continued

Universal Human Values Groups – Meet once a week with 1st year students with the same faculty mentor & senior student guide.

Semester 2 to 4

Every student should register for some activity mentioned above in every semester. Spend 3-5 hours per week on the activity.

1.   Environment Science (mandatory non-credit course prescribed at 1/2 semester)
2.   Constitution of India (mandatory non-credit course prescribed at 3/4 semester)
3.   Essence of Indian Traditional Knowledge (mandatory non-credit course prescribed at 3/4 semester)

For mandatory non-credit courses, these will be graded as Pass or Fail (P/F). Thus, the grades obtained will not affect the grade point average. However, they will appear on the grade sheet.

Semester 5 to 8

Every student should register for some activity mentioned above in every semester. Spend 3-5 hours per week on the activity. For activities, suitable registration system in case of the semesters will be developed.

INDUCTION PROGRAMME (Zero Semester)

Induction programme for newly admitted students is conducted in line with AICTE/UGC Induction programme policy, every year before the commencement of the first semester classes. The objective of the Induction programme is to demystify what is expected of students in Intermediate level and to provide adequate foundation in the core applied science subjects and English limited to moderate level so that students do not face any difficulty when the classes commence.

The syllabus for the course is framed in such a way that equal importance is given to both Engineering discipline and personality development which includes soft skills, sports and cultural Activities. The duration of the induction programme is **THREE** weeks. The students are trained in Foundation courses, basics of programming and English apart from other co-curricular and extra-curricular activities.

The objective of the Induction Programme is to work closely with the newly joined students in order to facilitate the following:

- Make the students feel comfortable in the new environment

- Allow them to explore their academic interests and activities

- Reduce competition and make them work for excellence

- Promote bonding within them

- Build relations between teachers and students

- Give a broader view of life

- Build character

Phase	Course Code	Name of the course	Lecture	Practical
Regular Phase	19A501	Proficiency classes: Familiarity with a computer	2	2
Regular Phase	19AC01	Proficiency classes: English Communication Skills	2	2
Regular Phase	19A502	Basics of Programming and Lab	3	2
Regular Phase	19AC02	Foundation classes in Mathematics	3	0
Regular Phase	19AC03	Foundation classes in Physics	3	2
Regular Phase	19AC04	Foundation classes in Chemistry	3	2
Regular Phase	19AC05	Universal Human Values	2	0
Regular Phase	19A301	Fundamentals of Engineering Drawing	1	0
Regular Phase	-	Physical education activities – Sports and Games	0	1
Non daily	-	Creative Arts		
Non daily	-	Lectures by eminent personalities		
Non daily	-	Visits to local area		
Non daily	-	Extra-curricular activities		

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET (AUTONOMOUS)

Department of Mechanical Engineering

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 OBEJCTIVES (PEOs)

PEO1: Work productively as Mechanical engineers, including supportive and leadership roles on multi-disciplinary teams.

PEO2: Meet the needs of Indian and Multinational companies to synthesize data and technical concepts for application in new product design.

PEO3: Communicate effectively, recognize, and incorporate societal needs and constraints in their professional endeavors along with professional ethics in their professional practice.

PEO4: Engage in continuous learning, such as graduate study to remain current in their profession and be leaders in the technological society.

PROGRAMME OUTCOMES

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. 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.
11. 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.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

Mechanical Engineering Graduate will be able to

1. Apply the knowledge of Engineering Mathematics (statistics, probability distributions) and technical competency to solve problems related to design, simulation, value engineering and risk management of mechanical systems.
2. Conduct independent research for information required in engineering problem solving.
3. Measure, analyze and improve mechanical engineering processes using appropriate tools and techniques in real time business scenarios.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(AUTONOMOUS)

Department of Mechanical Engineering
I B. Tech - Zero Semester

Phase	Course Code	Name of the course	Lecture	Practical
Regular Phase	19A501	Proficiency classes: Familiarity with a computer	2	2
Regular Phase	19AC01	Proficiency classes: English Communication Skills	2	2
Regular Phase	19A502	Basics of Programming and Lab	3	2
Regular Phase	19AC02	Foundation classes in Mathematics	3	0
Regular Phase	19AC03	Foundation classes in Physics	3	2
Regular Phase	19AC04	Foundation classes in Chemistry	3	2
Regular Phase	19AC05	Universal Human Values	2	0
Regular Phase	19A301	Fundamentals of Engineering Drawing	1	0
Regular Phase	-	Physical education activities – Sports and Games	0	1
Non daily	-	Creative Arts		
Non daily	-	Lectures by eminent personalities		
Non daily	-	Visits to local area		
Non daily	-	Extra-curricular activities		

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(AUTONOMOUS)
Department of Mechanical Engineering
Course Structure for R19 Regulations

I Year I Semester

S. No.	Category	Course Code	Course Title	L	T	P	Credits
1	HS	19AC15T	Functional English and Life Skills	3	-	-	3
2	BS	19AC11T	Algebra and Calculus	3	1	-	4
3	BS	19AC13T	Chemistry of Materials	3	-	-	3
4	ES	19A311T	Engineering Graphics –I	1	-	2	2
5	ES	19A511T	Problem Solving and C Programming	3	-	-	3
6	MC	19AC16T	Environmental Science	3	-	-	0
Lab Courses							
7	HS	19AC15L	Communicative English Lab	-	-	3	1.5
8	BS	19AC13L	Chemistry of Materials lab	-	-	3	1.5
9	ES	19A511L	C Programming Lab	-	-	3	1.5
				16	1	11	19.5

I Year II Semester

S. No.	Category	Course Code	Course Title	L	T	P	Credits
1	BS	19AC21T	Differential Equations and Vector Calculus	3	1	-	4
2	BS	19AC23T	Engineering Physics	3	-	-	3
3	ES	19A521T	Python Programming	3	-	-	3
4	ES	19A321T	Engineering Graphics –II	2	-	2	3
5	ES	19A322T	Engineering Mechanics	2	1	-	3
Lab Courses							
6	ES	19A521L	Python Programming Lab	-	-	3	1.5
7	BS	19AC23L	Engineering Physics Lab	-	-	3	1.5
8	ES	19A323L	Engineering & IT Workshop	-	-	3	1.5
				13	2	11	20.5

Department of Mechanical Engineering

II Year I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	BS	19AC31T	Partial Differential Equations and Complex Variables	3		-	3
2	ES	19A236T	Basic Electrical and Electronics Engineering	3	-	-	3
3	BS	19AC34T	Life Sciences for Engineers	2	-	-	2
4	PC	19A331T	Mechanics of Solids	2	1	-	3
5	PC	19A332T	Metallurgy & Material Science	3	-	-	3
6	PC	19A333T	Basic Thermodynamics	2	1	-	3
7	PC	19A334T	Kinematics of Machinery	2	1	-	3
			Lab Courses				
8	PC	19A335L	Material Science Lab & Mechanics of Solids Lab	-	-	2	1
9	PC	19A336L	CAD Machine Drawing lab	-	-	2	1
10	ES	19A236L	Basic Electrical and Electronics Engineering lab	-	-	2	1
				17	3	6	23

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	BS	19AC41T	Numerical Methods & Probability and Statistics	3	-	-	3
2	HS	19AE41T	Managerial Economics and Financial Accounting	2	1	-	3
3	PC	19A341T	Manufacturing Processes	3	-	-	3
4	PC	19A342T	Fluid Mechanics &and Hydraulic Machinery	2	1	-	3
5	PC	19A343T	Dynamics of Machinery	2	1	-	3
6	PC	19A344T	Applied Thermodynamics – I	2	1	-	3
7	MC	19AC45T	Essence of Indian Traditional Knowledge	3	-	-	0
			Lab Courses				
8	PC	19A341L	Manufacturing Processes Lab	-	-	2	1
9	PC	19A342L	Fluid Mechanics & Hydraulic Machines Lab	-	-	2	1
10	PC	19A345L	Theory of Machines Lab	-	-	2	1
				17	4	6	21

Department of Mechanical Engineering

III Year I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PC	19A351T	Applied Thermodynamics – II	2	1	-	3
2	PC	19A352T	Machine tools	2	1	-	3
3	PC	19A353T	Design of Machine Elements-I	2	1	-	3
4	PE	19A35AT	IC Engines	3	-	-	3
		19A35BT	Design and Transmission System				
		19A35CT	Industrial Management				
		19A35DT	Optimization Techniques through MATLAB				
5	PE	19A35ET	Automobile Engineering	3	-	-	3
		19A35FT	Design for Manufacturing				
		19A35GT	Non-Destructive Testing				
		19A35HT	Automation & Robotics				
6	OE	19A35IT	Rapid Prototyping	3	-	-	3
		19A35JT	Industrial Robotics				
		19A35KT	Entrepreneurship development				
7	MC	19AC57T	Constitution of India	3	-	-	0
8	HS	19AC53T	Universal Human Values - II	1	1	-	2
Lab Courses							
9	HS	19AC51L	General Aptitude	-	-	2	1
9	PC	19A351L	Thermal Engineering Lab	-	-	2	1
				18	3	4	22

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PC	19A361T	Heat Transfer	2	1	0	3
2	PC	19A362T	Engineering Metrology	2	1	0	3
3	PC	19A363T	Applied Thermodynamics-III	2	1	0	3
4	PC	19A364T	Design of Machine Elements-II	3	-	0	3
5	PE	19A36AT	Turbo machinery	3	-	0	3
		19A36BT	Tribology				
		19A36CT	Instrumentation and control systems				
		19A36DT	Additive Manufacturing				
6	OE	19A16GT	Basic Civil Engineering	3	-	0	3
		19A16HT	Water Resources and Conservation				
		19A26GT	Energy Management and Conservation				
		19A26HT	Fuzzy Logic and Neural Networks				
		19A46GT	Electronic Circuits and its Applications				
		19A46HT	Basics of Communication Systems				
		19A56IT	Artificial Intelligence				
		19A56JT	Cyber Security				
Lab Courses							
7	BS	19AC62L	Professional Communication Skills Lab	-	-	3	1.5
8	PC	19A361L	Heat Transfer Lab	-	-	2	1.5
9	PC	19A362L	Metrology& Machine Tools Lab	-	-	2	1
10	INTERN	19A366I	Innovative project / Socially relevant project / Entrepreneurship / Internship	-	-	-	2
				15	3	7	24

Department of Mechanical Engineering

IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PC	19A371T	CAD/CAM	2	-	-	2
2	PC	19A372T	Operations Research	2	1	0	3
3	PE	19A37AT	R&AC	3	-	0	3
		19A37BT	Finite Element Methods				
		19A37CT	Unconventional machining process				
		19A37DT	Mechatronics				
4	PE	19A37ET	Non-conventional sources of energy	3	-	0	3
		19A37FT	Mechanical Vibrations				
		19A37GT	Total Quality Management				
		19A37HT	CNC and Adaptive Control				
5	OE	19A37IT	Open Elective-3 (MOOCs)	3	-	0	3
Lab Courses							
6	PC	19A371L	CAD/CAM Lab	0	-	2	1
7	PC	19A373L	Instrumentation/Optimization lab with MATLAB software lab	0	-	2	1
8	PW	19A374P	Project Phase I	-	-	-	2
				13	1	4	18

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	
1	PE	19A38AT	Power plant engineering	3	-	0	3
		19A38BT	Composite materials				
		19A38CT	Production and Operation Management				
		19A38DT	Supply chain Management				
2	OE	19A18DT	Disaster Management	3	-	0	3
		19A18ET	Building Planning and Construction				
		19A28DT	Battery Energy Storage Systems				
		19A28ET	System Modelling and Simulation				
		19A48DT	Introduction to Digital Design				
		19A48ET	Industrial Electronics				
		19A58ET	Internet of Things				
		19A58FT	Web Programming				
Lab Courses							
3	PW	19A381P	Project Phase II	-	-	-	8
				6	-	-	14

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   Functional English and Life Skills
Category   HS
Course Code   19AC15T
Year   I Year
Semester   I Semester (Common to CE, ME, CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To focus on appropriate reading strategies for comprehension of various academic texts and authentic materials.
- To impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays.
- To provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.
- To build self-confidence, encourage critical thinking, foster independence and help people to communicate more effectively.

Unit 1   9
Reading: *On the Conduct of Life* by William Hazlitt
Life Skills: 'Values and Ethics' with reference to Rudyard Kipling's poem '*If*'
Grammar and Vocabulary: Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.
Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.

Unit 2   9
Reading: *The Brook* by Alfred Tennyson
Life Skills: 'Self-Improvement' with reference to George Bernard Shaw's speech '*How I Became a Public Speaker*'
Grammar and Vocabulary: Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.
Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.

Unit 3   9
Reading: *The Death Trap* by Saki
Life Skills: 'Time Management' with reference to an extract from Seneca's letter to his friend '*On Saving Time*'
Grammar and Vocabulary: Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.
Writing: Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

Unit 4   9
Reading: *ChinduYellamma*
Life Skills: 'Innovation' with reference to the life of 'Muhammad Yunus'
Grammar and Vocabulary: Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms
Writing: Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables.

Unit 5   9

Reading: *Politics and the English Language b*y George Orwell
Life Skills: 'Motivation with reference to Ranjana Deve's article 'The Dancer with a White Parasol'
Grammar and Vocabulary: Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Writing: Writing structured essays on specific topics using suitable claims and evidences.

Prescribed Text Books:
1. Language and Life published by Orient Black Swan (with CD).
Reference Books:
1. English Grammar in Use: A Self Study Reference and Practice Book, Raymond Murphy, Fourth Edition, Cambridge Publications.
2. English Grammar and Composition, David Grene, Mc Millan India Ltd.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Read, scan and skim texts such as literary forms, journalistic articles and scientific readings for comprehension and retention.	L2
2. Exhibit self-confidence and innovative thinking and communicate more effectively.	L3
3. Understand the factors that influence use of grammar and vocabulary in speech and writing and formulate sentences with grammatical accuracy	L2
4. Produce coherent and unified paragraphs with adequate support and detail	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC15T.1	-	-	-	-	-	-	-	-	-	3	-	2
19AC15T.2	-	-	-	-	-	-	-	-	-	3	-	2
19AC15T.3	-	-	-	-	-	-	-	-	-	3	-	2
19AC15T.4	-	-	-	-	-	-	-	-	-	3	-	2
19AC15T.5	-	-	-	-	-	-	-	-	-	3	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Algebra and Calculus
Category   BS
Course Code   19AC11T
Year   I Year
Semester   I Semester (Common to all branches of Engineering)

Lecture Hours	Tutorial Hours	Practical	Credits
3	1	-	4

Course Objectives:
* This course will illuminate the students in the concepts of calculus and linear algebra.
* This course will equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Unit 1   Matrix Operations and Solving Systems of Linear Equations   8
Rank of a matrix by echelon form - solving system of homogeneous and non-homogeneous linear equations by rank method - Eigen values and Eigen vectors - their properties.

Unit 2   Cayley-Hamilton theorem   8
Cayley-Hamilton theorem (without proof) - finding inverse and power of a matrix by Cayley-Hamilton theorem - diagonalisation of a matrix, quadratic forms and nature of the quadratic forms - reduction of quadratic form to canonical forms by orthogonal transformation.

Unit 3   Functions of several variables   8
Partial derivatives - total derivatives - chain rule - change of variables – Jacobian - maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers for three variables.

Unit 4   Mean value theorems and curve tracing   6
Taylor's and Maclaurin's theorems (without proofs) – simple problems. Curve tracing – Cartesian and polar curves

Unit 5   Multiple Integrals and Special Functions   10
Double integrals: Evaluation - change of order of integration - change of variables (Cartesian to polar) - areas enclosed by plane curves and Evaluation of triple integral.Beta and Gamma functions and their properties - relation between beta and gamma functions.

Prescribed Text Books:
1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
Reference Books:
1. Higher Engineering Mathematics, Ramana B.V., Tata McGraw
2. Higher Engineering Mathematics, John Bird 7th Edition, Routledge-Tylor and /francis Group London, 2014

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Apply the knowledge to solve System of linear equations.   L3
2. Develop the use of matrix algebra techniques that is needed by engineers for   L3
    practical applications.
3. Classify the functions of several variables which is useful in optimization.   L4
4. Understand mean value theorems to real life problems and will understand the   L2
    applications of curve tracing.

5. Solve important tools of calculus in higher dimensions and be familiar with 2-dimensional, 3- dimensional coordinate systems and also learn the utilization of special functions.   L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC11T.1	3	3	-	-	-	-	-	-	-	-	-	3
19AC11T.2	3	2	-	-	-	-	-	-	-	-	-	3
19AC11T.3	3	3	-	-	-	-	-	-	-	-	-	2
19AC11T.4	3	3	-	-	-	-	-	-	-	-	-	2
19AC11T.5	3	3	-	-	-	-	-	-	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   Chemistry of Materials
Category   BS
Course Code   19AC13T
Year   I Year
Semester   I Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To acquaint the students with soft and hard water types and softening methods.
- To introduce the basic concepts of electrochemical cells and photovoltaic cells.
- To familiarize the students with engineering materials, their properties and applications.
- To impart knowledge on corrosion and its significance.
- To explain nano and smart materials and their uses.

Unit 1   Water Technology   8
Introduction –Hard and Soft water, Estimation of hardness by EDTA Method -Boiler troubles -scale and sludge-priming and foaming, specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, Industrial water treatment – zeolite and ion-exchange processes-desalination of brackish water, reverse osmosis (RO) and electro dialysis..

Unit 2   Energy Sources and Applications   10
Electrode potential, determination of single electrode potential –Nernst's equation, reference electrodes, Weston Cd Cell, hydrogen and calomel electrodes – electrochemical series and its applications – primary cell, dry or Leclanche cell – secondary cell, lead acid storage cell, nickel-cadmium cell – lithium batteries (Lithium-MnO$_2$) – fuel cell, hydrogen-oxygen fuel cell. Solar energy, photovoltaic cell and applications.

Unit 3   Corrosion Engineering   10
Corrosion: Definition – theories of corrosion, dry corrosion and electro chemical corrosion – factors affecting corrosion, nature of the metal and nature of the environment.
Corrosion controlling methods: Sacrificial and Impressed current cathodic protection, Metallic coatings, anodic coatings, cathodic coating, galvanizing and tinning, anodic inhibitors and cathodic inhibitors –organic coatings, paints and varnishes (constituents and their functions).

Unit 4   Polymers and Fuel Technology   10
Polymers: Introduction, differences between thermoplastic and thermo setting resins, Preparation, properties and uses of PVC, Bakelite and polyphosphazenes.
Fuels – Types of fuels, calorific value, numerical problems based on calorific value. Liquid Fuels refining of petroleum, fuels for IC engines, knocking and anti-knock agents, Octane and Cetane values, alternative fuels- propane, ethanol, bio fuels
Cement: Portland cement, constituents, Manufacture of Portland Cement, chemistry of setting and hardening of cement

Unit 5   Nano and Smart Materials   10
Nano Materials: Introduction to Nano materials, chemical synthesis of nanomaterials: Sol-gel method, Reverse micellar method, Characterization of nanoparticles by BET method, characterization of nanomaterials by SEM & TEM (includes basic principles of SEM & TEM), Applications of nanomaterials in waste water treatment, lubricants and engines.
Smart Materials: Introduction – Types of smart materials-self healing materials. Uses of smart materials.

Prescribed Text Books:
1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, (2014).
2. B.K. Sharma, Engineering Chemistry, Krishna Prakasham, (2014).

Reference Books:
1. Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003).
2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press (2013).
3. S.S. Dara, A Textbook of Engineering Chemistry, S.Chand& Co, (2010).
4. V. Raghavan, A Material Science and Engineering, Prentice-Hall India Ltd, (2004).
5. N. Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014).
6. K. Sesha Maheshwaramma and MridulaChugh, Engineering Chemistry, PearsonIndia Edn services, (2016).

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. List different water analysis methods and water treatment processes.	L1
2. Understand different cells and illustrate the principles of solar energy	L2
3. Classify theories of corrosion and apply their principles for corrosion control	L3
4. Distinguish between various polymers, fuels and analyze the composition of cement	L4
5. Analyze the properties and application of nano materials and smart materials	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC13T.1	2	2	-	2	-	-	-	-	-	-	-	2
19AC13T.2	3	2	-	2	-	-	-	-	-	-	-	2
19AC13T.3	3	2	-		-	-	-	-	-	-	-	2
19AC13T.4	3	2	-		-	-	-	-	-	-	-	-
19AC13T.5	2	2	-	2	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   Engineering Graphics - I
Category   ES
Course Code   19A311T
Year   I Year
Semester   I Semester (Common to CE, ME)

Lecture Hours	Tutorial Hours	Practical	Credits
1	-	2	2

Course Objectives: This course will
* Cover BIS standards and conventions while drawing Lines, printing Letters and showing Dimensions.
* Teach the fundamental in Geometrical Constructions, Polygons and Curves used in Engineering Practices.
* Prepare the student for future Engineering positions.

Unit 1   Introduction   Theory Hours: 06 Practice sessions: 06
Lettering – Geometrical constructions - Curves used in Engineering Practice: Conic Sections– General method only. Special methods: Ellipse – Oblong method, Arcs of circle method and Concentric circles method - Rectangle method and Tangent method for Parabola – Rectangular Hyperbola.

Unit 2   Cycloidal Curves and Involutes   Theory Hours: 03 Practice sessions: 03
Cycloidal Curves: Cycloid, Epicycloid and Hypocycloid (treatment of simple problems only)
Involutes – Square, Pentagon, Hexagon and Circle.

Unit 3   Projections of Points and Lines   Theory Hours: 05 Practice sessions: 05
Projections of Points and Projections of Lines-inclined to one reference plane - inclined to both reference planes, finding the True lengths.

Unit 4   Projections of Planes   Theory Hours: 05 Practice sessions: 05
Projections of regular Plane surfaces inclined to one reference plane and both reference planes and Projection of planes using auxiliary planes.

Unit 5   Projections of Solids   Theory Hours: 05 Practice sessions: 05
Projections of Regular Solids – Cylinder, Cone, Prism and Pyramid - inclined to one reference and both reference planes.

Prescribed Text Books:
1. Engineering Drawing, N.D. Bhatt, Charotar Publishers.
2. Engineering Drawing, K.L. Narayana, P. Kanniah, Scitech Pub.
Reference Books:
1. Engineering Drawing and Graphics, Venugopal/ New age.
2. Engineering Drawing, Johle, Tata McGraw-Hill.
3. Engineering Drawing, Shah and Rana, Pearson Education

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the concepts of Conic Sections.	L2
2. Understand the concept of Cycloidal Curves, Involutes and the application of industry standards.	L2
3. 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.	L3

4. Understand and apply Orthographic Projections of Planes wherever necessary and becomes efficient in applying the concept of Auxiliary Projections of Points, Lines and Planes in industrial applications   L3

5. Understand and analyze the Orthographic Projections of Solids.   L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A311T.1	3	-	-	-	-	3	2	-	1	2	-	-	1	-	1
19A311T.2	3	-	-	-	-	3	2	-	1	2	-	-	1	-	2
19A311T.3	3	2	-	-	-	3	2	-	1	2	-	-	1	-	3
19A311T.4	3	2	-	-	-	3	2	-	1	2	-	-	1	-	3
19A311T.5	3	-	2	-	2	2	-	3	3	-	-	3	1	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   Problem Solving and C programming
Category   ES
Course Code   19A511T
Year   I Year
Semester   I Semester (Common to CE, EEE, ME, ECE & CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- Understanding the steps in problem solving and formulation of algorithms to problems.
- Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
- Develop intuition to enable students to come up with creative approaches to problems.
- Develop programs using pointers, structures and unions.
- Manipulation of text data using files.

Unit 1   20
Problem Solving: Steps to solve problems, algorithm, Pseudo code, Flowchart with examples, Program Development Environments.
Introduction to programming: Programming languages and generations.
Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, data types, constants, I/O statements, operators, precedence and associatively.

Unit 2   17
Introduction to decision control statements: Selective, looping and nested statements, jumping statements.
Arrays: Introduction, declaration of arrays, accessing and storage of array elements, searching (linear and binary search algorithms) and sorting (selection and bubble) algorithms, multidimensional arrays, matrix operations.

Unit 3   15
Strings: Declaration and Initialization, String Input / Output functions, String manipulation functions.
Functions: Types of functions, recursion, scope of variables and storage classes.
Preprocessor Directives: Types of preprocessor directives, examples.

Unit 4   16
Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, function pointers, dynamic memory allocation, advantages and drawbacks of pointers

Unit 5   18
Structures: Structure definition, initialization and accessing the members of a structure, nested structures, array of structures, structures and functions, structures and pointers, self-referential structures, unions and enumerated data types.
Files: Introduction to files, file operations, reading and writing data on files, error handling during file operations.

Prescribed Text Books:
1. C Programming and Data Structures. B.AForouzan,R. F.Gilberg,Cengage learning, Indian edition
2. C and Data Structures, E.Balaguruswamy, Tata McGraw Hill.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.

Reference Books:
1. LET US C, YeswanthKanitkar, Ninth Edition, BPB Publication.
2. Byron Gottfried, Schaum's" Outline of Programming with C", McGraw-Hill.

3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
4. A K Sharma "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018.
5. PradeepDey and Manas Ghosh, "Programming in C", Oxford Press, 2ndEdition, 2017.
6. ReemaTharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

Course Outcomes:

Student will be able to   Blooms Level of Learning

1. Formulate solutions to problems and represent those using algorithms /Flowcharts.   L3
2. Choose proper control statements and use arrays for solving problems.   L3
3. Decompose a problem into modules and use functions to implement the modules.   L4
4. Apply and use allocation of memory for pointers and solve the problems related to   L3
   manipulation of text data using files and structures.
5. Develop the solutions for problems using C programming Language.   L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A511T.1	1	2	2	3	-	1	-	-	-	-	-	-	3	-	-
19A511T.2	3	3	3	3	3	-	-	-	1	-	-	-	3	-	-
19A511T.3	3	2	1	2	1	-	-	-	1	-	-	2	3	-	-
19A511T.4	2	3	2	2	3	-	-	-	1	-	1	2	3	-	-
19A511T.5	3	2	2	2	2	-	-	-	1	-	-	2	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Environmental Science
Category   MC
Course Code   19AC16T
Year   I Year
Semester   I Semester (Common to CE, ME & CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	0

Course Objectives:
- To make the student to get awareness on environment and understand the importance of protecting natural resources.
- To enable the student to know the importance of ecosystems and biodiversity for future generations.
- To make the student to know pollution problems due to the day to day activities of human life to save earth from the inventions by the engineers.
- To enable the student to acquire skills for identifying and solving the social issues related to environment.
- To enable the student to understand the impact of human population on the environment.

Unit 1   Multidisciplinary Nature of Environmental Studies   8
Definition, Scope and Importance – Need for Public Awareness. NATURAL RESOURCES : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources: Use and over – exploitation, deforestation, dams and their effects on forest and tribal people – Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources – Food resources: Changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity – Land Resources: Land degradation, soil erosion - Energy resources: Renewable and non-renewable energy resources, use of alternate energy resources

Unit 2   Ecosystems, Biodiversity, and its Conservation   12
Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers –Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
Biodiversity And Its Conservation : Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Unit 3   Environmental Pollution and Solid Waste Management   8
Environmental Pollution: Definition, Causes, effects and control measures of: Air Pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.
Solid Waste Management: Causes, effects and control measures of urbanwaste – Role of an individual in prevention of pollution – Pollution case studies

Unit 4   Social Issues and the Environment   10
Social Issues And The Environment: From Unsustainable to Sustainable development – Water conservation, rain water harvesting, Environmental ethics: Issues and possible solutions –global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust – Wasteland reclamation – Consumerism and waste products – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act.

Unit 5   Human Population and the Environment   7

Human Population and The Environment: Population explosion – Family Welfare Programmes – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest/ grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.,

Prescribed Text Books:
1. Text book of Environmental Studies for undergraduate courses by ErachBharucha for University Grant Commission, University press, New Delhi, 2004.
2. Environmental Studies by Palaniswamy, Second edition, Pearson education, New Delhi, 2014.

Reference Books:
1. Environmental Studies, Benny Joseph, Second edition, McGraw Hill Education (India) Private Limited, New Delhi, 2013
2. Environmental Studies from crisis to cure, R. Rajagopalan, Oxford University Press, New Delhi, 2015
3. Environmental Studies: A Text Book for Undergraduates, Dr.K. Mukkanti, S. Chand and Company Ltd, New Delhi, 2010
4. Ecology, Environmental Science and Conservation, J.S. Singh, S.P. Singh and S.R. Gupta, S. Chand and Company Ltd, New Delhi, 2014
5. A Text book of Environmental Studies, Shashi Chawla, Tata McGraw Hill Education, India, 2012

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Explain how natural resources should be used	L2
2. Identify the importance of protection of different ecosystems and biodiversity for future generations	L3
3. List out the causes, effects and control measures of environmental pollution	L1
4. Demonstrate knowledge to the society in the proper utilization of goods and services	L2
5. Outline the interconnectedness of human dependence on the earth's ecosystems	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC16T.1	1	1	-	-	-	3	3	1	-	-	-	3
19AC16T.2	1	2	-	-	-	3	3	1	-	-	-	3
19AC16T.3	-	1	-	-	-	3	3	1	-	-	-	3
19AC16T.4	2	-	-	-	-	3	3	1	-	-	-	3
19AC16T.5	1	-	-	-	-	3	3	1	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   Communicative English Lab
Category   HS
Course Code   19AC15L
Year   I Year
Semester   I Semester (Common to CE, ME &CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
• Students will learn better English pronunciation.
• Students will be trained to use language effectively in every day conversations.
• Students will be trained to make formal oral presentations using effective strategies in professional life.
• Students will be exposed to a variety of self-instructional, learner friendly modes of language learning.

Detailed Syllabus:

Pronunciation   6
Introduction to English speech sounds.
Listening Comprehension: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. Answering a series of questions about main idea and supporting ideas after listening to audio texts.Listening for global comprehension and summarizing what is listened to.

Speaking   24
Situational Dialogues (Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions - Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.)
Oral Presentations: Formal oral presentations on topics from academic contexts - Formal presentations using PPT slides with graphic elements, deliver an enthusiastic and well-practiced presentation
Describing people and situations (learn new adjectives, practice describing themselves and others, describe objects using proper adjectives, use details in pictures to make predictions orally, describing situations, Integrate and evaluate information presented in diverse media visually and orally.

Reading   6
Information Transfer (Studying the use of graphic elements in texts to convey information, reveal trends/ patterns/ relationships, communicate processes or display complicated data.

Minimum Requirement
1. Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.
2. 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.
Prescribed Book: Lab Manual developed by Faculty Members of AITS Rajampet
Suggested Software:
1. Loose Your Accent in 28 days, CD Rom, Judy Ravin
2. Sky Pronunciation Suite.
3. Clarity Pronunciation Power – Part I
4. Learning to Speak English - 4 CDs

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Neutralize their pronunciation of English sounds, and their accent.	L3
2. Adopt effective listening skills for better comprehension of English, spoken by native speakers.	L2
3. Illustrate themselves in social and professional context effectively.	L3
4. Improve their public speaking skills and make technical presentations confidently.	L4
5. Describe people and situations using adjectives effectively	L3
6. Assess and Deduct data from graphs/pie charts/tables	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC15L.1	-	-	-	-	-	-	-	-	-	2	-	1
19AC15L.2	-	-	-	-	-	-	-	-	-	1	-	2
19AC15L.3	-	-	-	-	-	-	-	-	3	3	-	3
19AC15L.4	-	-	-	-	-	-	-	-	3	2	-	1
19AC15L.5	-	-	-	-	-	-	-	-	1	3	-	3
19AC15L.6	-	-	-	-	-	-	-	-	-	2	-	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Chemistry of Materials Lab
Category	BS
Course Code	19AC13L
Year	I Year
Semester	I Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
- To familiarize the students with the basic concepts of chemistry of materials.
- To impart training for handling of different instruments.
- To familiarize with digital and instrumental methods of analysis.
- To expose the students in practical aspects of the theoretical concepts.

List of Experiments
Any TEN of the following experiments must be performed
1. Determination of Hardness of a groundwater sample.
2. Estimation of active chlorine content in Bleaching powder.
3. Determination of calorific value of a fuel by bomb calorimeter
4. Determination of strength of an acid by pH metric method.
5. Determination of Fe (II) in Mohr's salt by potentiometric method.
6. Estimation of calcium in Portland cement
7. Conductometric titration of Acid mixture against Strong base
8. Determination of chromium (VI) in potassium dichromate
9. Preparation of Phenol-formaldehyde resin
10. Preparation of TiO_2/ZnO nano particles.
11. Determination of viscosity of a liquid
12. Determination of surface tension of a liquid
13. Estimation of Ferrous iron by Dichrometry.
14. Determination of copper by Iodometry.
15. SEM / TEM analysis of nano materials

Prescribed Books:
1. Mendham J, Denney RC, Barnes JD, Thomas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).
2. N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007).

Course Outcomes:

The student will be able to	Blooms Level of Learning
1. Explain the functioning of instruments such as pH meter, conductivity meter and potentiometer.	L2
2. Estimate Cr, Fe & Cu and other metals in various compounds	L2
3. Analyze the quality of ground water sample and determine physical properties of liquids	L4
4. Determine the calorific value of different fuel samples and synthesize polymers and nano materials.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC13L.1	3	2	2	-	-	-	-	-	-	-	-	-
19AC13L.2	3	2	2	2	-	-	-	-	-	-	-	-
19AC13L.3	3	2	2	2	-	-	-	-	-	-	-	-
19AC13L.4	3	2	2	2	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   C Programming Lab
Category   ES
Course Code   19A511L
Year   I Year
Semester   I Semester (Common to all Branches)

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
- Setting up programming environment.
- Develop Programming skills to solve problems.
- Use of appropriate C programming constructs to implement algorithms.
- Identification and rectification of coding errors in program.
- Develop applications in a modular fashion.
- Manage data using files.

Minimum number of FOUR programmes from each exercise are to be done by students.
     Exercise I (week-1): Data types, Variables, Constants and Input and Output.
     Exercise 2:(week-2): Operators, Expressions and Type Conversions.
     Exercise 3:(week-3): Conditional Statements [two way and multipath].
     Exercise 4:(week-4): Loop Control Statements. [for, while and do-While]
     Exercise 5:(week-5): Unconditioned JUMP Statements- break, continue, goto.
     Exercise 6:(week-6): Declaring Arrays, Referencing Arrays, Array Subscripts. Using for loop for sequential Access.
     Exercise 7:(week-7): Multidimensional Arrays
     Exercise 8:(week-8): String Basics, String Library Functions and Array of Strings.
     Exercise 9:(week-9): Simple user defined functions, Parameter passing methods- pass by value, pass by reference.
     Exercise 10:(week-10): Storage classes- Auto, Register, Static and Extern
     Exercise 11:(week-11): Recursive Functions, Preprocessor commands.
     Exercise 12:(week-12): Array Elements as Function Arguments.
     Exercise 13:(week-13): Pointers and structures.
     Exercise 14:(week-14): Dynamic memory allocation and error handling.
     Exercise 15:(week-15): File handling
Recommended Systems/Software Requirements: Intel based desktop PC with ANSI C/ TURBO C Compiler and Supporting Editors

Prescribed Text Books:
1. C and Data Structures, E.Balaguruswamy, Tata McGraw Hill.
2. LET US C, YeswanthKanitkar, Ninth Edition, BPB Publication.
References:
1. https://www.cprogramming.com/
2. https://www.mycplus.com/tutorials/c-programming-tutorials

Course Outcomes:

The student will be able to	Blooms Level of Learning
1. Identify and setup program development environment	L2
2. Implement the algorithms using C programming language constructs	L3
3. Identify and rectify the syntax errors and debug program for semantic errors	L3
4. Solve problems in a modular approach using functions	L4
5. Implement file operations with simple text data	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A511L.1	3	2	-	2	2	-	-	-	2	2	1	-
19A511L.2	2	2	-	-	-	-	-	-	1	-	-	-
19A511L.3	3	3	3	3	-	-	-	-	1	-	-	3
19A511L.4	3	3	3	3	-	-	-	-	-	-	-	3
19A511L.5	3	3	3	3	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Differential Equations and Vector Calculus
Category	BS
Course Code	19AC21T
Year	I Year
Semester	II Semester (Common to all Engineering Branhces)

Lecture Hours	Tutorial Hours	Practical	Credits
3	1	-	4

Course Objectives:
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Unit 1   *Linear Differential Equations of Higher Order*   10
Definitions-complete solution-operator D-rules for finding complimentary function-inverse operator-rules for finding particular integral for RHS term of the type $e^{ax}, \sin ax / \cos ax$, polynomials in x, $e^{ax} \sin ax / e^{ax} \cos ax / e^{ax} x^n, x \sin ax / x \cos ax$ -method of variation of parameters.

Unit 2   *Equations Reducible to Linear Differential Equations and Applications*   08
Cauchy's and Legendre's linear equations-simultaneous linear equations with constant coefficients.
Applications: Electrical Circuits – L-C and L-C-R Circuit problems

Unit 3   *Partial Differential Equations*   08
Formation of PDEs by eliminating arbitrary constants and arbitrary functions-solutions of first order linear and non-linear PDEs using Charpits method-solutions of boundary value problems by using method of separation of variables.

Unit 4   *Vector differentiation and integration*   10
Scalar and vector point functions-vector operator del, del applies to scalar point functions-Gradient-del applied to vector point functions-Divergence and Curl-del applied twice to scalar point function-Line integral-circulation-work done-surface integral-flux-volume integral.

Unit 5   *Vector integral theorems*   06
Green's theorem in the plane (without proof) -Stoke's theorem (without proof) - Divergence theorem (without proof)-Applications

Prescribed Text Books:
1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:
1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Solve the differential equations related to various engineering fields.   L3
2. Formulate and solve the higher order differential equation by analyzing physical   L3
    situations.

3. Identify solution methods for partial differential equations that model physical processes.   L3

4. Interpret the physical meaning of different operators such as gradient, curl and divergence and estimate the work done against a field, circulation and flux using vector calculus.   L2

5. Evaluate double and triple integrals using Green's, Stoke's and Divergence theorem.   L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC21T.1	3	3	-	-	-	-	-	-	-	-	-	2
19AC21T.2	3	3	-	-	-	-	-	-	-	-	-	2
19AC21T.3	3	3	-	-	-	-	-	-	-	-	-	3
19AC21T.4	3	3	-	-	-	-	-	-	-	-	-	2
19AC21T.5	3	3	-	-	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Engineering Physics
Category	BS
Course Code	19AC23T
Year	I Year
Semester	II Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:
- To impart knowledge in basic concepts of mechanics, acoustics and ultrasonics with their engineering applications.
- To explain the significant concepts of dielectrics and magnetic materials in the field of engineering and their potential applications
- To impart knowledge in basic concepts of LASERs and optical fibers along with its engineering applications.
- Familiarize types of sensors for various engineering applications.

Unit 1   Mechanics   9
Basic laws of vectors and scalars-rotational frames-conservative forces- F = - grad V, torque and angular momentum - Newton's laws in inertial and linear accelerating non-inertial frames of reference-rotating frame of reference with constant angular velocity-qualitative explanation of Foucault's pendulum-rigid body-angular velocity vector-centre of mass- gravitation and Kepler's laws(qualitative).

Unit 2   Acoustics and Ultrasonics   11
Acoustics: Introduction- reverberation-reverberation time-Sabine's formula- derivation using growth and decay method – Absorption coefficient and its determination –factors affecting acoustics of buildings and their remedies.
Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

Unit 3   Dielectric and Magnetic materials   9
Introduction-Dielectric polarization - Dielectric polarizability - Susceptibility and Dielectric constant - Types of polarizations: Electronic and Ionic (quantitative), Orientation polarizations(qualitative) -Frequency dependence of polarization-Lorentz(internal) field-Claussius -Mosotti equation-Applications of Dielectrics.
Introduction- Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials-weiss domain theory of ferromagnetism (qualitative)-Hysteresis-soft and hard magnetic materials-Magnetic device applications

Unit 4   LASERs and Fiber Optics   8
Introduction- characteristics of lasers-spontaneous and stimulated emission of radiation-Einstein's coefficients-population inversion- He-Ne laser-semiconductor laser- applications of lasers.
Introduction to Optical Fibers-Total Internal Reflection-Critical angle of propagation-Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile - Propagation of electromagnetic waves through optical fiber – modes-importance of V number-attenuation and optical fiber losses-Block diagram of fiber optic communication- Medical Applications.

Unit 5   Sensors   8
Sensors:(qualitative description only): Different types of sensors and applications; Strain and Pressure sensors-Piezoelectric, magnetostrictive sensors, Fiber optic methods of pressure sensing; Temperature sensors - bimetallic strip, pyro electric detectors, Hall-effect sensor, smoke and fire detectors.

Prescribed Text Books:
1. M K Varma "Introduction to Mechanics"-Universities Press-2015.
2. D.K. Bhattacharya and A. Bhaskaran, "Engineering Physics"- Oxford Publications-2015.
Reference Books:
1. K.Thyagarajan. "Engineering Physics"-Mc Graw Hill Publishing company Ltd,2015.
2. . Ian R Sinclair, Sensors and Transducers, 3rd eds,2001, Elsevier (Newnes).

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Explain physics applied to solve engineering problems in mechanics	L2
2. Apply the principles of acoustics for noise cancellation and explain the application of ultrasonic's in various engineering fields.	L3 & L2
3. Summarize the various types of polarization of dielectrics, classification of magnetic materials and the applications of dielectric and magnetic materials.	L2
4. Apply the lasers and optical fibre concepts in various applications.	L3
5. Identify the sensors for various engineering applications.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC23T.1	3	2	-	-	-	-	-	-	-	-	-	-
19AC23T.2	3	2	2	-	-	-	-	-	-	-	-	-
19AC23T.3	3	2	2	-	-	-	-	-	-	-	-	2
19AC23T.4	3	2	2	-	-	-	-	-	-	-	-	2
19AC23T.5	3	2	2	-	-	-	-	-	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Python Programming
Category   ES
Course Code   19A521T
Year   I Year
Semester   II Semester (Common to All Branches)

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
• To learn basics of computational problem solving, python programming and basic control structures.
• To understand python programming basic constructs like lists, dictionaries, sets and functions
• To learn module design and usage of text files in python programming
• To understand basics of object oriented programming.
• To understand elementary data structures like linked list, stacks and queues.

Unit 1   12
Computational problem solving, Introduction to python programming language, literals, variables and identifiers, operators, expressions and data types.
Control Structures: Control structure importance, Boolean expressions, selection control, and iterative control.

Unit 2   14
Lists: List structures, lists in python, iterating over lists in python, more on python lists
Dictionaries and sets: Dictionary type in python, Set data type
Functions: Program routines,more on functions

Unit 3   12
Module Design: Modules, Top-Down design, python modules
Text Files: Text File, Using Text files, string processing, exception handling

Unit 4   10
Objects and their usage: software objects
Introduction to Object oriented programming: class, three fundamental features of object oriented programming, encapsulation-what is encapsulation, defining classes in python.

Unit 5   12
Data structures: Introduction to abstract data types, Single Linked List-traversing, searching, prepending, and removing nodes, Stacks-implementing using python list& linked list, Queues-implementing using python list& linked list.

Prescribed Text Books:
1. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, Charles Dierbach.
2. Data Structures and Algorithms using Python , RanceD.Necaise, Wiley Publications.

Reference Books:
1. Python Programming using problem solving approach, ReemaThareja, Oxford University press
2. Python Programming: An Introduction to Computer Science, John Zelle, Franklin,Beedle&Associates Inc., 3rd Edition
3. Think Python: How to think like a computer Scientist, Allen Downey 2nd Edition O'Reilly Publications.
4. Problem solving with algorithms and data structures using python, Bradley Miller, David L.Ranum, Franklin, Beedle& Associates incorporated, independent publishers.
5. Learning Python, Mark Lutz, O'Reilly Publications 5th Edition

6. Learn Python the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code Zed Shaw,Zed Shaw's Hard Way Series, Third Edition
7. Automate the Boring Stuff with Python: Practical Programming for Total Beginners, Al Sweigart, 1st Edition.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand computational problem solving and basic elements of python programming.	L1
2. Understand and apply python programming basic constructs like lists, dictionaries, sets and functions.	L1,L3
3. Illustrate module design and usage of text files in python programming	L3
4. Understand apply basics of object-oriented programming in python.	L1,L3
5. Understand and demonstrate elementary data structures.	L1,L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A521T.1	3	-	3	-	-	-	-	-	-	-	-	3
19A521T.2	3	-	3	3	-	-	-	-	-	-	-	3
19A521T.3	3	-	3	3	-	-	-	-	-	-	-	3
19A521T.4	3	-	3	3	-	-	-	-	-	-	-	3
19A521T.5	3	-	3	3	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Engineering Graphics - II
Category   ES
Course Code   19A321T
Year   I Year
Semester   II Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
2	-	2	3

Course Objectives: This course will
- Increase an ability to communicate graphically and vorally with the people.
- Prepare the student for future Engineering positions.

PART – A: Manual Drawing
Unit 1   Sections of Solids   Theory Hours: 05 Practice sessions: 05
Section Planes and Sectional views of Right Regular Solids–Prism, Cylinder, Pyramid and Cone. True shapes of the sections.
Unit 2   Development of Surfaces   Theory Hours: 04 Practice sessions: 04
Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid, Cone and their Sectioned parts
Unit 3   Interpenetration of Solids   Theory Hours: 02 Practice sessions: 02
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 4   Isometric Projections / Views   Theory Hours: 04 Practice sessions: 04
Principles of Isometric Projection – Isometric Scale – Isometric Views– Conventions – Isometric Views - Lines, Plane Figures, Simple and Compound Solids.
Unit 5   Conversion of Views   Theory Hours: 05 Practice sessions: 05
Conversion of Isometric views to Orthographic Views and Conversion of Orthographic views to Isometric views.

PART - B
Introduction to CAD: Theory Hours: 04 Practice sessions: 04
(For Internal Evaluation Weightage only)
Introduction to CAD and Co-ordinate Systems - Basic Commands: Editing, Moving, Copying, Scaling, Mirroring, Rotating, Erase, Undo, Redo, Trimming – Practicing of Geometrical Constructions: Line, Arc, Circle, Rectangle, Polygons – Dimensioning - Conversion of Isometric Views into Orthographic Views

Prescribed Text Books:
1. Engineering Drawing, N.D. Bhatt, Charotar Publishers.
2. Engineering Drawing, K.L. Narayana, P. Kanniah, Scitech Pub.
Reference Books:
1. Engineering Drawing and Graphics, Venugopal/ New age.
2. Engineering Drawing, Johle, Tata McGraw-Hill.
3. Engineering Drawing, Shah and Rana, Pearson Education

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Analyze the internal details of an object through sectional views.	L4
2. Develop a sheet which meets the specifications of an object	L3
3. Analyze the image of an intersected solid.	L4
4. Employ freehand 3D pictorial sketching to aid in the visualization process and efficiently communicate ideas graphically.	L4
5. Analyze a drawing and can efficiently communicate ideas graphically.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A321T.1	3	-	2	-	2	2	-	3	3	-	-	3	3	-	-
19A321T.2	3	2	3	2	-	2	-	3	3	-	-	-	3	1	-
19A321T.3	3	2	3	2	-	2	-	3	3	-	-	-	3	-	-
19A321T.4	3	2	-	-	-	2	-	3	3	-	-	2	3	1	3
19A321T.5	3	2	3	-	-	2	-	3	3	-	3	3	3	1	3

Department of Mechanical Engineering

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Engineering Mechanics
Category	ES
Course Code	19A322T
Year	I Year
Semester	II Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:
- To explain the effect of force and moment in the different engineering applications
- To familiarize frictional forces in mechanical applications
- To teach centre of gravity and moment of inertia of solids and surfaces.
- To understand the analysis of rigid bodies under dynamic conditions

Unit 1   Introduction to Engineering Mechanics   8
Introduction to Engineering Mechanics: Composition and resolution of forces, parallelogram law, principle of transmissibility, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force Varignon's theorem, concept of free body diagrams, concept of equilibrium of coplanar force and non-coplanar systems.

Unit 2   Analysis of Structures and Friction   9
Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections.
Friction: Laws of friction, types of friction, equilibrium of force systems involving frictional forces, wedge friction. Free body diagrams involving frictional forces.

Unit 3   Properties of Surfaces and Moment of Inertia   9
Properties of Surfaces and Volumes: Centroid and center of gravity, derivation of centroids from first moment of area, centroidsof composite sections, center of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guldinus.
Moment of Inertia: Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes -thin plates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

Unit 4   Kinematics   8
Equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, motion under gravity -projectile motion, use of rectangular coordinates, tangential and normal coordinates, radius of curvature, rotation of a rigid body about a fixed axis, introduction to plane motion.

Unit 5   Kinetics and Ideal Systems   8
Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy.
Ideal Systems: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse, impact - types of impact.

Prescribed Text Books:
1. A Nelson, Engineering Mechanics: Statics and Dynamics,1st edition (July 2017) McGraw Hill publications
2. J.L.Meriam , L.G.Kraige , J.N.Bolton ,Engineering Mechanics-statics, Engineering Mechanics-Dynamics,Wiley India Private Limited, Fifth edition (June 2006)
3. S S Bhavikatti, Engineering Mechanics, New Age International Publishers (December 2016)
4. RK Bansal , Engineering Mechanics, Laxmi Publications,Sixth edition (2015)
Reference Books:

1. Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2. Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynam-ics, 4/e, Pearson, 2009.
3. K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Resolve forces and couples in mechanical systems.	L1, L3
2. Identify different types of trusses and analyze the plane trusses by method of joints and the method of sections	L1, L2, L4
3. Identify the frictional forces and its influence on equilibrium	L1, L3
4. Find the centre of gravity and moment of inertia for various geometric shapes	L1, L3
5. Develop equations for different motions.	L1, L4
6. Determine the displacement, velocity and acceleration relations in dynamic systems	L1, L4
7. Relate the impulse and momentum	L1, L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A322T.1	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
19A322T.2	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
19A322T.3	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
19A322T.4	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
19A322T.5	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
19A322T.6	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-
19A322T.7	3	3	3	2	-	-	-	-	-	-	-	2	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Python Programming Lab
Category   ES
Course Code   19A521L
Year   I Year
Semester   II Semester (Common to CE, ME & CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives: This course will
- To practice basics of computational problem solving, python programming and basic control structures.
- To practice python programming basic constructs like lists, dictionaries, sets and functions
- To practice module design and usage of text files in python programming
- To practice basics of object-oriented programming and elementary data structures.

List of Experiments
1. Install Python ecosystem and execute "Hello World" program.
2. Practice
   a. Python literals,variables,identifiers and data types
   b. Python operators
   c. Input and output statements.
   d. Control statements
3. Practice Python Programs on Numbers
   a. Prime Numbers
   b. Armstrong Numbers
   c. Fibonacci Numbers and Series
   d. Sum of squares for the first n natural numbers.
   e. Reverse of a number
4. Implement python program on temperature conversion
5. Implement the python program to convert age in seconds.
6. Practice python programs on various types of triangle patterns
7. Implement python programs to find factorial and Fibonacci number using recursion
8. Practice python programs on lists
9. Practice python programs on sets and dictionaries
10. Practice python programs on functions and their implementation
11. Practice any one python program on module design
12. Practice python programs on text files, string processing
13. Practice python program on exception handling
14. Implement python programs on
    i) Stacks ii) Queues
15. Implement Single linked list data structure.

Prescribed Text Books:
1. Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, Charles Dierbach
2. Data Structures and Algorithms using Python , Rance D. Necaise, Wiley Publications
Reference Books:
1. Python Programming using problem solving approach, Reema Thareja, Oxford University press
2. Python Programming: An Introduction to Computer Science, John Zelle, Franklin, Beedle & Associates Inc., 3rd Edition
3. Think Python: How to think like a computer Scientist, Allen Downey 2nd Edition O'Reilly Publications.
4. Problem solving with algorithms and data structures using python, Bradley Miller, David L.Ranum, Franklin, Beedle& Associates incorporated, independent publishers.

5. Learning Python, Mark Lutz, O'Reilly Publications 5th Edition
6. Learn Python the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code
   Zed Shaw,Zed Shaw's Hard Way Series, Third Edition
7. Automate the Boring Stuff with Python: Practical Programming for Total Beginners, Al Sweigart, 1st Edition.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Use python basic concepts to develop problems to solve computational problems.	L3
2. Apply lists, dictionaries, sets and functions in python programming.	L3
3. Experiment module design and text files in python programming	L3
4. Solve problems using object-oriented concepts, elementary data structures in python programming.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A521L.1	-	-	3	3	3	-	-	-	-	-	-	-
19A521L.2	-	-	3	3	3	-	-	-	-	-	-	-
19A521L.3	-	-	3	3	3	-	-	-	-	-	-	-
19A521L.4	-	-	3	3	3	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Engineering Physics Lab
Category   BS
Course Code   19AC23L
Year   I Year
Semester   II Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Course Objectives:
- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser and ultrasonics
- by studying its characteristics and its application in finding the particle size.
- Illustrate the semiconductor, magnetic and dielectric materials applications
- Identify the various sensor applications.

Note: In the following list of experiments, out of 15 experiments any 10 experiments must be performed in a semester.

List of Experiments:
1. Determination of wavelength of LASER light using diffraction grating.
2. Determination of particle size using LASER.
3. Determination of spring constant of springs using Coupled Oscillator
4. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
5. Determination of Dielectric constant of dielectric material using charging and discharging of capacitor.
6. Magnetic field along the axis of a circular coil carrying current.
7. Rigidity modulus of material of a wire-dynamic method byTorsional pendulum
8. Determination of hysteresis loss by tracing B-H Curve of ferromagnetic material.
9. Determination of the numerical aperture of a given optical fiber and hence to find its acceptance angle.
10. Measurement of magnetic susceptibility by Gouy's method
11. Determination of ultrasonic velocity in liquid (Acoustic grating)
12. Determination of pressure variation using Strain Guage sensor.
13. Determination of temperature change using Strain Guage sensor.
14. Determination of pressure variations using optical fiber sensors.
15. Determination of temperature changes using optical fiber sensors

Reference Books:
1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S Chand Publishers, 2017.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the characteristics and behavior of various materials	L2
2. Estimate the basic characteristic quantities of LASER and ultrasonic's.	L2
3. Exhibit an ability to use techniques and skills associated with modern engineering tools such as fiber optics and sensors.	L2 & L3
4. Measure properties of a semiconductor, magnetic and dielectric materials.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC23L.1	3	-	-	-	2	-	-	-	-	-	-	-
19AC23L.2	3	-	-	-	-	-	-	-	-	-	-	-
19AC23L.3	3	2	-	-	2	-	-	-	-	-	-	-
19AC23L.4	3	2	-	-	2	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Engineering & IT Workshop
Category   ES
Course Code   19A323L
Year   I Year
Semester   II Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

Engineering Workshop

Course Objectives:
- To read and interpret job drawing, plan various operations and make assembly.
- To identify and select the hand tools and instruments used in various trades.
- To gain practical skills by performing the experiments in different trades of workshop.

Trades for exercises   Practice hours: 24
Carpentry shop– Two joints (exercises) from : Mortise and tenon T joint, Dove tail joint, Bridle T joint, middle lap T joint, Half Lap joint, cross lap joint, Corner Dovetail joint or Bridle Joint from soft wood stock.
Sheet metal shop– Two jobs (exercises) from: Tapered Tray, cylinder, conical funnel from out of 22 or 20 guage G.I. sheet
Fitting shop– Two jobs (exercises) from: square Fit, V-Fit, Semi-circular fit, dove tail fit from M.S. stock
House-wiring– Two jobs (exercises) from: Parallel and Series, Two way switch, Tube –Light connection, Stair case connection
Trades for demonstration:
- Plumbing
- Machine Shop
- Metal Cutting
- Soldering and Brazing

Reference Books:
1. Kannaiah P. and Narayana K.L., Workshop Manual, 3rd Edn, Scitech publishers.
2. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.
3. Jeyapoovan T.and Pranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.

Course Outcomes:

Student will be able to,	Blooms Level of Learning
1. Apply wood working skills in real world applications.	L3
2. Build different parts with metal sheets used in various appliances.	L3
3. Apply fitting operations in various assemblies.	L3
4. Apply basic electrical engineering knowledge for house wiring practice.	L3

IT Workshop

Course Objectives: This course will
- Demonstrate the disassembling and assembling of a personal computer system.
- Demonstrate the Installation the operating system and other software required in a personal computer system.
- Introduce connecting the PC on to the internet from home and workplace and effectively usage of the internet, Usage of web browsers, email, news groups and discussion forums.
- Introduce the usage of Productivity tools in crafting professional word documents, excel spreadsheets and power point presentations.
- Demonstrate the disassembling and assembling of a personal computer system.

Preparing your Computer   Practice Hours: 9

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 troubleshooting a computer.

Task 3: Install Operating System: Student should install MS Windows on the computer. Students should record the entire installation process.

Internet   Practice Hours: 3

Task 4: 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, and search process using different natural languages, and creating e-mail account.

Productivity tools   Practice Hours:3

Task 5: 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 6: 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 7: 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.

Prescribed Text Books:
1.   Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
2.   Upgrading and Repairing PCs, 22nd Edition, Scott Muller QUE, Pearson Education.
3.   Comdex Information Technology Course Kit, Vikas Gupta, WILEY Dreamtech.
4.   MOS 2010 Study Guide for Microsoft Word, Excel, PowerPoint, and Outlook Exams, 1st Edition, Joan Lambert, Joyce Cox, Microsoft Press

Reference Books:
1.   IT Essentials PC Hardware and Software Companion Guide, CICSO Networking Academy
2.   Network Your Computer & Devices Step by Step 1st Edition, CiprianRusen, Microsoft Press
3.   Troubleshooting, Maintaining & Repairing PCs, 5th Edition, Bigelow, TMH
4.   Introduction to computers, Peter Norton, 6/e, Mc Graw Hill

Course Outcomes:

Student will be able to,	Blooms Level of Learning
5. Recognize the peripherals of a computer, perform assembling and disassembling of various components of a computer.	L1, L3
6. Describe and perform installation and un-installation of Windows operating systems and also perform troubleshooting of various hardware and software components.	L2,L3
7. Use Web browsers to access Internet, Search Engines.	L3
8. Use word processor; spread sheet, presentation and data storage tools.	L3

Department of Mechanical Engineering

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A323L.1	3	-	1	-	1	-	-	-	-	-	-	1
19A323L.2	3	-	1	-	1	-	-	-	-	-	-	1
19A323L.3	3	-	1	-	1	-	-	-	-	-	-	1
19A323L.4	2	-	1	-	1	-	-	-	-	-	-	1
19A323L.5	3	3	1	-	3	-	-	-	-	-	-	3
19A323L.6	3	3	1	-	3	-	-	-	-	-	-	3
19A323L.7	3	3	1	-	3	-	-	-	-	-	-	3
19A323L.8	3	3	1	-	3	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Partial Differential Equations and Complex Variables
Category	BS
Course Code	19AC31T
Year	II Year
Semester	I Semester (Common to CE, EEE, ME & ECE)

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:
- To familiarize the transform techniques and complex variables.
- To equip the students to solve application problems in their disciplines.

Unit 1   Laplace transforms   10
Laplace transforms of standard functions- First shifting theorem- change of scale property- multiplication by t^n- division by t- transforms of derivatives and integrals- Laplace transform of Periodic functions. (Without proofs).

Unit 2   Inverse Laplace transforms   8
Inverse Laplace transforms – Convolution theorem. (Without proof).
Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

Unit 3   Fourier series   6
Fourier series- Dirichlet conditions- functions of any period-odd and even functions - half range series.

Unit 4   Applications of Partial Differential Equations   8
Method of separation of variables- second order partial differential equations- solutions of 1D-wave- 1D-heat and 2D-Laplace equations in Cartesian coordinates.

Unit 5   Complex Variables   8
Differentiability-Analyticity -C-R equations (without proof) - harmonic functions- finding harmonic conjugate. Contour integrals- Cauchy's theorem (without proof) - Cauchy's integral formula-Generalized Cauchy's integral formula (without proof).

Prescribed Text Books:
1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2015.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006
Reference Books:
1. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
2. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008

Course Outcomes:
Student will be able to	Blooms Level of Learning
1. Apply the Laplace transformations for different types of functions	L3
2. Apply the inverse Laplace transformations for different types of functions and solve ordinary differential equations by using Laplace transformation technique.	L3
3. Understand the nature of the Fourier series that represent even and odd functions.	L2

4. Solve the boundary value problems (related to heat, one dimensional wave equation.   L3
5. Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic and evaluate contour integrals.   L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC31T.1	3	2	-	-	-	-	-	-	-	-	-	2
19AC31T.2	3	2	-	-	-	-	-	-	-	-	-	2
19AC31T.3	3	2	-	-	-	-	-	-	-	-	-	2
19AC31T.4	3	2	-	-	-	-	-	-	-	-	-	2
19AC31T.5	3	3	-	-	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Basic Electrical and Electronics Engineering
Category	ES
Course Code	19A236T
Year	II Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

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.

Unit 1   Electrical Circuits   10
Basic definitions, types of elements, ohms law, resistive, inductive, capacitive networks, Series-parallel circuits, Star and Delta transformations, and Kirchhoff's laws.

Unit 2   DC Machines   10
DC Generator: Constructional Details of DC machine, Principle of operation, emf equation, types of generators, applications.
DC Motor: principle of operation, torque equation, types, losses and efficiency, applications.
TEST: Brake test, Swinburne's test and Speed control methods.

Unit 3   AC Machines   10
1-Φ Transformer: 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.
TEST: Brake Test on 3-φ induction motor.

Unit 4   Diode and Transistors   10
Diode: PN junction diode, symbol, V-I characteristics, applications, Half wave, full wave and bridge rectifiers.
Transistors: PNP and NPN junction transistors, characteristics of CE configuration, Transistor as an amplifier.

Unit 5   Electric Heating and CRO   10
Induction Heating: Theory of induction heating, applications in industries.
Dielectric Heating:Theory of dielectric heating and its industrial application.
CRO: Block diagram of CRO, Principle of CRT (cathode ray tube), applications of CRO, voltage, current and frequency measurements.

Prescribed Text Books:
1.   K. Mehta, Principles of Electrical and Electronics Engineering. S. Chand & Co 2010.
2.   T. Thyagarajan, Fundamentals of Electrical and Electronics Engineering. SciTech publications, 2011, 5th Ed
Reference Books:
1.   M.S Naidu and S.Kamakshaiah, Introduction to Electrical Engineering. TMH Publications.
2.   D.P Kothari and I.J Nagrath, Basic Electrical Engineering, TMH, 3rdEd.2010
3.   Millman and Halkias, Electriconics devices and circuits

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Apply fundamental concepts to find response of electrical circuits.	L1
2. Identify the types of DC-Machines and their applications.	L1,L3
3. Explain the principle operation of Transformer, Induction Motor.	L2
4. Identify the semi-conductor devices.	L1
5. Explain the types of heating and working principle of CRO.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A236T.1	2	2	-	2	-	-	-	-	2	-	2	-
19A236T.2	2	3	2	2	-	-	-	-	2	-	2	-
19A236T.3	2	3	2	2	-	-	-	-	2	-	2	-
19A236T.4	2	2	-	3	-	-	-	-	2	-	2	-
19A236T.5	2	2	-	3	-	-	-	-	2	-	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Life Sciences for Engineers
Category	BS
Course Code	19AC34T
Year	II Year
Semester	I Semester (Common to CE, ME, & CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
2	-	-	2

Course Objectives:
• Introduce the molecular basis of life.
• Provide the basis for classification of living organisms.
• Describe the transfer of genetic information.
• Introduce the techniques used for modification of living organisms.
• Describe the applications of biomaterials

Unit 1   Living Organisms   6
Comparison of biological organisms with manmade systems, Classification of living organisms, Cellular basis of life, differences between prokaryotes and eukaryotes, classification on the basis of carbon and energy sources, molecular taxonomy.

Unit 2   Proteins and Enzymes   6
Water, Biomolecules, structure and functions of proteins and nucleic acids, hemoglobin, antibodies and enzymes, Industrial applications of enzymes, Fermentation and its industrial applications.

Unit 3   Human Physiology   6
Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis, Human physiology, neurons, synaptic and neuromuscular junctions.

Unit 4   Genes and DNA   6
Mendel's laws, gene mapping, Mitosis and Meiosis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

Unit 5   RNA   6
Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

Prescribed Text Books:
1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011.
Reference Books:
1. Alberts Et.Al. The molecular biology of the cell, 6/e, Garland Science, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009.
3. John Enderle and Joseph Bronzino Introduction to Biomedical Engineering, 3/e, 2012.

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Explain catalytic properties of enzymes.   L2
2. Summarize application of enzymes and fermentation in industry.   L2
3. Identify DNA as a genetic material in the molecular basis of information transfer.   L2

4. Apply thermodynamic principles to biological systems.   L2
5. Analyze biological processes at the reductionistic level.   L4
6. Identify the potential of recombinant DNA technology.   L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC34T.1												
19AC34T.2												
19AC34T.3												
19AC34T.4												
19AC34T.5												
19AC34T.6												

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Mechanics of Solids
Category   PC
Course Code   19A331T
Year   II Year
Semester   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

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 bending and shear loads.
• To calculate the deflection of beams under complex loading.
• To analyze the cylindrical and spherical shells under circumferential and radial loading conditions.

Unit 1   Simple Stresses & Strains   12
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 – Bars of varying section – composite bars – Thermal stresses. Strain energy – Resilience –Mohr's circle for plane stress and plain strain (Simple   problems).

Unit 2   Shear Force and Bending Moment   8
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 – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Unit 3   Flexural Stresses & Shear Stresses   7
FLEXURAL STRESSES: Theory of simple bending – Assumptions – Derivation of bending equation: M/ I = f/y = E/R Neutral axis –Determination of 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 beam sections like rectangular, circular, triangular, I, T and angle sections.

Unit 4   Deflection of Beams   7
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.

Unit 5   Thin Cylinders, Thick Cylinders & Columns and Struts   8
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.

Prescribed Text Books:
1. Bhavikatti, Strength of Materials, Lakshmi publications, 4th edition 2013.
2. B C Punmia, Mechanics of Materials, Lakshmi publications, 2015.
Reference Books:
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.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Determine the simple stresses and strains when members are subjected to axial loads.	L1, L2, L3, L4
2. Draw the shear force and bending moment diagrams for the beam subjected to different loading conditions.	L1, L2, L3
3. Evaluate stresses induced in different cross-sectional members subjected to bending and shear loads.	L1, L2, L3, L4
4. Evaluate the deflections in beams subjected to different loading conditions.	L1, L2, L4
5. Analyze the columns and struts, thin and thick cylindrical shells.	L1, L2, L3, L4, L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A331T.1	3	-	3	-	-	3	3	-	-	-	-	-	-	-	-
19A331T.2	3	3	3	-	-	3	3	-	-	-	-	-	2	-	-
19A331T.3	3	3	3	-	-	3	3	-	-	-	-	-	-	-	-
19A331T.4	3	3	3	-	-	3	3	-	-	-	-	-	2	-	-
19A331T.5	3	-	3	-	-	3	3	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Metallurgy & Material Science
Category	PC
Course Code	19A332T
Year	II Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To understand the basic structure, properties of metals, mechanism of crystallization and imperfections in crystals.
- To study the importance of binary phase diagrams.
- To acquire knowledge on properties and structure of ferrous and nonferrous alloys and to select suitable materials for various engineering applications.
- To learn various methods of heat treatment and surface coating processes.
- To gain knowledge on advanced materials and concepts of metallurgy.

Unit 1   Structure of Metals & Constitution of Alloys   8
STRUCTURE OF METALS: Bonds in Solids – Metallic bond - crystallization of metals, imperfections, 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 2   Equilibrium Diagrams   7
Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, 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 binary phase diagram of $Fe-Fe_3C$.

Unit 3   Cast Irons and Steels & Non-Ferrous Metals and Alloys   8
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 4   Heat Treatment of Alloys & Surface Engineering   7
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.
SURFACE ENGINEERING: Surface treatment processes and their characteristics and applications, mechanical coatings, Diffusion coatings.

Unit 5   Ceramic Materials, Composite Materials & Metallurgy   7
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, Introduction to Powder Metallurgy

Prescribed Text Books:
1. Kodgire, Material Science and Metallurgy, 42nd edition Everest Publishing House 2017.
2. Donald R. Askeland, Essential of Materials Science and Engineering. Thomson Publications 2014.

Reference Books:
1. Sidney H. Avener, Introduction to Physical Metallurgy, TMH
2. William and collister, Materials Science and Engineering, wiley pub. 2014
3. V. Raghavan, Material science and 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

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the mechanism of crystallization, methods of determining grain size and factors affecting the solid solubility.	L2
2. Use the phase diagrams of binary systems and iron-carbide diagram to select the material composition.	L2
3. Understand the structure and properties of various cast irons, steels and non-ferrous alloys.	L2
4. Apply the various heat treatment processes, TTT diagram, surface hardening methods & coatings depending on material requirements.	L3
5. Understand the importance of ceramics, composites and concepts of metallurgy.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A332T.1	3	3	3	3	3	3	3	-	-	-	-	3	-	-	-
19A332T.2	3	3	3	3	3	3	3	-	-	-	-	3	-	-	-
19A332T.3	3	3	3	3	3	3	3	-	-	-	-	3	-	-	-
19A332T.4	3	3	3	3	3	3	3	-	-	-	-	3	-	2	2
19A332T.5	3	3	3	3	3	3	3	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Basic Thermodynamics
Category   PC
Course Code   19A333T
Year   II Year
Semester   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives: This course will
- Impart the awareness on fundamental laws of thermodynamics.
- Enable the students to understand second law of thermodynamics and its applications to various systems.
- Familiarize with properties of pure substances and usage of mollier chart and steam tables.
- Make the students understand various gas laws and equations of state and can able to solve problems of estimating enthalpy, entropy, specific heat, internal energy.
- Develop the skill of applying the principles of thermodynamics in evaluating the properties of mixtures.

Unit 1   Basic Concepts & First Law of Thermodynamics   12
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 –Temperature Scales-Various Thermometers-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 2   Second Law of Thermodynamics   12
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 3   Pure Substances   6
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 4   Perfect Gas Laws   9
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.

Unit 5   Mixture of Perfect Gases   6
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.

Prescribed 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. Yunus Cengel& Boles, TMH. Mcgraw Higher Ed Edition: 8, 2015
Reference Books:
1. Fundamentals of Thermodynamics. Sonntag, Borgnakke and Van wylen, John Wiley & sons (ASIA) Pt Ltd. Publisher: Wiley; 8 edition (December 26, 2012)
2. Thermodynamics. Mc Graw Hill 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)

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Apply the fundamentals to the thermodynamic problems.	L1,L2,L3
2. Solve the problems related to performance of thermal engineering devices by the concept of Second law of Thermodynamics.	L1,L2, L3
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.	L2, L3
4. Differentiate the ideal and real gas behavior and evaluate the performance of gas power cycles by demonstrating the usage of thermodynamic properties and equations of state	L2,L3
5. Show their knowledge in solving various thermodynamic properties during mixing process of perfect gases.	L2,L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A333T.1	3	3	-	-	-	-	3	-	-	-	-	3	-	-	-
19A333T.2	3	3	-	-	-	-	3	-	1	-	-	3	1	-	-
19A333T.3	3	3	-	-	-	-	-	-	-	-	-	3	1	-	-
19A333T.4	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
19A333T.5	3	3	-	-	-	-	3	-	-	-	-	3	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Kinematics of Machinery
Category   PC
Course Code   19A334T
Year   II Year
Semester   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

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

Unit 1   Mechanisms, Machine and Structure   7
Element or Link – Classification – Rigid Link, flexible and fluid link – Kinematic pair – Types – sliding, turning, rolling, screw and spherical pairs, Lower and Higher pairs, closed and open pairs – Constrained motion – completely, partially or successfully constrained motion, and incompletely constrained motion.
Kinematic chain – Degrees of freedom of planar mechanisms – inversion of mechanism – inversion of quadric cycle chain, single and double slider crank chain.

Unit 2   Velocity and Acceleration analysis of mechanisms   7
Velocity Analysis:
Relative velocity method: Motion of Link – construction of velocity diagrams – determination of angular velocity of points and links – four bar chain, single slider crank chain and other simple mechanisms.
Instantaneous center method: Instantaneous center of rotation – Three centres in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.
Acceleration Analysis: Acceleration diagram for simple mechanisms – determination of acceleration of points and angular acceleration of links – Corioli's acceleration – Klein's construction.

Unit 3   Straight line motion mechanisms, Steering mechanisms, and Hooke's Joint   6
Straight line motion mechanisms: Exact and approximate copiers and generated types – Peaucellier, Hart's and Scott Russell – Grosshopper, Watt, T-Chebicheff, Robert mechanisms.
Steering mechanisms: Condition for correct steering – Davis steering gear, Ackerman's steering gear.
Hooke's Joint: Single and double Hooke's joint – velocity ratio, simple problems.

Unit 4   Gears and Gear trains   7
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 intereference.
Gear trains: Introduction – train value – types – simple, compound, reverted and epicyclic gear trains – methods of finding train value or velocity ratio of epicyclic gear trains – sun & planetary gear systems – differential gear of an automobile.

Unit 5   Cams   5
Definitions – Cam and Follower – uses – types of followers and cams – radial cam terminology – types of follower motion – uniform velocity, simple harmonic, uniform acceleration and retardation motion – maximum velocity and maximum acceleration during outward and return strokes in the above cases.

Prescribed Text Books:
1. S.S.Rattan, Theory of Machines, Tata McGraw Hill Education (India) Pvt. Ltd.
2. R.S.Khurmi & J.K.Gupta, Theory of Mahines, S.Chand Publications.
Reference Books:
1. Jagadish 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. P L Ballaney, Theory of Machines, Khanna Publishers.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify different mechanisms, inversions of different kinematic chins and mobility of mechanisms.	L1, L2
2. Draw the velocity and acceleration diagrams of simple plane mechanisms by using relative velocity method and instantaneous center method.	L1, L2, L3
3. Understand the mechanism of straight line motion mechanisms, steering mechanisms and Hooke's joint.	L1, L2, L3
4. Know gear terminology, types of gears, contact ratio, interference in gears and application of bevel gears in differential gear and to calculate train value for different gear trains.	L1, L2, L3, L4
5. Draw displacement diagram and cam profile for different types of motions of the follower.	L1, L2, L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A334T.1	3	3	-	-	-	-	-	-	3	-	3	-	3	3	-
19A334T.2	3	3	-	-	-	-	-	-	3	-	3	-	3	3	-
19A334T.3	3	3	-	-	-	-	-	-	3	-	3	-	3	3	-
19A334T.4	3	3	-	-	-	-	-	-	3	-	3	-	3	3	-
19A334T.5	3	3	-	-	-	-	-	-	3	-	3	-	3	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Material Science Lab & Mechanics of Solids Lab
Category	PC
Course Code	19A335L
Year	II Year
Semester	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

Material Science Lab

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.

List of Experiments: 16
1. Study of Microstructures of Pure Metals – Copper & Aluminium.
2. Study of Microstructures of Non – Ferrous Alloy – Brass.
3. Study of Microstructures of Other Alloys – Stainless Steel, Case Carburized Steel & Bearing Metal.
4. Study of Microstructures of Cast Irons – Gray, Malleable & White Cast Irons.
5. Study of Microstructures of Low Carbon Steel & Medium Carbon Steel.
6. Study of Microstructures of Heat Treated Steels.
7. Finding out the Hardness of Treated and Untreated Steels.
8. Finding out the Hardability of Steels by using Jominy End Quench Test Apparatus.

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Know and draw the microstructure of ferrous and nonferrous alloys.   L1
2. Calculate the hardness of treated and untreated steels.   L2
3. Conduct experiment for hardenability.   L2

Mechanics of Solids Lab

Course Objectives:
- 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.

List of Experiments: 16
1. Direct tension test
2. Torsion test
3. Hardness test
    a. Brinell hardness test
    b. Rockwell hardness test
4. Test on springs
5. Compression test on wood
6. Impact test
    a. Charpy test
    b. Izod test
7. Shear test

Course Outcomes:

Student will be able to	Blooms Level of Learning
4. Determine the young's modulus by tension test.	L4
5. Calculate the modulus of rigidity of ductile materials.	L4
6. Calculate & compare the hardness values for various materials.	L4
7. Calculate modulus of rigidity and stiffness for springs.	L4
8. Analyze the compression strength of wood by compression test.	L4
9. Apply the concept of impact loading and to determine impact values for various materials.	L4
10. Determine the shear stress for various materials.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A335L.1	3	-	-	3	-	-	-	-	-	-	-	-	1	2	2
19A335L.2	3	-	-	3	-	-	-	-	-	-	-	-	1	2	2
19A335L.3	3	-	-	3	-	-	-	-	-	-	-	-	1	2	2
19A335L.4	3	3	-	3	-	-	3	-	3	-	3	3	2	2	2
19A335L.5	3	3	-	3	-	-	3	-	3	-	3	3	2	2	2
19A335L.6	3	3	-	3	-	-	3	-	3	-	3	3	2	2	2
19A335L.7	3	3	-	3	-	-	3	-	3	-	3	3	2	2	2
19A335L.8	3	3	-	3	-	-	3	-	3	-	3	3	2	2	2
19A335L.9	3	3	-	3	-	-	3	-	3	-	3	3	2	2	2
19A335L.10	3	3	-	3	-	-	3	-	3	-	3	3	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   CAD Machine Drawing Lab
Category   PC
Course Code   19A336L
Year   II Year
Semester   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

Course Objectives:
- This course will make the students to understand Code of drawing practice as per BIS conventions for mechanical elements using AutoCAD.
- To familiarize the students bolted joints and riveted joints using CAD.
- To prepare assembly drawings using standard CAD packages.
- To gain practical experience in handling 2D drafting and 3D modeling software systems.

List of Exercises: 48
Part – I:
Exercises on drawing of machine elements and simple parts using drafting software.(2D software)
1. Conventional representation of materials and machine components.
2. Different types of thread profiles-Square, Metric, ACME, Worm.
3. Hexagonal and square headed bolts and nuts.
4. Riveted joints for plates.
5. Shaft couplings and spigot joint

Part – II:
Exercises on assembly drawings using 3D modeling software. any 8 assembly drawing from the following.
1. Assembly of Sleeve and Cotter Joint.
2. Assembly of Shaft Coupling
3. Assembly of Knuckle Joint
4. Assembly of Universal Joint
5. Assembly of Screw Jack
6. Assembly of Plummer Block
7. Assembly of Simple Eccentric
8. Assembly of Stuffing Box
9. Assembly of Tail stock
10. Assembly of Petrol engine connecting rod

Reference Books:
1. Cecil Jensen, Jay Helsel and Donald D. Voisinet, Computer aided Engineering Drawing ,Tata MC Graw-Hill, NY,2000
2. K. L Narayana, P. Kannaiah, A text book on engineering, Sci Tech publications, 2014
3. Machine drawing with Auto CAD, Goutam Pohit and Goutam Ghosh,pearson publications 2002

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Demonstrate the conventional representation of materials and machine components	L1
2. Identify different types of bolts, nuts and screw threads	L1
3. Visualize and prepare detail drawing of a given object.	L2
4. Draw details and assembly of mechanical system	L2
5. Create 3-D models using any CAD software	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A336L.1	2	-	2	-	-	-	-	-	-	2	-	-	2	-	2
19A336L.2	2	-	2	-	-	-	-	-	-	2	-	-	2	-	2
19A336L.3	2	-	2	-	-	-	-	-	-	2	-	-	2	-	2
19A336L.4	2	-	2	-	-	-	-	-	-	2	-	-	2	-	2
19A336L.5	2	-	2	-	-	-	-	-	-	2	-	-	2	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Basic Electrical and Electronics Engineering Lab
Category   ES
Course Code   19A236L
Year   II Year
Semester   I semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

Course Objectives:
• To impart knowledge and practical exposure on various elements of electrical circuits, operational aspects of various electrical machines and electronic circuits.

List of Experiments:
1. Pre-determination of efficiency of DC shunt Machine working as Motor as well as Generator(Swinburne's Test)
2. Determination of Performance Characteristics of DC Shunt Motor(Brake Test)
3. Speed Control of DC Shunt Motor(Armature Control Method and Field Control Method)
4. Determination of Performance Characteristics of Three Phase Squirrel Cage Induction Motor(Brake Test)
5. Predetermination of efficiency and regulation of Single Phase Transformer at different power factors(OC and SC test on single phase transformers)
6. Study of V-I Characteristics of PN junction Diode.
7. Determination of Ripple Factor and Regulation of Half Wave Rectifier with and without Capacitive filter.
8. Determination of Ripple Factor and Regulation of Full Wave Rectifier with and without Capacitive filter.
9. Study of Input and Output Characteristics of Bipolar Junction Transistor in Common Emitter Configuration.
10. Study of Cathode Ray Oscilloscope.(CRO)
11. Determination of V-I Characteristics of ZENER Diode.
12. Study of Frequency response of a single stage CE amplifier.
Note: Perform any ten experiments out of the following

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Apply the conceptual knowledge of various electrical machines to understand   L3
   their operation and control aspects through practical investigations.
2. Apply the conceptual knowledge of semiconductor devicesto analyze the   L3
   electronic circuits through practical investigations.
3. Apply ethics and norms of the engineering practices while exercising experimental   L3
   investigations.
4. Function effectively as an individual and as a member in a team   L1
5. Communicate effectively in verbal and written forms   L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A236L.1	3	-	-	3	-	-	-	-	-	-	-	-
19A236L.2	3	-	-	3	-	-	-	-	-	-	-	-
19A236L.3	-	-	-	-	-	-	-	3	-	-	-	-
19A236L.4	-	-	-	-	-	-	-	-	-	-	1	-
19A236L.5	-	-	-	-	-	-	-	-	-	-	1	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Numerical Methods & Probability and Statistics
Category	BS
Course Code	19AC41T
Year	II Year
Semester	II Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:
- To familiarize the students with numerical methods of solving the non-linear equations, interpolation, differentiation, integration, and ordinary differential equations.
- To impart knowledge in basic concepts and few techniques in probability and statistics in relation to the engineering applications.

Unit 1   Algebraic and transcendental equations, Interpolation   8
Solutions of algebraic and transcendental equations: Bisection method-Regula-Falsi method - Newton-Raphson method.
Interpolation: Finite differences - forward differences and backward differences-Newton's forward interpolation formula-Newton's backward interpolation formula- Lagrange's interpolation formula.

Unit 2   Numerical Differentiation, Integration and Solutions of Ordinary Differential Equations   8
Numerical Differentiation; Numerical integration - Trapezoidal rule - Simpson's 1/3rd and 3/8 rules.
Numerical Solutions of ordinary differential equations of first order: Taylor's series- Modified Euler's method- Runge-Kutta method of fourth order.

Unit 3   Probability   10
Introduction to probability - Random variables (discrete and continuous) - Mean - Variance
Probability distributions: Binomial distribution, Poisson distribution and normal distribution.

Unit 4   Testing of Hypothesis for Large Sample Tests   6
Large sample tests: test for single mean and difference of means - test for single proportion and difference of proportions.

Unit 5   Testing of Hypothesis for Small Sample Tests   8
Student t-distribution (single mean, two means and paired t-test) - Testing of equality of variances (F-test) - χ2 - test for goodness of fit - χ2 - test for independence of attributes.

Prescribed Text Books:
1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2/e, Reprint 2012.

Reference Books:
1. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Apply the knowledge of numerical methods to solve algebraic and transcendental equations and will acquire the knowledge of interpolation.	L3
2. Understand the techniques of numerical differentiation, numerical integration and numerical solutions of ODE.	L2

3. Apply discrete and continuous probability distributions.   L3
4. Test various hypothetical statements for large samples.   L4
5. Infer the statistical inferential methods based on small sampling tests.   L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC41T.1	3	3	-	-	-	-	-	-	-	-	-	2
19AC41T.2	3	3	-	1	-	-	-	-	-	-	-	2
19AC41T.3	3	3	-		-	-	-	-	-	-	-	2
19AC41T.4	3	3	-	2	-	-	-	-	-	-	-	2
19AC41T.5	3	3	-	2	-	-	-	-	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Managerial Economics and Financial Accounting
Category	HS
Course Code	19AE41T
Year	II Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

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.

Unit 1   Introduction to Managerial Economics   7
MANAGERIAL ECONOMICS: Meaning and Nature, Definition, Scope, relationship with other areas.
DEMAND ANALYSIS: Definition and types of Demand, Demand Determinants, and Law of Demand and its exceptions, Elasticity of Demand-types, measurement and Significance, Demand forecasting methods.

Unit 2   Production and Cost Analysis   7
PRODUCTION: 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 3   Market Structure and Forms of Business Organizations   7
MARKETS: Perfect market, imperfect market- 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 proprietorship, Partnership, Joint Hindu family business, co-operative societies, joint stock companies.
PUBLIC SECTOR- Departmental organizations, public corporations, government companies.

Unit 4   Capital and Capital Budgeting   7
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, Profitability Index method(simple problems).

Unit 5   Introduction to Financial Accounting and Analysis   7
FINANCIAL ACCOUNTING: Accounting definition, Principles of accounting, 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.

Prescribed 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.
6. Mehta P.L., Managerial Economics-Analysis, Problems, Cases, S Chand and Sons,New Delhi, 2001.
7. S.A. Siddiqui& A.S Siddiqui. Managerial Economics and Financial analysis, New Age International Pvt.Ltd

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. Domnick Salvatore: Managerial Economics In a Global Economy, 4th Edition,Thomson.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Predict the demand for a product or product mix of a company & to analyze various factors influencing demand elasticity.	L1
2. Assess the cost behavior, costs useful for managerial decision making and determine Break Even Point (BEP) of an enterprise.	L2
3. Differentiate private & public sector undertakings in their promotion, incorporation, regulation, administration, legal formalities & existence.	L2
4. List features, steps, merits, uses & limitations of Pay Back, ARR, NPV, PI & IRR methods of Capital Budgeting and compute rank of the projects.	L2
5. Analyze, interpret & comment on the financial statements of a business enterprise by using liquidity leverage, coverage and turnover & profitability ratios.	L3, L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AE41T.1	3	3	-	-	-	-	-	3	-	-	-	-
19AE41T.2	3	3	-	-	-	-	-	3	-	-	-	-
19AE41T.3	3	3	-	-	-	-	-	3	-	-	-	-
19AE41T.4	-	-	-	-	-	-	-	-	-	3		3
19AE41T.5	-	-	-	-	-	-	-	-	-	3		3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	Manufacturing Processes
Category	PC
Course Code	19A341T
Year	II Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives: This Course Will
- Introduce the concepts of basic manufacturing processes of casting, pattern preparation and designing of Gating system.
- Introduce the concepts of various joining and cutting processes.
- Introduce the concept of metal forming processes, mechanism and their working principle, tools and dies, its types and applications.
- Introduce the concepts of basic extrusion and forging processes and its applications.
- Introduce the basic knowledge on plastics, 3 D Printing, classification, processing of plastics and its applications.

Unit 1   Sand Casting   8
Steps involved in making casting– Types of patterns–Pattern Materials—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 – Types of Risers, function and design, casting design considerations, Special casting processes: Centrifugal- Die –Investment- stir casting.

Unit 2   Joining Processes   8
Classification of welding process, types of welds, forward, backward welding 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 non-destructive testing of welds. Cutting of metals: Oxy–Acetylene Gas cutting, Cutting of ferrous, non-ferrous metals. – Friction stir Welding

Unit 3   Metal Forming Process   8
Hot working and cold working of metals –strain hardening, recovery, re-crystallization 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.

Unit 4   Extrusion and Forging   6
Basic extrusion and its characteristics – Hot and cold extrusion – Forward and backward extrusion - Impact extrusion – Hydro static extrusion. Forging processes: Principles of forging–Tools and dies–Types of Forging – Smith forging –Drop Forging– Roll forging–Forging hammers: Rotary forging – forging defects – Rotary swaging.

Unit 5   Plastics   6
Classification – Properties – Plastics as engineering materials – Method of processing plastics – Injection moulding –Blow moulding -extrusion compression and transfer moulding – Introduction to 3 D printing

Prescribed Text Books:
1. P.N. Rao, Manufacturing Technology.TMH,2017
2. Kalpak Jain, Manufacturing Technology.Pearsoneducation,2015

3. Lindberg, PE, Process and materials of manufacturing, Allyn and Bacon,1977

Reference Books:
1. R.K.Jain, Production Technology, KhannaPublisher, 2004.
2. Rosenthal, Principles of MetalCastings,TMH, 1976.
3. Parmar, Welding Process, Khanna Publishers, 2010.
4. R.K.Rajput, Manufacturing Technology. Laxmi Publications, 2007.
5. K.LNarayana, Production Technology, I. K. International Pub, 2010.
6. Hazrachoudary, Elements of workshop technology volume–1,IndianBook distributing company,Calcutta,2010.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand various casting process involved in the conversion of raw materials to useful products, gating system features and designing of Risers.	L1
2. Identify and analyze various welding and metal cutting operations.	L1
3. Apply the knowledge of metal working process in sheet metal forming Processes, drawing and rolling and analyzing the process variables.	L2
4. Understand the primary forming processes like forging, extrusion, equipment used and process variables.	L1
5. Identify various plastic parts manufacturing techniques, 3 D Printing and their methods.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A341T.1	-	3	3	-	-	-	-	2	-	-	-	1	-	1	2
19A341T.2	-	3	3	-	3	3	-	2	-	-	-	1	-	1	2
19A341T.3	-	3	3	-	-	3	-	2	-	-	-	1	2	-	-
19A341T.4	-	3	3	-	-	3	-	2	-	-	-	1	-	1	-
19A341T.5	-	3	3	-	-	-	-	2	-	-	-	1	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	Fluid Mechanics and Hydraulic Machinery
Category	PC
Course Code	19A342T
Year	II Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

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.

Unit 1   Fluid Statics   7
Dimensions and units: physical properties of fluids- specific gravity, viscosity, and 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, meta-centre, metacentre height, condition of equilibrium height of a floating and submerged bodies.
FLUID KINEMATICS: Stream line, path line, 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 2   Fluid Dynamics   7
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's experiment- 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, venturi meter and orifice meter.

Unit 3   Hydroelectric Power Stations   10
Elements of hydroelectric 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 4   Hydraulic Turbines   12
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 5   Centrifugal Pumps   7
Classification, working, work done – mano metric head losses and efficiencies specific speed- pumps in series and parallel- performance - characteristic curves, NPSH. RECIPROCATING PUMPS: Working, Discharge, slip, indicator diagrams.

Prescribed Text Books:
1. Fluid Mechanics and Hydraulic machines by Dr. R.K.Bansal
2. Hydraulics and Fluid Mechanics including Hydraulic Machines by Dr. P.N.Modi and Dr. S.M.Seth

Reference Books:
1. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering. Kotaria& Sons – 2013 edition.
2. D. Rama Durgaiah, Fluid Mechanics and Machinery. New Age International, 1st edition – 2002
3. Banga& Sharma, Hydraulic Machines.Khanna Publishers.
4. James W. Dally, William E. Riley, Instrumentation for Engineering Measurements. John Wiley & Sons Inc, 2nd edition – 2010.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Gain the knowledge on fluid mechanics fundamentals like fluid statics and fluid kinematics	L1,L2
2. Have basic idea about the fundamental equations used in Fluid Dynamics and are able to apply these concepts in real working environment	L2,L3
3. Study the fundamentals of turbo machinery and elements of hydroelectric power plant	L2,L3
4. Measure the performance of the different types of Hydraulic Turbines	L2,L3,L4
5. Calculate the performance of the different types of Hydraulic Pump	L2,L3,L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A342T.1	3	3	3	-	3	-	3	-	-	-	-	-	1	-	-
19A342T.2	3	3	3	-	3	-	3	-	-	-	-	-	1	-	-
19A342T.3	3	3	3	3	-	3	3	-	-	1	-	-	1	-	-
19A342T.4	3	3	3	3	3	3	3	-	2	-	-	-	1	-	-
19A342T.5	3	3	3	3	3	3	3	-	2	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   Dynamics of Machinery
Category   PC
Course Code   19A343T
Year   II Year
Semester   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

Course Objectives:
6. To understand the method of different force analysis on screw threads, bearing and clutches.
7. To Understand and analyze the concept of forces on brakes, dynamometers& Precession.
8. To understand the basics concepts of turning moment diagrams for IC engines and governors.
9. To Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
10. To Develop understanding of vibrations and its significance on engineering design

Unit 1   Friction   7
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 2   Brakes, Dynamometers & Precession   7
Simple block brakes, internal expanding brake, band brake. Dynamometers – absorption and transmission types – Prony brake, Rope brake, Epi-cyclic train, Belt transmission and torsion dynamometers - General description and methods of operation.
Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, aero planes and ships.

Unit 3   Turning Moment Diagram& Governors   6
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.
Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors. Sensitiveness, isochronism and hunting.

Unit 4   Balancing of Rotating & Reciprocating Masses   8
Balancing of rotating masses - single and multiple – single and different planes. Balancing of masses Primary, Secondary and higher balancing of reciprocating masses by graphical methods. Unbalanced forces and couples – V, multi cylinder, in - line and radial engines for primary and secondary balancing, locomotive balancing, Hammer blow, Swaying couple, variation of tractive force.

Unit 5   Vibrations   7
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 vibrations, single and two rotor systems.

Prescribed Text Books:
1. S.S Ratan, Theory 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 Publication
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

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Compute frictional losses, torque transmission of mechanical systems like bearings & clutches.	L2, L3, L4
2. Differentiate the working of machine elements like brakes & dynamometers & analyze the effect of a gyroscope on ships, aero plane and automobile.	L2, L3, L4
3. Understand the basics concepts of turning moment diagram and various forces acting on governors	L1, L2, L3
4. Analyze the theory involved in balancing of rotating and reciprocating members & also evaluate the unbalanced forces in a Reciprocating engine	L4, L5
5. Understand how to determine the natural frequencies of continuous systems starting from the general equation of displacement.	L1, L2, L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A343T.1	3	3	3	3	-	-	-	3	2	2	-	-	3	-	-
19A343T.2	3	3	3	3	-	-	-	3	2	2	-	-	3	-	3
19A343T.3	3	3	3	3	-	-	-	3	2	2	-	-	3	-	3
19A343T.4	3	3	3	3	-	-	-	3	2	2	-	-	3	-	3
19A343T.5	3	3	3	3	-	-	-	3	2	2	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   Applied Thermodynamics-I
Category   PC
Course Code   19A344T
Year   II Year
Semester   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:
- To provide the concept of various air standard cycles with the help of P-V and T-S Diagrams.
- To know about actual cycles and to compare them with air standard cycles.
- To understand the working and combustion phenomenon in internal combustion engines.
- To solve and evaluate the performance parameters of internal combustion engines.
- To learn the concept of Air compressors and to solve engineering problems on different air compressors.

Unit 1   Power Cycles   8
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.
ACTUAL CYCLES AND THEIR ANALYSIS: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down - Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

Unit 2   I.C. Engines   10
Classification - Working principles, Valve and Port Timing Diagrams, 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 cooing system – Thermo syphon system and Forced Circulation system and Lubrication - Importance - Mist Lubrication System, Wet sump Lubrication system and Dry sump Lubrication system

Unit 3   Combustion in S.I. Engines And C.I. Engines   8
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, 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 4   Testing and Performance of Engines   7
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 5   Air Compressors   9
Classification –positive displacement and roto dynamic machinery – Power producing and power consuming 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 operation.
Working of Centrifugal compressors and axial flow compressors (Elementary treatment only).

Prescribed Text Books:
1. V. Ganesan, I.C. Engines. TMH.4th edition, 2012
2. Thermal engineering, Rathore. TMH, 2010
3. Heywood, I.C. Engines. Mc Graw Hill. 1st edition,2017

Reference Books:
1. Mathur & Sharma, IC Engines. Dhanpath Rai & Sons, 2013
2. Pulkrabek, Engineering fundamentals of IC Engines. Pearson, PHI,2nd edition, 1994
3. Rudramoorthy, Thermal Engineering. TMH, 2003
4. Rajput, Thermal Engineering. Lakshmi Publications. 8th edition, 2010
5. R.S. Khurmi & J. K. Gupta, Thermal Engineering. S. Chand, 14th edition, 1997
6. B. Srinivasulu Reddy, Thermal engineering data book. JK International Pub, 2007
7. Applied thermodynamics by Omkar Singh, 4th edition, New age Int.pub,2015

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Explain the power cycles used in I.C engines	L1
2. Understand various engine systems used in I.C engines	L2
3. Understand the concept of combustion in SI and CI engines	L2
4. Conduct the performance test & estimating the performance of I.C engines	L3
5. Understand the concept of different air compressors and evaluate performance of reciprocating compressor	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A344T.1	3	3	3	3	-	-	-	-	-	-	-	-	2	1	-
19A344T.2	3	3	3	3	-	3	-	-	-	1	-	-	-	-	-
19A344T.3	3	3	3	-	-	3	-	-	-	-	-	3	-	1	-
19A344T.4	3	3	3	3	-	3	-	1				3	1	1	-
19A344T.5	3	3	3	3	-	3	-	-	-	-	-	3	1	1	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	Essence of Indian Traditional Knowledge
Category	MC
Course Code	19AC45T
Year	II Year
Semester	II Semester (Common to CE, ME & CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	0

Course Objectives:
- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003.
- To focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection.

Unit 1   8
Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems.

Unit 2   8
Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.

Unit 3   8
Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK, Protection, value of TK in global economy, Role of Government to harness TK.

Unit 4   8
Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Unit 5   8
Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

Prescribed Text Books:
1. Traditional Knowledge System in India, by Amit Jha, 2009.
Reference Books:
1. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012.
2. Knowledge Traditions and Practices of India, Kapil Kapoor, Michel Danino.
3. e-resources: https://www.youtube.com/watch?v=LZP1StpYEPM

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the concept of Traditional knowledge and its importance.	L2
2. know the need and importance of protecting traditional knowledge	L1
3. Know the various enactments related to the protection of traditional knowledge.	L1
4. Understand the concepts of Intellectual property to protect the traditional knowledge.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC45T.1	-	-	-	-	-	-	-	-	-	-	-	3
19AC45T.2	-	-	-	-	-	-	-	-	-	-	-	3
19AC45T.3	-	-	-	-	-	-	-	-	-	-	-	3
19AC45T.4	-	-	-	-	-	-	-	-	-	-	-	3
19AC45T.5	-	-	-	-	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   Manufacturing Processes Lab
Category   PC
Course Code   19A341L
Year   II Year
Semester   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

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.

List of Experiments: 24 hrs
  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
Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the making of patterns and calculation of its allowances.	L2
2. Prepare a mould cavity and casting.	L6
3. Understand the joining of metals by welding process, and its heat affected zone on weldments.	L2
4. Understand the joining thin metals by spot welding.	L2
5. Understand the joining of metals by TIG welding and Gas welding processes.	L2
6. Understand the moulding sand properties with the help of permeability meter, universal sand strength machine.	L2
7. Understand the making of hallow parts like bottles by the blow moulding machine.	L2
8. Understand the plastic components by the injection moulding machine.	L2
9. Demonstrate different deformation processes of manufacturing.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A341L.1	3	2	3	3	-	-	-	-	3	1	-	1	-	2	-
19A341L.2	3	2	1	3	2	-	-	-	3	1	-	1	-	2	-
19A341L.3	3	2	1	1	2	-	-	-	3	-	-	1	-	2	-
19A341L.4	3	2	1	1	2	-	-	-	3	-	-	1	-	2	-
19A341L.5	3	2	1	1	2	-	-	-	3	-	-	1	-	2	-
19A341L.6	3	3	1	3	1	-	-	-	3	-	-	1	-	2	-
19A341L.7	3	2	1	1	2	-	-	-	3	-	-	1	-	2	-
19A341L.8	3	2	1	1	2	-	-	-	3	-	-	1	-	2	-
19A341L.9	3	2	1	1	2	-	-	-	3	-	-	1	-	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	Fluid Mechanics & Hydraulic Machines Lab
Category	PC
Course Code	19A342L
Year	II Year
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

Course Objectives:
- To provide knowledge in verifying Bernoulli's Theorem.
- To impart knowledge in Fluid flow measuring devices like Venturi meter & Orifice meter
- To understand frictional losses in pipes with various diameters.
- To acquire knowledge about various hydraulic Machines like Centrifugal pump, Reciprocating pump, Pelton Turbine, Kaplan Turbine, Francis Turbine etc.
- To understand impact of jet on vanes like Flat vane & Semi circular vane
- To develop the students 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.

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. Turbine flow meter.
13. Verification of Bernoulli's theorem.
Note: Any 10 of the above 13 experiments are to be conducted

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Verify the Bernoulli's Theorem	L3
2. Measure the flow rate of fluids by the instruments like Venturimeter and Orifice meter.	L3
3. Analyze the frictional losses and discharge in pipes.	L3
4. Analyze impact of jet on vanes like Flat vane & Semi circular vane.	L3
5. Conduct experiments, analyze the data and interpret results of hydraulic machineries.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A342L.1	3	-	2	-	-	-	-	-	-	-	-	-	2	-	-
19A342L .2	2	1			-	-	-	-	-	-	-	-	2	-	-
19A342L .3	2	1	1	-	-	-	-	-	-	-	-	-	1	-	-
19A342L .4	2	1	2	-	-	-	-	-	-	-	-	-	2	-	-
19A342L .5	3	2	3	2	-	-	-	-	-	-	-	-	3	2	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   Theory of Machines Laboratory
Category   PC
Course Code   19A345L
Year   II Year
Semester   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

Course Objectives:
- To Understand the fundamentals of the theory of kinematics and dynamics of machines
- To Understand techniques for studying motion of machines and their components
- To determine the balancing of masses of rotating machine elements
- To understand the vibrational behavior of systems, principles of gyroscope and governors

List of Experiments:
1. To study various types of Links, Pairs, Chain and Mechanism
2. To study inversion of Four Bar Mechanism, Single Slider Crank Chain Mechanism and Double Slider Crank Chain Mechanism
3. To study various types of steering mechanisms
4. To study various kinds of belt drives
5. To study Different types of Gears
6. Forced vibrations of a spring-mass system.
7. Determination of Torsional natural frequency of single and two rotor system.
8. Study of gyroscopic effect and couple.
9. Determination of characteristic curves of Watt Governor
10. Determination of damped natural frequency of Torsional vibrating system.
11. Determination of characteristic curves of Proell Governor
12. To study various types of Cam and Follower arrangement
Note: Any 10 experiments need to be performed

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Demonstrate the working of simple bar, link and steering mechanisms   L3
2. Distinguish different types of gears and belt drives and their applications   L2
3. Apply the principles of balancing of masses to various links, mechanisms and engines   L3
4. Apply the principles of gyroscopic effects and stabilization on various transport vehicles and applications of various governors   L3
5. Determine the vibration parameters of different systems   L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A345L.1	1	-	1	2	-	-	-	-	-	-	-	-	1	-	-
19A345L.2	1	-	1	-	-	-	-	-	-	-	-	-	1	-	-
19A345L.3	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
19A345L.4	2	-	3	-	-	-	-	-	-	-	-	-	3	-	-
19A345L.5	2	-	-	3	-	-	-	-	-	-	-	-	3	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   Applied Thermodynamics – II
Category   :   PC
Course Code   :   19A351T
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

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

Unit 1   Introduction to Steam Power Plant   10
Rankine's cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance – Regeneration – reheating- combined- cycles, Steam engines (elementary treatment).

Unit 2   Boilers   14
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 3   Steam Nozzles   08
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

Unit 4   Steam Condensers   08
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 5   Steam Turbines   08
Steam Turbines - Impulse and reaction Turbines, Pressure and Velocity compounding of steam turbines, multistage reaction Turbines, reheat factor and Efficiency, degree of reaction.

Prescribed Text Books:
1. Rathore, Thermal Engineering. TMH.1st Ed.2010 - ISBN-13: 978-0070681132
2. P.K. Nag, Basic and Applied Thermodynamics.TMH. 2nd Ed.2010 - ISBN-10: 0070151318
3. M.L. Mathur& Mehta, Thermal Engineering. Jain bros. 3rd Ed.2013 - ISBN-10: 8183600832

Reference Books:

1. R. Yadav, Thermodynamics and Heat Engines. Central Book Depot.6th ed.2012,ISBN 8185444021
2. R. S Khurmi & JS Gupta, Thermal Engineering. S.Chand. 14th Ed.1997. ISBN 9788121925730
3. Claus Borgnakke, Richard Edwin Sonntag, Fundamentals of Thermodynamics, Wiley,7th Ed.2009

Course Outcomes:

Student will be able to   Blooms Level of Learning

1. Evaluate the efficiency of steam power plant and recommend efficiency   L1, L2, L3
    enhancement methods in improving the overall efficiency of the plant.
2. Identify different types of boilers and their working, draughts and can calculate   L1, L2, L3
    the chimney height for maximum discharge.
3. Evaluate the performance characteristics of steam nozzles and different   L1, L2, L3
    nozzles used in steam power plants.
4. Evaluate the efficiency of steam condensers and the importance of cooling   L1, L2, L3
    towers requirement in steam power plant.
5. Calculate the performance parameters of turbines and can demonstrate the   L1, L2, L3
    influence of governing mechanisms in steam power plants.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A351T.1	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
19A351T.2	3	3	3	-	-	1	1	-	-	-	-	3	-	2	-
19A351T.3	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-
19A351T.4	3	3	-	-	-	-	-	-	-	-	-	3	-	-	-
19A351T.5	3	3	3	-	-	-	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   Machine Tools
Category   :   PC
Course Code   :   19A352T
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:

- To get the basic knowledge of metal cutting theory and Learn about the geometry of cutting tools, chip formation, different forces acting on cutting tool and different cutting tool materials
- To become familiar with the different types of machines for machining with various constructional features and operations performed
- To become familiar with reciprocating machine tools, construction and its operations
- To become familiar with various grinding and super finishing operations by using different machining processes
- To become familiar with various work holding and tool holding devices

Unit 1   Fundamentals of Machining   12
Introduction to orthogonal and oblique cutting, Merchant Circle Diagram, Mechanics of Machining, types of chip, single point, Nomenclature (ORS & ASA) and multi-point cutting tools, forces in turning process; Cutting tool materials, tool wear, tool life and cutting fluids, Thermal aspects in machining – Economics of machining.

Unit 2   Lathe and Lathe operations   10
Centre lathe, constructional features, specifications, lathe operations – taper turning methods, thread cutting – calculations of machining time. Capstan and turret lathes-tool layout – Automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

Unit 3   Reciprocating machine tools   10
Shaper, Planer and Slotter- Construction, Types and operations.
Drilling machines -construction, specifications, types, and operations performed – Reaming and Boring
Milling machines: types, working principle, Dividing head and Index, methods of indexing – Simple Indexing, Milling cutters types

Unit 4   Grinding and Super finishing process   10
Grinding wheel – Specification of grinding wheel and selection, types of grinding process– cylindrical grinding, surface grinding, Center less grinding, internal grinding- micro finishing methods - Typical applications – concepts of surface integrity.
Broaching machines: broach construction, types – push, pull broach.
Super finishing: Honing (Types and Construction), Lapping, Buffing, Burnishing and polishing process.

Unit 5   Jigs & Fixtures   06
Materials used in Jigs & Fixtures, Principles of work holding, design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping– Types of clamping - Typical examples of jigs and fixtures.

Prescribed Text Books:
1. Rao. P.N "Manufacturing Technology," Metal Cutting and Machine Tools, Tata McGraw- Hill, New Delhi, 2003, ISBN - 9780070087699

2. Kalpak jian & Schmid, "Manufacturing Engineering & Technology", Pearson, 2005, ISBN - 8177581708
3. Joshi PH, "Jigs & Fixtures", New Delhi – Tata McGraw Hill Pub. Co. Ltd., 11th Print 1999. ISBN - 9780070680739

Reference Books:
1. Roy. A. Lindberg, "Process and materials of manufacture," PHI/Pearson Education fourth, Edition 2006, ISBN - 9788120306639
2. Geofrey Boothroyd, Fundamentals of Metal Machining and Machine Tools, McGraw Hill, 1984, ISBN - 1574446592
3. Hajra Choudhury & Nirjhar Roy S.K "Elements Of Workshop Technology -Volume II - Machine Tools" Media promoters and publishers Pvt. Ltd, ISBN - :81850991541

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the fundamentals of metal cutting, chip formation, cutting forces involved in orthogonal metal cutting, and different cutting forces, tool materials and cutting fluids will be learned	L2
2. Analyze the classification of cylindrical work parts and their operations performed on turning machines.	L4
3. Analyze the classification of various non-rotational work part machines with their constructional features and operations	L4
4. Evaluate the surface finishing operations with abrasive processes such as grinding and broaching machines, types and working principle.	L5
5. Analyzing the constructional features and the terminologies related to various types of Jigs and Fixtures.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A352T.1	3	3	3	3	-	3	3	3	-	-	-	-	-	3	-
19A352T.2	2	-	2	2	-	-	-	-	-	-	-	-	-	2	-
19A352T.3	2	-	2	2	-	-	-	-	-	-	-	-	-	2	-
19A352T.4	2	-	2	2	-	-	-	-	-	-	-	-	-	2	-
19A352T.5	1	1	1	1	-	1	1	1	-	-	-	1	-	1	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	:	Design of Machine Elements-I
Category	:	PC
Course Code	:	19A353T
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	-	3

Course Objectives:

- To provide an introduction to design of machine elements.
- To familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- To explain design procedures to different types of joints.
- To familiarize with various theories related the design of machine elements for different loading conditions.

Unit 1   Introduction, Design for Static Loads   12

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

Design for static loads: Modes of failure, Design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Unit 2   Design for Dynamic Loads   10

Stress concentration –notch sensitivity, Types of fluctuating loads– Design for fluctuating stresses –finite life - Endurance limit - Estimation of Endurance limit – Soderberg, Goodman and Modified Goodman criterion for fatigue failure.

Unit 3   Design of Bolted, Rivetted and Welded joints   10

Design of Bolted Joints: Preload of bolts, various stresses induced in the bolts, torque requirement for bolt tightening, eccentrically loaded joints.

Design of Riveted joints: Design of lap, butt and eccentrically loaded joints, efficiency of Riveted joints.

Design of Welded Joints: Stresses of lap and butt welds, eccentrically loaded welded joints. Joints subjected to bending and torsion.

Unit 4 :   Design of Keys, Cotter and Knuckle Joints   08

Keys: Design of sunk, saddle, Kennedy and woodruff keys.

Cotter and Knuckle Joints: Socket and spigot joint, Sleeve and Cotter joints, Gib and Cotter joint, Knuckle joint.

Unit 5 :   Design of Shafts and Couplings   08

Shafts: Design of solid and hollow shafts bending, torsion, axial and combined bending and axial loading.

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

Prescribed Text Books:

1. V B Bhandari, Design of machine elements, 4th edition, TMH, 2017. ISBN 9780070611412
2. Pandya & Shah, Machine design, 20th edition, Charotar Publishers, 2009. ISBN : 978-93-85039-10-2
3. R.S. Khurmi & J.S.Gupta, Machine Design, S.Chand Publications, 2014. ISBN-13: 978-8121905015

Reference Books:

1. J.E. Shigley, Machine design, TMH, 2015. ISBN-10: 9780073398204
2. T. Krishna Rao, Design of Machine Elements-I. I.K. International, 2010. ISBN 9789381141373
3. M.F. Spotts, Design of Machine Elements. PHI, 2006. ISBN 9788177584219
4. Kannaiah,Machine Design. Scietech, 2009. ISBN 13: 9788183711517
5. Machine Design, Schaum series, ISBN 13: 9780070255951.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify the suitable materials for machine elements, apply the codes and standards in design, and apply theories of failures in designing of machine elements subjected to static loads.	L1, L3
2. Apply theories of failures in designing of machine elements subjected to dynamic loads.	L3
3. Identify different types of joints; analyze stresses induced in joints subjected to different loads, and design different joints subjected to combined loading.	L1, L4, L6
4. Design keys, cotter and knuckle joints subjected to various loads.	L6
5. Design the shafts subjected to various loads, selection of shaft couplings for a given application and outline the design procedure.	L3, L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A353T.1	3	2	-	-	-	-	-	-	2	-	-	-	-	-	-
19A353T.2	3	3	-	-	-	-	-	-	2	-	-	-	-	-	-
19A353T.3	3	3	-	-	-	-	-	-	3	-	-	-	-	-	-
19A353T.4	3	3	-	-	-	-	-	-	3	-	-	-	-	-	-
19A353T.5	3	3	-	-	-	-	-	-	3	-	-	-	-	-	-

<p style="text-align:center">Department of Mechanical Engineering</p>

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course   :   IC ENGINES
Category   :   PE
Course Code   :   19A35AT
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To familiarize with the working of S.I. and C.I. engines and its important systems
- To acquaint with the various methods for measurement of engine performance
- To provide insight into the harmful effects of engine pollutants and its control
- To familiarize with the latest technological developments in engine technology

Unit 1 :   Introduction   07

I.C. ENGINES :Introduction Classification of I.C. Engines; Parts of I.C. Engine and their materials, Cycle of operation in Four stroke and Two-stroke IC engines and their comparative study; Fuel air cycles and their analysis, Actual working cycle, Valve Timing Diagram- Homogeneous charge compression Ignition, Rotary engine-Six stroke engine concept.

Unit 2 :   Combustion in SI ,Fuel Supply and Ignition System Engines   12

Combustion in SI Engines: Combustion phenomenon in SI Engines, Ignition delay, Flame propagation, Pressure Crank angle diagram, Abnormal combustion, Auto ignition, Detonation and Knocking, Factors affecting combustion and detonation& its control , Types of combustion chambers.

Fuel Supply System: Spark ignition Engine mixture requirements, Fuel-Air ratio, Simple carburetor and auxiliary circuits (excluding mathematical analysis of carburetors)

Injection systems: Single-point and Multipoint injection, Gasoline Direct Injection.

Ignition System: need of Ignition System, Working of Battery Ignition System, Magneto Ignition System and Electronic Ignition Systems.

Unit 3 :   Combustion in CI Engines and Fuel Supply System   12

Combustion in CI Engines: Combustion phenomenon in CI engines, Stages of combustion, Delay period, Knocking, Pressure-Crank angle diagram, Factors affecting combustion and knocking, Types of combustion chambers.

Fuel Injection Systems: Air injection systems, Airless/solid injection systems, Common rail, individual pump, distributor and unit systems. Injection pumps, Fuel injector, Types of nozzle, Electronically controlled unit fuel injection system.

Engine Cooling: Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling, Liquid cooling.

Engine lubrication: Types of lubricants and their properties, SAE rating of lubricants, Types of lubrication systems.

Supercharging/Turbo-charging: Objectives, Limitations, Methods and Types, Different arrangements of turbochargers and superchargers.

Unit 4 :   Engine Testing and Performance   08

Engine Testing and Performance: Measurement of Brake Power, Indicated Power, Frictional Power, Fuel Consumption, Air flow, BMEP, Performance characteristic of SI and CI Engine Effect of load and speed on Mechanical, Indicated Thermal, Brake Thermal and Volumetric efficiencies, Heat balance sheet.

Unit 5 :   Engine Exhaust Emission and its control and Alternative Fuels for IC Engines   06

Engine Exhaust Emission and its control: Constituents of exhaust emission at its harmful effect on environment and human health, Formation of NOx, HC, CO and particulate emissions, Methods of controlling emissions; Catalytic convertors, particulate traps, Exhaust Gas Recirculation, EURO and BHARAT norms

Alternative Fuels :Alcohol, Hydrogen, Natural Gas and Liquefied Petroleum Gas ,Biodiesel, Biogas, Producer Gas ,Properties, Suitability ,Engine Modifications, Merits and Demerits as fuels.

Prescribed Text Books:
1. V. Ganesan, I.C. Engines. TMH.6th edition, 2018. ISBN: 9781259006197
2. Thermal engineering, Rathore. TMH, 2018. ISBN: 9789353160845, 9353160847
3. Heywood, I.C. Engines. McGrawHill. 2nd edition, 2018. ISBN: 9781260116113, 1260116115

Reference Books:
1. Mathur& Sharma, IC Engines. DhanpathRai& Sons, 2016. ISBN: 9788170237440, 8170237440
2. Pulkrabek, Engineering fundamentals of IC Engines. Pearson, PHI, 4th edition, 2013. ISBN:9781292054971
3. Rajput, Thermal Engineering. Lakshmi Publications. 8th edition, 2010. ISBN: 9788131808047
4. R.S. Khurmi&J.K.Gupta, Thermal Engineering. S.Chand, 16th edition, 2016. ISBN: 9788121925730
5. Applied thermodynamics by Omkar Singh, 4th edition, New age Int.pub, 2015. ISBN: 9788122417630
6. B.Srinivasulu Reddy, Thermal engineering data book. JK International Pub, 2016. ISBN:978-81-89866-32-7
7. Rudramoorthy, Thermal Engineering. TMH, 2003. ISBN: 9780070494985

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Gain the knowledge on type of application of various engine systems used in I.C engines.	L1, L2
2. Understand the concept of combustion and Ignition system in SI engine.	L2
3. Understand the concept of combustion and Fuel Supply system in SI engine	L2
4. Conduct the performance test & estimating the performance of an I.C engines.	L2, L3
5. Show their ability to Justify Engine Exhaust Emission and its Control in IC Engine by Choosing Alternative Fuels.	L1, L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35AT.1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35AT.2	3	3	3	3	-	-	1	-	-	-	-	-	-	2	-
19A35AT.3	3	3	3	-	-	-	-	-	-	-	-	3	-	2	-
19A35AT.4	3	3	3	3	-	-	-	-	-	1	-	3	-	2	-
19A35AT.5	3	3	3	3	-	1	-	-	-	-	-	3	-	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course	:	Design and Transmission System
Category	:	PE
Course Code	:	19A35BT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues (Use of P S G Design Data Book permitted)

Unit 1   Design Of Flexible Elements   08
Design of Flat belts and pulleys – Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

Unit 2   Spur Gears And Parallel Axis Helical Gears   10
Speed ratios and number of teeth-Force analysis -Tooth stresses – Dynamic effects – Fatigue strength – Factor of safety – Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

Unit 3   Bevel, Worm And Cross Helical Gears   10
Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

Unit 4   Gear Boxes   10
Geometric progression – Standard step ratio – Ray diagram, kinematics layout -Design of sliding mesh gear box – Design of multi speed gear box for machine tool applications – Constant mesh gear box – Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

Unit 5   Clutches And Brakes   10
Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes – external shoe brakes – Internal expanding shoe brake.
NOTE: Usage of Design Data Book is permitted in the University examination

Prescribed Text Books:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016. ISBN 10: 9339221125 ISBN 13: 9789339221126
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008. ISBN: 9780070668614, 0070668612

Reference Books:

1. Sundararaja moorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003. ISBN: 9788184721188
2. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw - Hill , 2009. ISBN-10-007-14679-9
3. Data Books: (i) P.S.G. College of Technology (ii) BalaveerSwamy and Mahadevan

Tables/Codes: Design data books are to be supplied in examination

Course Outcomes:

Student will be able to   Blooms Level of Learning

1. Apply the concepts of design to belts, chains and rope drives.   L3
2. Apply the concepts of design to spur, helical gears.   L3
3. Apply the concepts of design to worm and bevel gears   L3
4. Apply the concepts of design to gear boxes   L3
5. Apply the concepts of design to cams, brakes and clutches   L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35BT.1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35BT.2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35BT.3	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35BT.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A35BT.5	3	3	3	3	-	-	-	3	2	2	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

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Title of the Course	:	Industrial Management
Category	:	PE
Course Code	:	19A35CT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To create awareness to learn principles, concepts, functions of management and also to design organizational structures.
- To gain knowledge on plant location, layouts and analyze concepts of network techniques.
- To familiarize the students regarding work study and work sampling
- To train with materials and marketing management concepts in organizational context.
- To get awareness on Human Resource Management and its functions

Unit 1 :   Management and Organization   9

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. Basic concepts related to Organization - Departmentation and Decentralization, Types of organization, Line organization, Line and staff organization, functional organization, Committee organization, matrix organization and their merits and demerits

Unit 2 :   Plant Location & Project Management   12

Plant location, definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection of plant. Plant Layout – definition, objectives, types of production, types of plant layout.

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 and Resource Leveling

Unit 3 :   Work Study   11

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. Predetermined motion time study – Method time measurement (MTM), introduction to ergonomics.

Unit 4 :   Materials Management   10

MATERIALS MANAGEMENT: Objectives, Inventory – functions, types, associated costs, inventory classification techniques. Stores Management and Stores Records. Purchase management, duties of purchase manager, associated forms. Marketing, selling, marketing mix, product life cycle.

Unit 5:   Human Resource Management   6

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.

Prescribed Text Books:

1. Armine, Manufacturing Organization and Management. Pearson, 2009, 6thed. ISBN-10: 8177582755
2. O.P. Khanna, Industrial Engineering and Management., DhanpatRai, 2018,17thed ISBN-10: 818992835X
3. Stoner, Freeman, Gilbert, Management, Pearson Edu., 2007, 6th Ed. ISBN: 9788131707043
4. Pannerselvam, Production and Operations Management. PHI, 2010 ISBN-10: 9788120345553

Reference Books:

1. Ralph M Barnes, Motion and Time Studies. John Wiley and Sons, 2007. ISBN: 978-0-471-05905-9
2. Chase, Jacobs, Aquilano, Operations Management. TMH, 2007, 10th Ed. ISBN-10: 0071215557
3. L.S. Srinath, PERT/CPM. East-West Press, 2005. ISBN 10: 8185336202

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Discuss the principles and functions of management & decide the competitive strategy that works best for the organization	L3 & L4
2. Understand the importance of plant locations and develop effective project management techniques	L3, L4 & L5
3. Understand the concept of work study, method study and types of associated charts, the work measurement, work sampling and their steps	L3
4. Learn the concepts of material management and apply the knowledge of inventory management and marketing strategies in work setting	L3
5. Discuss the importance of various sub systems of HRM	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35CT.1	3	-	-	-	-	-	-	-	3	3	-	3	-	-	-
19A35CT.2	3	3	-	3	-	-	-	-	-	-	3	-	-	2	-
19A35CT.3	3	3	-	3	-	-	-	-	-	-	-	3	-	-	-
19A35CT.4	3	3	-	-	-	1	-	-	3	3	3	3	-	-	-
19A35CT.5	-	-	-	-	-	-	-	1	3	3	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Optimization Techniques through MATLAB
Category	:	PE
Course Code	:	19A35DT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To Introduce basics of MATLAB
- To Familiarize the fundamentals of optimization
- To Explain single variable optimization using various methods
- To Implement multi variable optimization using various methods
- To Train various evolutionary algorithms.

Unit 1   Introduction to MAT LAB   08
Introduction to MAT LAB: Overview, MATLAB Preliminaries, Basics of MATLAB, Beyond the Basics of MATLAB, Popular Functions and Commands, Plotting using MATLAB, Optimization with MATLAB.

Unit 2   Introduction to Optimization   08
Introduction to Optimization: Statement of an optimization problem, Classifications of optimization Problems: Single variable optimization, Multi variable optimization with no constraints, Multi variable optimization with equality constraints, Multi variable optimization.

Unit 3   Single Variable Optimization   08
Single Variable Optimization: Finite difference method, Central difference method, Runge-Kutta method, interval halving method, golden section method with MATLAB code.

Unit 4   Multi Variable Optimization   09
Multi Variable Optimization: Conjugate gradient method, Newton's method, Powell's method, Flectcher- Reeves method, Hook and Jeeves method, interior penalty function with MATLAB code.

Unit 5   Evolutionary Algorithms   09
Evolutionary Algorithms: Overview, Genetic Algorithms: Basics of Genetic Algorithms, Options in MATLAB, Multi Objective Optimization using Genetic Algorithms, Ant Colony Optimization, Simulated Annealing, Particle Swarm Optimization.

Prescribed Text Books:
1. Rao V.Dukkipati, MATLAB: An Introduction with Applications, Anshan, 2010. ISBN 1848290438, 9781848290433
2. AchilleMessac, Optimization in practice with MATLAB, Cambridge University Press, 2015. ISBN 1107109183, 9781107109186
3. Jasbir S Arora, Introduction to optimum design, 2/e. Elsevier, 2004.Hardcover. ISBN: 9780120641550, eBook ISBN: 9780080470252

Reference Books:
1. Cesar Perez Lopez, MATLAB Optimization Techniques, Academic press, Springer publications, 2014. ISBN: 1484202929, 9781484202920

2. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and scientists, 4/e, McGraw-Hill Education, 2018.ISBN-10: 0073397962. ISBN-13: 978-0073397962

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. use optimization terminology and concepts, and understand how to classify an optimization problem	L4
2. apply optimization methods to engineering problems	L3
3. Implement optimization algorithms.	L3
4. Compare different genetic algorithms.	L5
5. Solve multivariable optimization problems.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35DT.1	3	2	2	3	2	2	-	-	2	-	3	2	2	2	2
19A35DT.2	3	2	2	3	2	2	-	-	2	-	3	2	2	2	2
19A35DT.3	3	2	2	3	2	2	-	-	2	-	3	2	2	2	2
19A35DT.4	3	2	2	3	2	2	-	-	2	-	3	2	2	2	2
19A35DT.5	3	2	2	2	2	2	-	-	2	-	3	2	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Automobile Engineering
Category : PE
Course Code : 19A35ET
Year : III Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

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.

Unit 1   Introduction   10
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 temperature indicator.

Unit 2   Emissions And Its Control   09
Emissions And Its Control: Pollution standards National and international –formation of emissions - Pollution Control Techniques – Common rail diesel injection Emissions from alternative energy sources, Exhaust gas recirculation, HCCI engine, particulate traps and Selective catalytic converter – hydrogen, Biomass, alcohols, LPG, CNG - their merits and demerits.

Unit 3   Transmission System   09
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 4   Steering System, Suspension System and Braking System   10
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.

Unit 5   Safety System   08
Safety System: Antilock braking system, air bag restraint system, voice warming system, seat belt system, road navigating system, anti theft system.

Prescribed Text Books:

1. Kirpal Singh, Automotive Mechanics –Vol.1&Vol.2., standard publisher's distributors, 13th Ed.2013. ISBN: 9788180142062
2. John Heywood, Internal combustion engine fundamentals, McGraw-hill 1988. ISBN: 9781260116106
3. William Crouse, Automobile Engineering. 10th Ed.2006. ISBN: 9780070634350

Reference Books:

1. K.K. Ramalingam, Automobile Engineering. SciTech Publ.3rdEd.2011. ISBN: 9788188429486
2. Newton, Steeds & Garret, Automotive Engines. ISBN 10: 1560918985
3. Richard Stone, Jeffrey K. Ball, (2004), Automotive Engineering Fundamentals" SAE International. ISBN: 9780768009873
4. G.B.S. Narang, Automobile Engineering (2009), Khanna Publishers. ISBN :9789387394254
5. S. Srinivasan, Automotive Mechanics, 2nd Ed., Tata McGraw Hill 2003. ISBN: 9780070494916
6. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992. ISBN :9789401168816
7. R.B. Gupta, Automobile Engineering (2011-12), Tech India Publications. ISBN: 9788176848589, 8176848581

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. To gain the knowledge on components and electrical system on four wheeler automobile.	L2
2. Enrich the standards in emission and its control techniques in automobiles.	L2
3. Acquire knowledge on transmission system of an automobile.	L2
4. Understand purpose of steering system, suspension system, braking system and their identification.	L2
5. Show their ability to identify different safety system used in automobile.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19AC11T.1	-	-	3	-	3	-	-	-	-	-	-	3	-	-	-
19AC11T.2	-	-	3	1	3	-	1	-	-	-	-	3	-	-	-
19AC11T.3	-	-	3	-	3	-	-	-	-	-	-	3	-	-	-
19AC11T.4	-	-	3	-	3	-	-	-	-	1	-	3	-	-	-
19AC11T.5	-	-	-	-	-	1	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Design For Manufacturing
Category	:	PE
Course Code	:	19A35FT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- To explain the product development cycle and manufacturing issues to be considered in design.
- To familiarize manufacturing consideration in cast, forged, and weld components.
- To describe the manufacture of sheet metal components.
- To impart knowledge plastics as substitution to metallic parts.

Unit 1   Introduction   10

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

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

Unit 2 :   Machining processes   09

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

Unit 3   Metal casting and Metal joining   12

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

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

Unit 4   Forging, Extrusion & Sheet metal work   08

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

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

Unit 5 :   Plastics   10

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

Prescribed Text Books:

1. George E Dieter and Linda Schmidt, Engineering Design, 4th Edition, McGraw Hill (2015) ISBN: 9780073398143
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 5th Edition, PHI Learning (2011). ISBN-10: 8120342828
3. David M Anderson, Design for Manufacturability, CRC Press (2013). ISBN: 9781482204926

Reference Books:
1. James G Bralla, Design For Manufacturability Handbook, 2nd Edition, McGraw Hill (2004). ISBN: 9780070071391
2. Dr. P.C.Sharma, Production Technology, S.Chand & Company (2009). ISBN-10 : 8121911141

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Design mechanical components with economical consideration	L1
2. Select materials and machining processes.	L1
3. Identify the necessity for redesigning components out of manufacturing considerations.	L1
4. Consider the manufacturing considerations while designing cast, forged weld and sheet metal components	L1
5. Design plastic parts with manufacturing considerations	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35FT.1	1	-	3	1	-	-	-	1	-	-	-	-	1	2	-
19A35FT.2	1	-	2	1	1	-	-	1	-	-	-	-	1	2	-
19A35FT.3	1	-	2	1	-	-	-	1	-	-	-	-	1	2	3
19A35FT.4	1	-	2	1	1	-	-	-	-	-	-	-	1	-	3
19A35FT.5	1	-	3	-	-	-	-	-	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Non-Destructive Testing
Category	:	PE
Course Code	:	19A35GT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To introduce basic concepts of nondestructive testing.
- To familiarize with characteristics of ultrasonic test, transducers, rejection and effectiveness.
- To describe concept of liquid Penetrant, eddy current and magnetic particle tests, its applications and limitations.
- To explain the principles of infrared and thermal testing, applications and honey comb and sandwich structures case studies.
- To impart NDE and its applications in pressure vessels, casting and welded constructions

Unit 1:   Introduction to non-destructive testing   06
Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

Unit 2:   Ultrasonic Testing   10
Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect, Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

Unit 3 :   Liquid Penetrant, Eddy Current & Magnetic Particle Testing   12
Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing. Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing. Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

Unit 4 :   Infrared and Thermal Testing: 10
Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography–Contact and non-contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –-thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

Unit 5 :   Industrial Applications of NDE   08
Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions

Prescribed Text Books:

1. J Prasad, GCK Nair , Nondestructive test and evaluation of Materials, Tata mcgraw-Hill Education Publishers, 2008. ISBN:9780070620841
2. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag, 1983. ISBN 978-3-662-10680-8
3. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993. ISBN 978-1-4471-1995-1

Reference Books:

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007. ISBN-10: 1571171630
2. ASTM Standards, Vol 3.01, Metals and alloys. ISBN 978-1-6822-1620-0

Course Outcomes:

Student will be able to   Blooms Level of Learning

1. Gain knowledge of the basic principles, techniques, applications and limitations of basic NDT methods.   L3
2. Understand the basic principles of Ultrasonic Testing.   L3
3. Apply relevant non-destructive testing method different applications   L2
4. Explain various methods of Infraredand Thermal testing.   L2
5. Outline the applications, limitations and disadvantages of NDE   L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35GT.1	3	3	-	-	3	3	-	-	-	-	-	-	-	-	2
19A35GT.2	3	3	-	-	3	3	-	-	-	-	-	-	-	-	2
19A35GT.3	3	3	-	-	3	3	-	-	-	-	-	-	-	-	2
19A35GT.4	3	3	-	-	3	3	-	-	-	-	-	-	-	-	2
19A35GT.5	3	3	-	-	3	3	-	-	-	-	-	-	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Automation and Robotics
Category	:	PE
Course Code	:	19A35HT
Year	:	III Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To acquire basic knowledge on automation and automated flow lines in automatic manufacturing systems.
- To learn about the line balancing methods and automated assembly systems.
- To learn about the robotics and fundamentals of robots with their needs in present trend.
- To understand robot kinematics, dynamics and to acquire knowledge on importance of trajectory planning in robots.
- To learn about the sensors, actuators and robot programming methods used in robots.

Unit 1   Introduction to Automation   07

Need, Types, Basic elements of an automated system, levels of automation, hardware components for automation and process control, automation principles, Automation strategies

AUTOMATED FLOW LINES: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage

Unit 2   Assembly Systems and Line Balancing   08

The Assembly Process, Assembly Systems, Manual Assembly Lines, The Line Balancing Problem, Methods of Line Balancing, Computerized Line Balancing Methods, Other ways to improve the Line Balancing, Flexible Manual Assembly Lines. Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multi-station Assembly Machines, Analysis of a Single Station Assembly Machine

Unit 3 :   Introduction to Industrial Robots   07

Need for robots in Present customization, Classification, laws of robots. Robot configurations, Functional line diagram, Degrees of Freedom, Components, common types of arms, joints, grippers, applications.

Unit 4 :   Manipulator Kinematics, Dynamics & Trajectory Planning   08

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 5 :   Robot- Actuators, Sensors, Programming   07

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.

Prescribed Text Books:

1. M.P.Groover, Automation, Production systems and CIM. Pearson Edu 2004. ISBN-10: 9789332572492, ISBN-13: 978-9332572492
2. M.P. Groover, Industrial Robotics. TMH 2003. ISBN-10 : 007024989X

Reference Books:

1. Fu KS, Robotics. McGraw Hill. 2014. ISBN: 9780071822282
2. Coiffet and M.Chaironze, An Introduction to Robot Technology. Kogam Page Ltd. London, 1983. ISBN 978-94-011-6100-8
3. Richard D.Klafter, Robotics Engineering. Prentice Hall. 1989. ISBN-10 : 0134687523
4. Ashitave Ghosal, Robotics, fundamental Concepts and analysis. Oxford Press, 2006. ISBN-10 : 0195673913
5. Mittal RK &Nagrath IJ, Robotics and Control. TMH 2003. ISBN-10 : 9780070482937
6. Saha, S.K., Introduction to Robtics, Second Edition McGraw Hill New Edition 2014. ISBN: 9789332902800.
7. Niku Saeed B., Introduction to Robotics:Analysis, systems, Applications, PHI New Delhi. ISBN-10: 0130613096
8. John J. Craig, Introduction to Robotics. Pearson Edu 2017. ISBN: 0133489795

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand and apply the knowledge on automation and the automated flow lines in real working environment.	L2
2. Learn the importance of line balancing methods and are able to design the assembly work stations in industrial assembly plants.	L3
3. Understand the robotics and the fundamental concepts of robots.	L2
4. learn concept of robot kinematics, dynamics and trajectory planning methods and are able to apply this concept in academic research	L3
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.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35HT.1	3	3	-	-	-	-	-	-	-	-	-	3	-	-	3
19A35HT.2	3	3	2	-	2	-	-	-	-	-	-	3	2	2	3
19A35HT.3	3	3	-	-	-	-	-	-	-	-	-	3	-	-	3
19A35HT.4	3	3	2	-	2	-	-	-	-	-	-	3	2	2	3
19A35HT.5	3	3	-	-	-	-	1	-	-	-	-	3	1	1	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

Title of the Course : Rapid Prototyping
Category : OE
Course Code : 19A35IT
Year : III Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To familiarize techniques for processing of CAD models for rapid prototyping
- To explain fundamentals of rapid prototyping techniques
- To demonstrate appropriate tooling for rapid prototyping process
- To focus Rapid prototyping techniques for reverse engineering
- To train Various Pre – Processing, Processing and Post Processing errors in RP Processes

Unit 1   10
Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.
RP Software: Need for RP software, MIMICS, Magics, Surgi Guide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

Unit 2   08
Solid and Liquid Based RP Systems:
Stereo lithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications.
Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications.
Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

Unit 3   08
Powder Based RP Systems: Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.
Other RP Systems:
Three-Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications.
Ballastic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications.
Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

Unit 4   08
Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.
Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

Unit 5   08

Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS, etc.

RP Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Prescribed Text Books:

1. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e Edition, World Scientific Publishers, 2010. ISBN: 9789812778987, 9789812778987

2. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st Edition, Springer, 2010. ISBN: 978-1-4419-1119-3

3. Ma W. and Venu Vinod P., Rapid Prototyping and Other Laser based processes, 2004, Kluwer Academic Press.ISBN 978-1-4419-5388-9.

Reference Books:

1. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007. ISBN 0849334098.

2. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid tooling, Springer, London 2001. ISBN 978-1-4471-1182-5

3. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003. ISBN 9781591248682.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Use techniques for processing of CAD models for rapid prototyping	L3
2. Understand and apply fundamentals of rapid prototyping techniques	L3
3. Use appropriate tooling for rapid prototyping process	L3
4. Use rapid prototyping techniques for reverse engineering	L3
5. Identify Various Pre – Processing, Processing and Post Processing errors in RP processes	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35IT.1	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
19A35IT.2	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
19A35IT.3	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
19A35IT.4	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-
19A35IT.5	3	3	3	2	2	-	-	-	-	-	-	-	-	3	-

Department of Mechanical Engineering

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Industrial Robotics
Category   :   OE
Course Code   :   19A35JT
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- 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.

Unit 1   Introduction To Industrial Robots   10
Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Unit 2   Manipulator Kinematics   10
Homogeneous transformations as applicable to rotation and translation - D-H notation, Forward and inverse kinematics.
Manipulator Dynamics: Differential transformation, Jacobians. Lagrange – Euler

Unit 3   Trajectory Planning   10
Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion – straight line motion.

Unit 4   Robot Actuators And Feedback Components   10
Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison Position sensors – potentiometers, resolvers, encoders – Velocity sensors, tactile sensors, Proximity sensors.

Unit 5   Robot programming   10
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.

Prescribed Text Books:

1. M.P.Groover, Automation, Production systems and CIM. Pearson Edu. ISBN-13: 9780133499612.
2. M.P. Groover, Industrial Robotics. TMH. ISBN 10: 1259006212 ISBN 13: 9781259006210
3. Saeed B Niku, Introduction to robotics : analysis, control, applications. 2019. ISBN: 978-1-119-52760-2

Reference Books:

1. Benedict. G.F. "Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York. 2019. ISBN 9780367403393
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw- Hill, New Delhi (1980). ISBN: 9780070965539

3. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998) 42 Industrial Robotics 3.0, 2014. ISBN: 9789400784826

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the robotics and the fundamental concepts of robots.	L2, L3
2. Learn concept of robot kinematics, dynamics and are able to apply these concept in academic research.	L2, L3
3. Learn concept of robot trajectory planning methods and are able to apply these concept in academic research.	L2, L3
4. Understand the sensors, actuators and create the solutions for contemporary issues.	L2, L3
5. Understand the robot programming methods used in robots and the applications of robots can develop a suitable program and create the solutions for contemporary issues.	L2, L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35JT .1	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
19A35JT.2	3	3	3	3	1	-	-	-	-	-	-	2	-	-	-
19A35JT .3	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
19A35JT .4	3	3	3	3	1	-	-	-	-	-	-	2	-	-	-
19A35JT.5	3	3	-	3	-	-	3	-	-	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Entrepreneurship Development
Category : OEC
Course Code : 19A35KT
Year : III Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:
- To develop and strengthen entrepreneurial quality and motivation in students
- To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

Unit 1   Entrepreneurship   09
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

Unit 2   Motivation   09
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

Unit 3   Business   10
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

Unit 4   Financing And Accounting   09
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

Unit 5   Support To Entrepreneurs   09
Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures
- Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting

Prescribed Text Books:
1. Khanka. S.S., "Entrepreneurial Development" S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013. ISBN : 81-219-1801-4
4. Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9th Edition, Cengage Learning, 2014. ISBN-10: 1285051750

Reference Books:
1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013. ISBN 1843769964
2. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech, 2005. ISBN 81-297-0260-6
3. Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011. ISBN 10: 0198072635
4. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship

Department of Mechanical Engineering

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the basic concepts of entrepreneurship	L2
2. Understand the importance of motivation for entrepreneur	L2 & L3
3. Gain knowledge and skills needed to run a business successfully.	L3, L4 & L5
4. Learn the concepts of financing and accounting	L3
5. Understand the basic concepts of various supporting process	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A35KT.1	3	-	-	-	-	-	-	-	3	3	-	2	-	-	-
19A35KT.2	3	-	-	-	-	-	-	-	-	3	-	-	-	2	-
19A35KT.3	3	-	-	-	-	2	-	2	2	3	-	3	-	-	-
19A35KT.4	3	3	-	-	-	-	-	-	3	3	-	-	-	-	-
19A35KT.5	3	-	-	-	-	-	-	-	3	3	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course	Constitution of India
Category	MC
Couse Code	19AC57T

Year	III B.Tech
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	0

Course Objectives:

- To enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of india and election commission of india.
- To understand the central and state relation financial and administrative

Unit 1   08

Introduction to Indian Constitution: Constitution' meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

Unit 2   08

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions

Unit 3   08

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

Unit 4   08

Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Unit 5   08

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

Prescribed Text Books
1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust

Reference Books
1. J.A. Siwach, Dynamics of Indian Government & Politics
2. D.C. Gupta, Indian Government and Politics
3. M.V. Pylee, India's Constitution

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Understand historical background of the constitution making and its   L2

importance for building ademocratic India.

2. Understand the functioning of three wings of the government ie., executive, legislative and judiciary. L2

3. Understand the value of the fundamental rights and duties for becoming good citizen of India. L2

4. Analyze the decentralization of power between central, state and local self-government. L3

5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19AC57T.1	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
19AC57T.2	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
19AC57T.3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
19AC57T.4	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
19AC57T.5	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course	Universal Human Values - II
Category	HS
Couse Code	19AC53T

Year	III B. Tech
Semester	I Semester
Branch	CE, ME & CSE

Lecture Hours	Tutorial Hours	Practical	Credits
1	1	-	2

Course Objectives:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection
- Development of commitment and courage to act

Unit 1   Course Introduction - Need, Basic Guidelines, Content and Process for Value Education   6
- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- the basic requirements for
- fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innateacceptance for living with responsibility (living in relationship, harmony and co-existence)rather than as arbitrariness in choice based on liking-disliking.

Unit 2   Understanding Harmony in the Human Being - Harmony in Myself!   6
- Understanding human being as a co-existence of the sentient 'I' and the material'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct
- appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goodsavailable to me. Identifying from one's own life. Differentiate between prosperity andaccumulation. Discuss program for ensuring health vs dealing with disease.

| Unit 3 | Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship | 6 |

- Understanding values in human-human relationship; meaning of Justice (nineuniversal values in relationships) and program for its fulfilment to ensure mutualhappiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect anddifferentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensiveHuman Goals
- Visualizing a universal harmonious order in society- Undivided Society, UniversalOrder- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute asextended family, real life examples, teacher-student relationship, goal of education etc.Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples fromstudents' lives

| Unit 4 | Understanding Harmony in the Nature and Existence -Whole existence as Coexistence | 6 |

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfilment among the four orders of nature recyclability
- and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all pervasive space
- Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

| Unit 5 | Implications of the above Holistic Understanding of Harmony on Professional Ethics | 6 |

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for aboveproduction systems.
- Case studies of typical holistic technologies, management models and production systems
- Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
- Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessionseg. To discuss the conduct as an engineer or scientist etc.

Prescribed Text Books
1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values andProfessional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course inHuman Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi,2019. ISBN 978-93-87034-53-2

Reference Books
1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).

4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
5. E. FSchumacher. "Small is Beautiful"
6. Slow is Beautiful –Cecile Andrews
7. J C Kumarappa "Economy of Permanence"
8. Pandit Sunderlal "Bharat Mein Angreji Raj"
9. Dharampal, "Rediscovering India"
10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule"
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland(English)
13. Gandhi - Romain Rolland (English)

Course Outcomes:

	Blooms Level of Learning
• Students are expected to become more aware of themselves, and their surroundings (family, society, nature)	L2
• They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.	L2
• They would have better critical ability.	L2
• They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).	L2
• It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC53T.1/63T.1												3
19AC53T.2/63T.2												3
19AC53T.3/63T.3												3
19AC53T.4/63T.4												3
19AC53T.5/63T.5												3

Assessment pattern for UHV-2

Assessment Pattern for Universal Human Values-II courses assessment is described hereunder.

UHV-2 course carries two credits. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

A student has to secure 40% marks out of 100 in the CIE and SEE together to qualify for the award of the degree. The distribution shall be 50 marks for continuous internal assessment and 50 marks for semester end examination.

Internal evaluation shall be conducted for the course during semester and shall be evaluated for 50 marks and distributions of marks as follows:

- Assessment by faculty mentor: 10 marks
- Self-assessment: 10 marks
- Assessment by peers: 10 marks
- Socially relevant project/Group Activities/Assignments: 20 marks

Semester End examination is done for 50 marks and is of 2 hours duration. The question paper shall be of subjective type with 5 questions, one question from each unit, with internal choice. All the questions carry equal marks of 10 each.

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course	General Aptitude
Category	HS
Couse Code	19AC51L

Year	III B. Tech
Semester	I Semester
Branch	CE, ME & CSE

Lecture Hours	Tutorial Hours	Practical	Credits
0	0	2	1

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.
- To equip students with English verbal and reasoning skills in order to help them succeed in exams like GRE, TOEFL and help them to do well in placement drives.
- To help students improve their knowledge of grammar, vocabulary and reasoning skills pertain to English.

Quantitative Aptitude:
Number Systems - HCF and LCM - Averages - Problems on ages– Percentages - Profit and loss - Simplification - Ratio and Proportion - Time and Work - Time and Distance - Simple interest and Compound interest – Calendar - Clocks – Mensuration: Area, Volume and Surface Areas - Data Interpretation: Tabulation, Line Graphs, Bar Graphs, Pie charts.

Reasoning:
Directions - Blood Relations - Series and Sequences - Odd man out - Coding and Decoding - Data Sufficiency- Logical deductions.

English for Competitive Examinations
Synonyms – Antonyms – Analogy – Words often confused, One-word substitutions – Idioms and Phrases – Homonyms – Spellings
Reading comprehension – Cloze tests
Articles – Prepositions – Tenses – Voice – Error spotting and correcting – Sentence improvement.
Rearrangement of jumbled words and jumbled sentences – word pairs – sentence completion

Prescribed Textbooks:
1. R.S. Agarwal, Quantitative Aptitude, S. Chand Publishers, New Delhi, 2005.
2. R.S.Agarwal, Verbal and Non-Verbal Reasoning, S.Chand Publishers, New Delhi, 1998.
3. Hari Prasad, "Objective English for Competitive Exams", TMH
4. R. S. Agarwal, "Objective English", S. Chand Publishers

Reference Books
1. Shakuntala Devi, Puzzles to Puzzle you, Orient Paper Backs Publishers (OPB), New Delhi, 2005.
2. Arun Sharma, How to Prepare for Quantitative Aptitude, TMH Publishers, New Delhi, 2003.
3. Sharon Weiner-Green, IrnK.Wolf, Barron's GRE, Galgotia Publications, New Delhi, 2006.

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

Course Outcomes:
Student will be able to   Blooms Level of
                                                                Learning

- Demonstrate various principles involved in solving mathematical problems pertain to Quantitative functions.
- Decode information from charts and interpret their logical thinking in the aspects.
- interrelate English vocabulary with the knowledge of synonyms, antonyms, idiomatic expressions and, accuracy in English spelling
- apply knowledge of articles, prepositions, tenses and voice to correct errors or to improve sentences

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19AC51L/61L.1	3											3
19AC51L/61L.2	3											3
19AC51L/61L.3										3		3
19AC51L/61L.4										3		3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Thermal Engineering Lab
Category   :   PC
Course Code   :   19A351L
Year   :   III Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

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

List of Experiments:

1. Disassembly/assembly of given engine.
2. Performance test on air compressor test rig.
3. Study 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)
   (b) port timing diagram (ptd)
7. Performance test on refrigeration test rig.
8. Heat balance sheet on 4-stroke diesel engine.
9. Heat balance sheet on 2-stroke petrol engine.
10. Study heat balance sheet on 4-stroke petrol engine.
11. Study morse test on 4-stroke petrol engine.
12. Motoring test on 2- stroke petrol engine.
13. Demonstration of boiler
14. (a) flash and fire point by clevel and (open) cup apparatus.
    (b) calorific value of fuel using bomb calorimeter.
15. Viscosity of the oil through saybolt viscometer apparatus.

Note: Any 12 experiments of the above 15 experiments are to be conducted.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. An ability to understand performance, heat balance sheet and morse test on I.C engines.	L3
2. Study Component of I.C engine.	L2
3. Identifying and study of the boiler models	L2
4. An ability to understand the working principle of Vapour compression Refrigeration system and evaluate the Coefficient of performance	L3

5. Determine the fluid properties.   L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A351L.1	3	3	1	3	2	1	1	-	3	2	1	1	2	1	-
19A351L.2	2	-	2	3	3	-	-	-	-	-	-	-	2	2	-
19A351L.3	3	3	1	3	3	2	2	-	3	2	1	1	2	1	-
19A351L.4	3	3	3	3	-	1	2	-	-	-	-	2	1	2	-
19A351L.5	-	-	1	3	-	-	-	-	-	-	-	-	2	1	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Heat Transfer
Category : PC
Course Code : 19A361T
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

Course Objectives:
- To impart the basic laws of conduction, convection, radiation heat transfer and their applications.
- To provide knowledge about heat flow in various systems.
- To familiarize the convective heat transfer concepts.
- To understand the principles of phase change processes and radiation heat transfer.
- To make conversant about heat transfer in various heat exchangers.

Unit 1   Introduction to conduction heat transfer   6
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 2   One dimensional steady state & transient heat conduction   12
One Dimensional Steady State Heat Conduction: In homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius/thickness of insulation–System with internal heat generation (elementary treatment-Plane Wall-Uniform). Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.
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 3   Convective heat transfer   10
Convective Heat Transfer: Forced Convection: External Flows-Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations 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 horizontal pipe flow, annular flow. Free Convection: -Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for plates and cylinders in horizontal and vertical orientation. Dimensional analysis Buckingham π Theorem- examples- Free & Forced convection.

Unit 4   Heat transfer with phase change & Radiation   12
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 5　　　　　Heat Exchangers　　　　　　　　　　　　　　　　　　　　　　　　8
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.

Prescribed Text Books:
1.　R.C. Sachdeva, Fundamentals of Engg. Heat and Mass Transfer. New Age International, 5th Ed.2017, ISBN-13: 978-1781831038.
2.　P.K.Nag, Heat Transfer. TMH, 3rd Ed. 2011, ISBN-13: 978-0070702530.
3.　J.P.Holman, Heat Transfer. TMH, 10th Ed. 2010, ISBN-13: 978-0073529363.

Reference Books:
1.　Incropera, Fundamentals of Heat and Mass transfer. Wiley India, 8th Ed,2017 ISBN: 978-1-119-35388-1.
2.　M. Thirumaleswar, Fundamentals of Heat and Mass Transfer. Pearson Edu. 2006 ISBN 13: 9788177585193.
3.　Arora and Domkunduwar/ A course in Heat and Mass transfer /Dhanpathrai and　sons.2007, ISBN-13: 978-8177000290
4.　C.P.kothandaraman & S.Subramanyam, Heat and Mass transfer data hand book, New Age Publications, 2014, ISBN-13: 978-8122435955.

Course Outcomes:
Student will be able to　　　　　　　　　　　　　　　　　　　Blooms Level of Learning
1.　Identify different modes of heat transfer.　　　　　　　　　　　　L3
2.　Apply the knowledge of conduction heat transfer for different phenomenon.　　L3
3.　Interpret forced and free convection heat transfer　　　　　　　　L5
4.　Determine the heat transfer rates in phase change process and radiation　　L5
5.　Measure the heat exchanger performance for a given application　　L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A361T.1	3	3	-	-	-	-	1	-	-	-	-	2	1	-	-
19A361T.2	3	3	1	-	-	-	1	-	-	-	-	2	1	-	-
19A361T.3	3	3	2	-	-	-	1	-	-	-	-	2	1	-	-
19A361T.4	3	3	2	-	-	1	2	-	-	-	-	2	1	-	-
19A361T.5	3	3	3	-	-	1	1	-	-	-	-	2	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Engineering Metrology
Category	:	PC
Course Code	:	19A362T
Year	:	III Year
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

Course Objectives:

- To understand the Limits and Fits, linear measurements and angular measurements, gauges, comparators, optical measuring methods, measurement of flatness and roughness of surface. And also learn about the screw thread and gear measuring methods.
- 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.

Unit 1   09

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 2   09

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.

Flatness Measurement: straight edge– surface plate – optical flat and their uses, optical projector, interferometers and auto collimator.

Unit 3   08

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 finishprofilograph, Talysurf, BIS symbols for indication of surface finish.

Measurement Through Comparators: Comparators – Mechanical, Optical, Electrical, Electronic, Pneumatic comparators and their uses.

Unit 4   08

Screw Thread Measurement: Elements of measurement – errors in screw threads – measurement of effective diameter – one wire, two wire, three wire and best size methods, 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.

Unit 5   08

Inspection And Quality Control: Types of inspections – Difference between inspection & quality control. Acceptance

sampling plan- single sampling and double sampling plans.

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

Surface Engineering: Surface treatment processes and their characteristics and applications. (a) Overlay coatings (b) Thermal or mechanical modification of Surfaces.

Prescribed Text Books:
1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH, 2012. ISBN 0-07-017338-9.
2. Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013. ISBN: 9788174091536 817409153X
3. Statistical Quality Control by EL Grantt, McGrawhil. 2001. ISBN-10 : 0078443547; ISBN-13 : 978-0078443541

Reference Books:
1. Engineering Metrology, Mahajan, DhanpatRai, 2nd edition, 2010. ISBN-10 : 8177000519
2. BIS standards on Limits & Fits
3. Fundamentals of Dimensional Metrology, Connie Dotson , 4e, Thomson. ISBN-10 : 0766820718
4. Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, Mc Graw Hill, 2017. ISBN-10 : 9780070140004; ISBN-13 : 978-0070140004
5. Instrumentation, measurement &analysis, B.C.Nakra& KKChoudhary, TMH, 6th edition, 2011. ISBN 0070482969
6. Mechanical Measurements ,Beckwith, Marangoni, Linehard, PHI, PE. ISBN-10: 0201847655.
7. Alan s.morris "the essence of measurement", prentice hall of india, 2004. ISBN 1-86058-073.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the Limits, Fits and Tolerance.	L2
2. Apply the fundamentals of linear, angular and flatness measurement techniques for measuring the engineering components.	L3
3. Use the different types of comparators for measuring engineering components dimensions and surface roughness.	L4
4. Use the different types of instruments for measuring Screw thread elements and Gear tooth profile.	L4
5. Understand the concepts of inspection, quality control, types of acceptance sampling plan, CMM and its applications, surface treatment processes and surface coatings.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A362T.1	3	3	3	1	3	1	-	-	-	1	-	-	-	2	-
19A362T.2	3	2	1	1	3	1	-	-	-	-	-	3	-	-	2
19A362T.3	3	2	1	1	3	1	-	-	-	-	-	3	-	-	2
19A362T.4	3	2	1	2	3	1	-	-	-	-	-	3	-	-	2
19A362T.5	3	2	2	1	1	1	-	-	-	-	-	3	-	-	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Applied Thermodynamics-III
Category   :   PC
Course Code   :   19A363T
Year   :   III Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

Course Objectives:

- To understand the principle and operation of gas turbines and jet propulsions.
- To understand the Basic principles of refrigeration and the applications of air refrigeration and vapour compression refrigeration systems
- To understand the basic components and working of a different vapour absorption refrigeration systems and refrigerants used for different refrigeration systems.
- To familiarize the students in understanding the psychometric process and operation of various air conditioning systems
- To gain knowledge on different Air conditioning equipment and heat pump circuits.

Unit 1   Gas Turbines and Jet Propulsions   12

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 2   Air Refrigeration And Vapour Compression Refrigeration   10

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 3   Vapour Absorption Refrigeration System   08

Description of vapour absorption refrigeration system and working of (NH_3) – 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 4   Introduction To Air Conditioning   11

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 5 :   Air Conditioning Equipment   07

Humidifiers – Dehumidifiers – air filters, fans and blowers.

Heat Pump:– Heat sources – different heat pump circuits.

Prescribed Text Books:

1. V. Ganesan, Gas Turbines, TMH Publishers, New Delhi. 2010. ISBN: 978-0-07-068192-7
2. A Course in Refrigeration and Air conditioning, SC Arora & Domkundwar, Dhanpat Rai & Co 2015. ISBN-13 : 978-1111644475
3. Refrigeration and Air Conditioning by R.K Rajput & S K Kataria & sons 3 rd Edition 2012. ISBN-10 : 9350142554.

Reference Books:

1. Gas dynamics and Jet Propulsion, S.L. Somasundaran, NAI Publishers, New Delhi. 1996. ISBN: 9788122409925.
2. A text book of Refrigeration and Air Conditioning, R.S.Khurmi & J.K.Gupta,S.Chand& Co 2015. ISBN: 9788121927819.
3. Refrigeration and Air Conditioning. P.L.Ballaney, Khanna Publcation 7th edition. ISBN: 9788174091369.
4. Refrigeration and Air Conditioning. R.C.Arora, PHI 2010. ISBN: ISBN-10 : 9788120339156.
5. Basic Refrigeration and Air Conditioning, Ananthanarayanan, TMH 3rd Edition. 2013. ISBN: 9781259062704
6. Refrigeration and Air Conditioning, Manohar Prasad, New Age, 3rd Ed,2011. ISBN: 9788122414295.

Data Hand Book:

- Refrigeration and air conditioning data book by Domkundwar & Domkundwar, Dhanpath Rai & co.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the basic cycle, working principle and classification, performance of gas turbines, Jet propulsion and rocket propulsion system.	L1
2. analyze the purpose and functioning of various components in the domestic refrigerator, analyzing the concept of sub-cooling and super heating in improving the COP.	L2
3. Analyze the basic cycle, working principle of various types of vapour absorption refrigeration systems, its calculation of COP And Refrigerant properties.	L2
4. Evaluate various Psychometric Properties, calculations of heat loads for various applications and selection of air-conditioning system based on climatic Seasons.	L3
5. Understand different heat pump circuits and Air conditioning equipment.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A363T.1	3	3	2	-	-	-	-	-	-	-	-	2	3	1	-
19A363T.2	3	3	2	-	-	-	-	-	-	-	-	2	3	1	-
19A363T.3	3	3	2	-	-	-	-	-	-	-	-	2	2	-	-
19A363T.4	3	3	2	-	-	-	-	-	-	-	-	2	2	1	-
19A363T.5	3	3	1	-	-	-	-	-	-	-	-	1	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Design of Machine Elements– II
Category	:	PC
Course Code	:	19A364T
Year	:	III Year
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

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.

Unit 1   Sliding Contact Bearings   08
Introduction, Types of Journal bearings – Lubrication – Petroff's equation, McKee's investigation, nomenclature, Bearing Modulus –bearing materials – journal bearing design.

Unit 2   Rolling Contact Bearings   08
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 3   Engine Parts   10
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 center cranks.

Unit 4   Mechanical Springs   10
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 5   Spur & Helical Gears   10
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.

Prescribed Text Books:
1. V.B.Bhandari, Machine Design. TMH, 2016. ISBN-10 : 9789339221126; ISBN-13 : 978-9339221126
2. R.S. Khurmi & J.S.Gupta, Machine Design. S.Chand Publications. 2005. ISBN: 9788121925372

Reference Books:
1. JE Shigley, Mech. Engg. Design. McGraw-Hill Education; 10 edition. 2014. ISBN-10 : 9780073398204

2. T. Krishna Rao, Design of Machine Elements-II. I.K. International. 2010. ISBN: 9380026633, 9789380026633
3. T.V. Sundaramoorthy & N.Shanmugam, Machine Design. Khanna Publishers, 2003. ISBN: 978-81-7409-190-1
4. Kanniah, Machine Design. Scitech Publishers. 2003. ISBN: 8188429104, 9788188429103
5. Data Books: (i) P.S.G. College of Technology (ii) Balaveer Swamy and Mahadevan

Tables/Codes: Design data books are to be supplied in examination

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Design journal bearings, ball bearings and roller bearings and to know the advantages of rolling contact bearings against sliding contact bearings.	L6
2. Know various forces acting on I C engine parts and failure criteria to be adopted for various parts.	L2
3. Know Helical springs for two wheel vehicle and laminated springs for trucks.	L2
4. Design belt drives for different input conditions.	L6
5. Design spur and helical gears for different input conditions.	L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A364T.1	3	3	3	3	-	-	3	-	-	-	2	-	-	-	-
19A364T.2	3	3	3	3	-	-	3	-	-	-	2	-	-	-	-
19A364T.3	3	3	3	3	-	-	3	-	-	-	-	-	-	-	-
19A364T.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
19A364T.5	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   :   Turbo machinery
Category   :   PE
Course Code   :   19A36AT
Year   :   III Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To impart the basic knowledge of turbo machinery
- To familiarize various power absorbing devices and its key parameters.
- To understand the flow characteristics of Centrifugal compressors
- To make conversant with the flow characteristics of Axial compressors
- To provide preliminary design on turbo machines.

Unit 1   Principles   8
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 2   Centrifugal Fans and Blowers   8
Types, stage and design parameters, flow analysis in impeller blades, volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

Unit 3   Centrifugal Compressor   9
Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

Unit 4   Axial Flow Compressor   9
Stage velocity triangles, enthalpy-entropy diagrams, stage losses and efficiency, work done factor, simple stage design problems and performance characteristics.

Unit 5   Axial and Radial Flow Turbines   14
Stage velocity diagrams, reaction stages, losses and coefficients blade design principles, testing and performance characteristics.

Prescribed Text Books:
1. Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill & Co. Ltd., 4th edition, 2010. ISBN 13: 9780070707023
2. V. Kadambi and Manohar Prasad, "An Introduction to Energy Conversion, Volume III, Turbo machinery", New Age International Publishers, reprint 2008. ISBN-13: 978-1781830086
3. Fundamentals of Turbo machinery: William W Perg, John Wiley & Sons, Inc. 2008. ISBN: 9780470124222

Reference Books:
1. S. L.Dixon, "Fluid Mechanics & Thermodynamics of Turbo machines", Elsevier (2005). ISBN-13: 978-0124159549
2. Fundamentals of turbo machinery, B.K.Venkanna PHI, New Delhi 2009. ISBN 13: 9788120337756
3. M. S. Govindgouda and A. M.Nagaraj, "A Text Book of Turbomachines", M. M. Publications, 10th Ed, 2014.

ISBN-135551234003189.
4. Earl Logan, Jr. Publisher: CRC Press; 2 edition (1 May 2003) ISBN-13: 978-0824709952
5. D. G. Shepherd, "Principals of Turbo machines" , the Macmillan Company (1964). ISBN-13: 978-0024096609

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Classify Turbo machines and discuss the importance of dimensionless numbers in turbo machines.	L2
2. Explain various losses and calculate the stage & design parameters in centrifugal fans and blowers.	L2
3. Assess air angle, pressure ratio and power required in centrifugal compressor.	L5
4. Determine stage losses, stage efficiency and pressure ratio in axial flow compressor.	L5
5. Evaluate the flow coefficient, loading coefficient and stage parameters in axial & radial flow turbines.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36AT.1	3	3	1	-	-	1	1	-	-	-	-	2	1	-	-
19A36AT.2	3	3	1	-	-	1	1	-	-	-	-	2	1	-	-
19A36AT.3	3	3	2	-	-	1	1	-	-	-	-	2	1	-	-
19A36AT.4	3	3	2	-	-	1	1	-	-	-	-	2	1	-	-
19A36AT.5	3	3	2	-	-	1	1	-	-	-	-	2	1	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Tribology
Category : PE
Course Code : 19A36BT
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To understand the lubricant principles, types of lubricants and their properties
- To understand the mechanisms of friction and wear in materials
- To analyse the friction force and power loss in hydrodynamic and hydrostatic lubrication.
- To understand the preparation of bearing materials.

Unit 1 Introduction to Tribology: 08
Properties of oils and equation of flow: Viscosity, Newton's Law of viscosity, Hagen-Poiseuille Law, Flow between parallel stationary planes, viscosity measuring apparatus. Purpose of lubrication, properties and characteristics of lubricants, types of lubricants (oils, greases, solid lubricants), lubrication systems, Lubricant Additives.

Unit 2 Friction and Wear 08
Friction: Material properties influencing friction, laws of friction, causes/theories of friction, Types of friction, Elastic and Visco-elastic effects in friction, effects of friction.
Wear:Causes/sources of wear, types of wear (adhesive, abrasive, corrosive, erosive, fretting), wear of polymers, wear of ceramic materials, effects of wear, steps for wear prevention/resistance, Wear measurement. Effects of speed, temperature and pressure. Tribological measures, Material selection.

Unit 3 Hydrodynamic Lubrication and Mechanism of Pressure Development in an Oil Film 07
Hydrodynamic Lubrication::Friction forces and power loss in lightly loaded bearing, Petroff's law, Tower's experiments, idealized full journal bearings.
Mechanism of Pressure Development in an Oil Film: Reynold's investigations, Reynold's equation in two dimensions. Partial journal bearings, end leakages in journal bearing, numerical problems.

Unit 4 Slider / Pad Bearing with a Fixed and Pivoted Shoe 07
Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a pivoted shoe bearing, influence of end leakage, numerical examples.

Unit 5 Hydrostatic Lubrication and Bearing Materials 07
Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing.
Bearing Materials: Commonly used bearings materials, properties of typical bearing materials.

Prescribed Text Books:
1. Lubrication of Bearings – Theoretical Principles and Design by Redzimovskay E I., Oxford press Company 2014. ISBN: 978-0073398204.
2. Principles and Applications of Tribology by Moore, Pergamaon press 2013. ISBN: 9781483157283.

Reference Books:
1. Fundamentals of Tribology by Basu S K., Sengupta A N., Ahuja B. B., , PHI 2006. ISBN: 9788120327238.
2. Introduction to Tribology Bearings by Mujumdar B. C., S. Chand company pvt. Ltd 2008. ISBN: 9788121929875

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Realize and describe the lubrication principles and mechanisms.	L3
2. Recognize the different friction and wear mechanism in tribological components.	L2,L4
3. Analyze the friction surfaces and power losses in hydrodynamic lubrication.	L3
4. Compute load carrying capacity in light and heavy loaded journal bearings.	L3
5. Compute load carrying capacity in hydrostatic step bearing and Identify the appropriate material for bearings based on the application.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36BT.1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
19A36BT.2	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
19A36BT.3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
19A36BT.4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
19A36BT.5	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   :   Instrumentation and control systems
Category   :   PE
Course Code   :   19A36CT
Year   :   III Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To understand generalized measurement system and its functional elements.
- To know about Sensors, Transducers and their working principles.
- To gain knowledge about the instruments, working principles of pressure, flow and temperature.
- To get knowledge on Measurement and their working of Force, Torque, Acceleration, Vibrations.
- To know about application of strain gauges for different measurements.
- To gain knowledge about Control Systems, Mathematical Models and Transfer Function.

Unit 1   Measurement And Instrumentation   09
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 2   Measurement Of Pressure, Flow And Temperature   11
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 3   Measurement of Force, Torque, Acceleration, Vibrations   09
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 4   Strain Gauges And Measurement   09
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 5   Control Systems, Mathematical Models And transfer Function   10
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.

Department of Mechanical Engineering

Prescribed Text Books:
1. Beckwith and Buck, Mechanical Measurements. Narosa Publication.2012. ISBN 9332518521
2. S. Ghosh, Control Systems – Theory & Applications. Pearson Education, New Delhi, 2014. ISBN 9781299446427
3. Er.R.K. Rajput, Mechanical Measurements and Instrumentation,S.K.Kataria,New Delhi 2019. ISBN 978-93-5014-285-1

Reference Books:
1. D.S. Kumar, Mechanical Measurements and Control. Metropolitan Books, New Delhi, 2015. ISBN 8120002728
2. B.S.Manke, Linear Control Systems. Khanna Publishers, New Delhi, 2009. ISBN 9788174093103
3. Nagarathan and Gopal, Control System Engineering, Narosa Publishers. 2020. ISBN 9781781833070
4. Naresh K. Sinha, Control Systems, NAI Publishers, New Delhi, 2013. ISBN 9788122433531

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the working of generalized measurement system and its functional elements.	L2
2. Apply the working principles of various instruments used for measuring pressure, flow and temperature.	L3
3. Apply the working principle of various instruments used for measuring force, torque, acceleration, vibrations.	L3
4. Analyze about measurement methods of strain gauges.	L4
5. Evaluate a control system to meet a specified performance using analytic, graphical, empirical and computer methods.	L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36CT.1	3	-	-	-	-	3	1	3	3	3	-	-	2	-	-
19A36CT.2	3	-	-	-	-	3	-	3	3	3	-	-	2	-	-
19A36CT.3	3	-	-	-	-	3	-	3	3	3	-	-	2	-	-
19A36CT.4	3	-	-	-	-	3	-	3	3	3	-	-	2	-	-
19A36CT.5	3	1	-	-	-	3	-	3	3	3	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Additive Manufacturing
Category	:	PE
Course Code	:	19A36DT
Year	:	III Year
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To understand the fundamentals of various Additive Manufacturing Technologies for application to various industrial needs.
- To convert part file into STL format.
- To understand the method of manufacturing of liquid based, powder based and solid based techniques.
- To understand the manufacturing procedure of a prototype using FDM technique.
- To understand the 3-D printing specifications, process and uses.

Unit 1   Introduction   09
Prototyping fundamentals, Historical development, Advantages of AMT, Commonly used terms, process chain, 3D modelling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats, Classification of AMT process, Applications to various fields

Unit 2   Liquid based systems   10
Stereo lithography apparatus (SLA): Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies. Solid ground curing (SGC): Models and specifications, process, working, principle, applications, advantages and disadvantages, case studies.

Unit 3   Solid based systems   09
Laminated object manufacturing (LOM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies. Fused Deposition Modelling (FDM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies, practical demonstration

Unit 4   Powder Based Systems   09
Selective laser sintering (SLS): Models and specifications, process, working principle, applications, advantages and disadvantages, case studies.

Unit 5   Three dimensional printing (3DP)   08
Models and specification, process, working principle, applications, advantages and disadvantages, case studies.

Prescribed Text Books:
1. Chua C.K., Leong K.F. and LIM C.S Rapid prototyping: Principles an Applications, World Scientific publications, 3rdEd., 2010. ISBN-10 : 9812778985; ISBN-13 : 978-9812778987
2. D.T. Pham and S.S. Dimov, "Rapid Manufacturing", Springer, 2001. ISBN-13: 978-1-4471-0703-3

Reference Books:
1. Terry Wohlers, " Wholers Report 2000", Wohlers Associates, 2000. ISBN 978-0-9913332-6-4

2. Paul F. Jacobs, " Rapid Prototyping and Manufacturing"–, ASME Press, 1996. ISBN. 0-9640233-3-4
3. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd Ed, 2014. ISBN 978-1-4939-2113-3

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the fundamentals of Additive Manufacturing Technologies for engineering applications.	L2
2. Understand the methodology to manufacture the products using SLA and SGC technologies and study their applications, advantages and case studies	L2
3. Understand the methodology to manufacture the products using LOM and FDM technologies and study their applications, advantages and case studies	L2
4. Understand the methodology to manufacture the products using SLS technologies and study their applications, advantages and case studies.	L2
5. Understand the 3D Printing technologies and study their applications, advantages and case studies.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36DT.1	3	-	3	3	-	3	3	-	-	-	-	-	-	-	-
19A36DT.2	3	3	-	3	-	3	3	2	-	-	-	-	-	-	2
19A36DT.3	3	3	3	-	-	3	3	-	-	-	-	1	-	1	-
19A36DT.4	3	3	3	3	-	3	3	-	-	-	-	-	-	1	-
19A36DT.5	3	-	3	-	-	3	3	2	-	-	1	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: Basic Civil Engineering
Category   :   OE
Course Code   :   19A16GT
Year   :   III B. Tech
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

- To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering.
- To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

Unit 1 :   08

Basic Understanding: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career.
History of Civil engineering: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers

Unit 2 :   10

Overview of National Planning for Construction and Infrastructure Development; Position
of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works;
Fundamentals of Building Materials: Stones, bricks, mortars, Plain, Reinforced & Pre-stressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes.

Unit 3 :   10

Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction;
Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling.

Unit 4 :   08

Hydraulics &Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi-purpose reservoir projects.
Surveying & Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;

Unit 5 :   08

Computational Methods, IT, IoT in Civil Engineering: Typical software used in CivilEngineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (STAAD, ETAB & AUTOCAD)

Prescribed Text Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth-Heinemann

2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
3. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
4. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering(Civil and Environmental Engineering) by V.N.S. Murthy
5. Building Planning & Drawing by Dr N. Kumaraswamy and A.KameswaraRao, Charitor Publications
6. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.

Reference Text books:

1. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc.corresponding to materials used for Civil Engineering applications
2. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
3. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-GrawHill.
4. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall,New Jersey.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identifying the various areas available to pursue and specialize within the overall field of Civil Engineering.	L3
2. Showcasing the many monuments, heritage structures, nationally important infrastructure, and impressive projects to serve as sources of inspiration.	L1
3. Highlighting the depth of engagement possible within each of these areas.	L3
4. Providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A16GT.1	-	-	-	-	-	3	-	-	2	-	-	1	1	2	-
19A16GT.2	-	-	-	-	-	3	-	-	2	-	-	1	1	2	-
19A16GT.3	-	-	-	-	-	3	-	-	2	-	-	1	1	2	-
19A16GT.4	-	-	-	-	-	3	-	-	2	-	-	1	1	2	-

Department of Mechanical Engineering

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course: Water Resources and Conservation
Category   :   OE
Course Code   :   19A16HT
Year   :   III B. Tech
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

- To impart knowledge about the planning and management of water resources.
- To introduce the concepts of watershed management, integrated water resources management, environmental interaction of water resources and policies/framework related to water resources.
- To enable the students to understand the different components of water resources and water conservation techniques.

Unit 1 :   08
Historical profile on world water resources development; Global water resources, Hydrologic cycle, Watershed zoning, Interrelation of water resources with other natural resources and the environment, Water quantity and water budget, Water allocation and water scheduling; Water resources availability and demand.

Unit 2 :   10
Hydrologic Processes – evaporation, transpiration and precipitation; Water quality parameters, Water pollution – causes, effects and measures; Rainfall-Runoff analysis, Floods measurement, frequency analysis, design of peak flood and routing, Reservoir operation and design.

Unit 3 :   10
Water resource planning – concept, preliminary study, feasibility study, detailed planning, Design of water distribution system, Irrigation scheduling and techniques;
Water use sectors – Domestic, Industries and Agriculture, Sustainable water resources development, Integrated Water Resources Management (IWRM), Socio-economic aspects of water resources management, Rainwater Harvesting Watershed management.

Unit 4 :   09
Global Efforts on Water conservation, Think Globally Act Locally on water resources, Local water organizations, National Water Policy, World water organizations - WUGs, WUAs, UN, WWP, WWC, etc. Environmental discourse on dam Construction.

Unit 5 :   08
Water conservation Techniques: Protection of Water from Pollution, Redistribution of Water, Rational Use of Groundwater, Renovation of Traditional Water Sources, Use of Modern Irrigation Methods, Increasing Forest Cover, Change in Crop Pattern, Flood Management, Conserving Water in Industries, Conservation of water by Municipal authorities, Use rainwater effectively, Make effective use of soil water reserves, Take measures to avoid run off, Avoid wasting water through evaporation, Reduce water losses through drainage, Plan your irrigation, Contour Farming& Contour Ploughing

Prescribed Text Books:

1. Global Water Partnership (GWP), Integrated Water Resources Management, Background Papers No. 4, Technical Advisory Committee (TAC)..
2. Water Resources Systems Planning and Management, Vol. 51 by Jain, S.K. and V.P. Singh, Elsevier Science

3. Hierarchical Analyses of Water Resources Systems: Modeling and Optimization of Largescale systems by Haimes, McGraw-Hill, New York.
4. Water Resources Systems Planning and Management by Loucks D.P. and van Beek E., UNESCO Publishing, The Netherlands.

Reference Text books:
1. Water Resources Systems Planning and Analysis by Loucks, D.P., J.R. Stedinger, and D.A. Haith, Prentice-Hall, N.J.
2. Hydro systems Engineering and Management by Mays, L.W. and K. Tung, McGraw-Hill Inc., New York.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify different problems related to water resources planning, management and development.	L3
2. Describe problems like water balance, rainfall-runoff analysis, water distribution networks, flood routing, irrigation scheduling, water pollution and other water related concerns	L2
3. Apply principles and guidelines to solve above mentioned problems.	L4
4. Understand different water conservation techniques, in order to save water for future	L2

CO-PO Mapping:

OE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A16HT.1	-	-	-	-	-	2	3	-	2	-	-	-	1	-	3
19A16HT.2	-	-	-	-	-	2	3	-	2	-	-	-	1	-	3
19A16HT.3	-	-	-	-	-	2	3	-	2	-	-	-	1	-	3
19A16HT.4	-	-	-	-	-	2	3	-	2	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Energy Management and Conservation
Category   : OE2
Course Code   : 19A26GT
Year   : III B. Tech
Semester   : II Semester (Common to CE, ME & CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	1	-	4

Course objective:
- To impart basic knowledge to the students about current energy scenario, energy conservation and management.
- To inculcate among the students systematic knowledge and skill about assessing the energy efficiency and energy management.

Unit-I   Principles of energy management   08
Organizing an energy management program – Initiating and managing an energy management program - Planning - Leading – Controlling – Promoting – Monitoring and reporting.

Unit-II   Electrical energy management   08
Energy efficient motors – Power factor improvement – Lighting and lighting system control – Energy saving opportunities.
Qualities and functions of energy managers – Qualities and functions of an energy manager – questionnaire -Check list for top management.

Unit-III Energy Scenario   0 6
Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy sector reforms, energy and environment, energy conservation and its importance, energy efficiency and its need, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change.

Unit-IV   Energy Conservation:
Principles of Energy Conservation. Energy Conservation Act 2001 and its feature, Electricity Act -2003 and features, The Energy Conservation (Amendment)Act,2010 and its importance. Prominent organizations at Centre and state level responsible for its implementation. Energy Consumption pattern, Resource availability, Energy pricing, Energy Security.

Unit-V   Basics of Energy, pricing and its uses in buildings
Electricity tariff, load management and maximum demand control, power factor
Improvement, selection & location of capacitors.
Estimation of Energy use in buildings: Estimation of Energy use in a building, Heat gain and Thermal Performance of building envelope- steady and Non-Steady heat transfer through the glazed window and the wall-standard for thermal performance of building envelope, Evaluation of the overall Thermal Transfer.

Text Books :
1. "Energy Management" - W.R.Murphy&G.MckeyButterworths.
2.   "Energy Management Hand Book" - W.C.Turner, John Wiley and Sons.
3. "Energy Management Principles" – Craig B Smith – Pergamon press
4. "Energy Conservation" -   Pa ulO'Callagan - Pergamon press.
5. S.C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991

Department of Mechanical Engineering

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. To understand the Principles and organization of energy management	L2 &L4
2. To acquaintance with electrical energy management like energy saving opportunities and Power factor improvement.	L3
3. Analyze the current energy scenario and its importance in energy conservation	L4
4. Understand the concepts of Energy conservation and its features.	L2
5. Understand the estimation of Energy use in buildings.	L2

COs-POs-PSOs Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A26GT.1	3	3	-	-	-	2	3	-	-	-	-	3
19A26GT.2	3	3	-	-	-	3	3	-	-	-	-	3
19A26GT.3	3	3	-	-	-	2	2	2	-	-	-	3
19A26GT.4	3	3	-	-	-	2	2	2	-	-	-	2
19A26GT.5	3	3	-	-	-	2	2	2	-	-	-	2

Department of Mechanical Engineering

ANNAMACHARYA INSTITUTE OF TECHNOLOGY & SCIENCES RAJAMPET

(AN AUTONOMOUS INSTITUTION)

Title of the course: Fuzzy Logic and Neural Network

Category   : OE
Course code   : 19A26HT
Year   : III B.Tech
Semester   : II Semester

Lecture Hours	Tutorial Hours	Practical Hours	Credits
3	-	-	3

Course Objectives
- To understand the fundamental concepts of Artificial Neural network
- To Understand the concepts of different types Neural network architectures and training algorithms
- To understand the concepts of classical sets Fuzzy sets
- To understand the concepts Fuzzy logic controllers
- To gain knowledge in neuro- fuzzy control and its applications in power systems

Unit 1:   Introduction to Artificial Neural Networks   12
Introduction, Biological Neuron, Biological Artificial Neuron model , Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of neural networks , Historical developments, Neural network architectures, McCulloch-Pitts Model, Types of neuron activation functions, Learning methods(supervised, unsupervised, Reinforcement), Applications of Neural Networks.

Unit-2:   Single layer and multi layer feed forward neural networks   12
Perceptron Models: Discrete, Continuous (concepts only), Perceptron Convergence   theorem, Limitations of the Perceptron Model, Applications, ADALINE, MADALINE, Back Propagation   Network, BP Learning Rule, Input Layer, Hidden Layer and output Layer computations, Radial Basis function network, Hetero associative memory neural and Auto associative memory net, applications.

Unit-3   Classical and Fuzzy sets   08
Introduction to classical sets, Fuzzy sets – Properties, Operations and Relations, Membership, Uncertainty, Fuzzy Relations, Cardinalities and Membership Functions.

Unit-4   Fuzzy Logic system and components   10
Fuzzification, Membership Value assignment, Development of Rule Base, Defuzzification to crisp sets, Defuzzification methods

Unit 5   Neural network and fuzzy logic applications to Power system   10
ANN Based Short Term Load Forecasting, Load Flow Studies, Fault diagnosis and Fuzzy Logic based Unit Commitment and load frequency control.

Text Books:
1. S.N.Sivanadam, S.N.Deepa *Principles of Soft Computing Techniques* , Wiley India publication.
2. JacekM.Zurada *Introduction to Artificial Neural Systems*, Jaico Publishing House, 1997.

Reference Books:
1. N. Yadaiah and S. BapiRaju, *Neural and Fuzzy Systems*: *Foundation, Architectures and Applications*, Pearson Education
2. James A Freeman and Davis S kapura, *Neural Networks* ,Pearson, 2002
3. Brok Kosko, *Neural Networks and Fuzzy Logic System* , , PHI Publications
4. Rajasekharan and Rai, *Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications* - PHI

Department of Mechanical Engineering

Publication.

Course Outcomes: By the end of this course, students will be able to
1. Able to analyze and form Neural Networks For Different Problems
2. Able to Get the knowledge of Different Types of Neural Networks
3. Understand fuzzy concepts and fuzzy logic components
4. Able to apply Neural Networks for Electrical Systems.
5. Able to apply Fuzzy Logic for Electrical Systems

COs-POs-PSOs Mapping

Course Outcomes	Program Outcomes														PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	1	2
19A26HT .1	1	1	1	1	1	-	-	-	1	1	1	1	1	1	1	1
19A26HT .2	2	3	2	2	3	-	-	-	2	2	2	2	2	2	2	2
19A26HT .3	-	2	-	-	-	-	-	-	-	-	2	-	-	-	-	2
19A26HT .4	-	-	-	3	-	-	-	-	-	-	-	3	-	-	2	-
19A26HT .5	2	3	2	2	2	-	-	-	2	2	2	2	2	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Electronic Circuits and its Applications
Category   :   OE
Course Code   :   19A46GT
Year   :   III B. Tech
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: The course aims to provide the student with the ability

- To analyze and design the transistor and feedback amplifiers.
- To understand and analyze the concepts of oscillators, linear and nonlinear wave shaping circuits.

Unit 1 :   SMALL SIGNAL ANALYSIS OF AMPLIFIERS   14

Introduction to h-parameter model, Small Signal model of BJT, Analysis of CB, CE and CC configurations using h-parameters – simplified hybrid model – miller's theorem – dual of miller's theorem. Analysis ofCascaded Transistor Amplifiers- RC Coupled amplifier, Frequency response of RC Coupled, Direct coupled and Transformer coupled amplifiers.

Unit 2 :   FEEDBACK AMPLIFIERS   14

Concept of Feedback, Classification of feedback amplifiers, Transfer Gain with feedback, General characteristics of negative feedback amplifiers. Voltage series, voltage shunt, current series, and current shunt feedback amplifiers with discrete components (Topologies).

Unit 3 :   OSCILLATORS   10

Condition for oscillations. Oscillator Types, Frequency and amplitude stability of oscillators, LC oscillators-Hartley and Colpitts oscillators, RC-phase shift and Wien bridge oscillators, Crystal Oscillators

Unit 4 :   LARGE SIGNAL AMPLIFIERS   09

Classifications, Class A power Amplifiers- Direct coupledand Transformer Coupled, Class B power Amplifiers- Push-pull and Complementary Symmetry-Transistor power dissipation, Power and Efficiency calculations.

Unit 5 :   LINEAR AND NON LINEAR WAVE SHAPING   12

High pass & low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and Exponential inputs. Diode and Transistor clippers and clampers, clamping circuit theorem.

Prescribed Text Books:
1. J. Millman and Christos C. Halkias- "Integrated Electronics", McGraw-Hill, 1972.
2. Robert T. Paynter- "Introductory Electronic Devices and Circuits", Pearson Education, 7th Edition.
3. J. Millman and H. Taub, "Pulse, Digital and Switching Waveforms", McGraw-Hill, second edition, 2007.

Reference Text books:
1. Robert L. Boylestad and Louis Nashelsky - "Electronic Devices and Circuits Theory", Pearson/Prentice Hall, 9th Edition, 2006.
2. Donald A. Neumann- "Electronic Circuit Analysis and Design", McGraw Hill.
3. Anand Kumar, "Pulse and Digital Circuits", PHI, 2005.Second Edition.

Course Outcomes:

Upon completion of the course, student can	Blooms Level of Learning
1. Analyze the single stage amplifiers using h-parameter model at low frequencies.	L4
2. Understand the feedback amplifiers and oscillators.	L2
3. Analyze the concepts of large signal amplifiers.	L4
4. Design and analyze linear and nonlinear wave shaping circuits.	L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A46GT.1	3	3	2	3	3	1	-	-	2	-	-	-	2	3	-
19A46GT.2	1	3	3	2	2	-	-	-	2	-	-	-	3	-	-
19A46GT.3	3	3	3	2	2	1	-	-	2	-	-	-	2	3	-
19A46GT.4	2	2	2	-	-	-	-	-	2	-	-	-	2	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Basics of Communication Systems
Category	:	OE
Course Code	:	19A46HT
Year	:	III B. Tech
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to
- Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
- Understand the concepts in Angle modulation for the design of communication systems.
- Design simple systems for generating and demodulating frequency modulated signals.
- Learn the concepts of random process and various types of noise.
- Analyze pulse modulation and sampling techniques.

Unit 1 :   AMPLITUDE MODULATION   10
AMPLITUDE MODULATION: Introduction, Amplitude Modulation: Time & Frequency – Domain description, Switching modulator, Envelop detector. DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.
SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television

Unit 2 :   ANGLE MODULATION   10
ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super heterodyne Receiver

Unit 3 :   RANDOM VARIABLES & PROCESS   10
RANDOM VARIABLES & PROCESS: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions.
NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth

Unit 4 :   NOISE IN ANALOG MODULATION   10
NOISE IN ANALOG MODULATION: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM

Unit 5 :   DIGITAL REPRESENTATION OF ANALOG SIGNALS   10
DIGITAL REPRESENTATION OF ANALOG SIGNALS: Introduction, Why Digitize Analog Sources?, The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, Pulse– Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing , Application to Vocoder

Prescribed Text Books:

1. **Communication Systems**, Simon Haykins&Moher, 5th Edition, John Willey, India Pvt. Ltd, 2010,

Reference Text books:

1. Modern Digital and Analog Communication Systems, B. P. Lathi, Oxford University Press., 4th edition.
2. An Introduction to Analog and Digital Communication, Simon Haykins, John Wiley India Pvt. Ltd., 2008,
3. Principles of Communication Systems, H.Taub&D.L.Schilling, TMH, 2011.
4. Communication Systems, Harold P.E, Stern Samy and A.Mahmond, Pearson Edition, 2004.
5. Communication Systems: Analog and Digital, R.P.Singh and S.Sapre: TMH 2nd edition, 2007.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Determine the performance of analog modulation schemes in time and frequency domains.	L4
2. Determine the performance of systems for generation and detection of modulated analog signals.	L4
3. Characterize analog signals in time domain as random processes and in frequency domain using Fourier transforms.	L3
4. Characterize the influence of channel on analog modulated signals	L3
5. Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
19A46HT.1	3	1	-	-	-	1	-	-	-	3	-	2	3	2
19A46HT.2	3	3	1	-	-	1	-	-	-	2	-	2	3	2
19A46HT.3	2	3	-	1	-	2	-	-	-	2	-	2	3	2
19A46HT.4	2	1	3	-	-	2	-	-	-	2	-	2	3	2
19A46HT.5	3	3	1	-	-	1	-	-	-	2	-	2	3	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Artificial Intelligence
Category	:	OE
Course Code	:	19A56IT
Year	:	III Year
Semester	:	II Semester (Offered to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will
1. To comprehend the building blocks of AI in terms of intelligent agents.
2. To understand the main approaches of artificial intelligence such as heuristic search, game search and logical inference.
3. To know how decision theory and planning is processed on the agents.
4. To verify the different types of objects in uncertain world for an agent
5. To identify the solution in uncertain knowledge with reasoning.

Unit 1 :   Introduction to Artificial Intelligence   9
   Introduction to AI, History of AI, Emergence of Intelligent Agents, Intelligent Agents: PEAS- Representation for an Agent, Types of Agents, Types of Agent Environments, Concept of Rational Agent, Structure of Intelligent agents, Defining the Problem as a State Space Search, Problem Characteristics.

Unit 2 :   Problem Solving   12
Solving problems by searching, Problem Formulation, Uninformed Search Techniques- DFS, BFS, Iterative Deepening, Comparing Different Techniques, Informed search methods – heuristic Functions, Hill Climbing, Simulated Annealing, A*, Performance Evaluation. Constrained Satisfaction Problems: Constraint Satisfaction Problems like – map Coloring, Crypt Arithmetic, Backtracking for CSP, Local Search.

Unit 3 :   Knowledge and Reasoning   9
   A knowledge Based Agent, Introduction To Logic, Propositional Logic, Reasoning in Propositional logic, First Order Logic: Syntax and Semantics, Extensions and Notational Variation, Inference in First Order Logic, Unification, Forward and Backward chaining, Resolution.

Unit 4 :   Knowledge Engineering and Planning   11
   Knowledge Engineering: Ontology, Categories and Objects, Mental Events and Objects.
   Planning: Planning problem, Planning with State Space Search, Partial Order Planning, Hierarchical Planning, Conditional Planning.

Unit 5 :   Uncertain Knowledge and Reasoning   10
   Uncertain Knowledge and Reasoning: Uncertainty, Acting Under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, Belief Networks, Simple Inference in Belief Networks, Fuzzy Logic.

Prescribed Text Books:
1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Publication.
2. Rich, E. and Knight, K., "Artificial Intelligence", Tata McGraw-Hill.

Reference Books:
1. George Lugar, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.
2. Robert J. Schalkolf, Artificial Intelligence: an Engineering approach, McGraw Hill, 1990.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson.

Course Outcomes:
Student will be able to   Blooms Level of Learning

1. Understand the importance of artificial Intelligence in real world environment — L2
2. Apply the artificial intelligence algorithms for problem solving — L3
3. Analyze the various reasoning and knowledge representation techniques — L4
4. Solve the problems using classification and planning techniques — L3
5. Apply knowledge and reasoning techniques in uncertain environment for obtaining solution — L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A56IT.1	3	3	-	-	-	3	-	-	3	2	-	2
19A56IT.2	3	3	3	3	-	3	2	-	3	-	-	2
19A56IT.3	3	3	3	3	-	3	-	-	3	2	-	-
19A56IT.4	3	3	3	3	1	3	2	-	3	-	-	-
19A56IT.5	3	3	3	3	-	3	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Cyber Security
Category	:	OE
Course Code	:	19A56JT
Year	:	III B. Tech
Semester	:	II Semester (Common to CE & ME)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to
- Remember Cyber Security architecture principles
- Compare different classes of attacks
- Understand about cybercrime with mobile and wireless devices
- Apply tools and methods used in cybercrime
- Understand about cyber security and social media marketing.

Unit 1 :   INTRODUCTION: 10
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, The Legal Perspectives, Indian Perspectives, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens
Cyber offenses: Introduction of Criminal Planning and Criminal Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing.

Unit 2 :   CYBERCRIME MOBILE AND WIRELESS DEVICES: 10
Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Unit 3 :   TOOLS AND METHODS USED IN CYBERCRIME: 9
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Phishing and Identity Theft: Introduction, Phishing, Identity Theft(ID Theft)

Unit 4 :   CYBERCRIMES AND CYBER SECURITY: 9
Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies.

Unit 5 :   UNDERSTANDING COMPUTER FORENSICS: 10
Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Antiforensics

Prescribed Text Books:
1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.
2. Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning.

Reference Text Books:
1. Information Security, Mark Rhodes, Ousley, MGH.
2. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press

Web References:
1.https://www.tutorialspoint.com/fundamentals_of_science_and_technology/cyber_crime_and_cyber_security.htm

Course Outcomes

Student will be able to	Blooms Level of Learning
1. Remember Cyber Security architecture principles	L1
2. Compare different classes of attacks	L2
3. Understand about cybercrime with mobile and wireless devices	L2
4. Apply tools and methods used in cybercrime	L3
5. Understand about cyber security and social media marketing	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A56JT.1	3	3	3	-	3	-	-	3	-	-	3	-
19A56JT.2	-	3	-	3	-	3	-	-	3	-	-	3
19A56JT.3	3	-	-	3	-	-	3	3	-	3	-	3
19A56JT.4	3	3	3	-	3	-	-	-	-	-	3	3
19A56JT.5	-	-	3	3	3	-	-	-	3	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Humanities and Sciences

Title of the Course   Professional Communication Skills Lab
Category   BS
Couse Code   19AC62L

Year   III Year
Semester   II Semester
Branch   CE, ME, CSE

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	3	1.5

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& Team) – collection of data from various sources –planning, preparation and practice – attention-gathering strategies - transitions – handling questions from audience

Listening Comprehension – listening for understanding - responding relevantly

Learning Resources: AECS Lab Manual prepared by Dept of HS, AITS Rajampet

Course Outcomes:
Student will be able to	Blooms Level of Learning
1. express himself/herself fluently in social and professional contexts	L4
2. demonstrate effective presentation skills	L4
3. face interviews confidently	L3
4. participate in meetings effectively	L4
5. listen actively for better understanding	L4

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
19AC62L. 1	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
19AC62L. 2	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
19AC62L. 3	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
19AC62L. 4	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
19AC62L. 5	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Heat Transfer Lab
Category : PC
Course Code : 19A361L
Year : III Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1.5

Course Objectives:
- To acquire Knowledge of the principle of mode of heat transfer
- 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

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. Experiment on Transient Heat Conduction
13. Heat transfer in drop and film wise condensation
14. Heat pipe demonstration

Note: 1. Any 12 experiments of the above 14 experiments are to be conducted.
    2. Heat Transfer data Books and Steam Tables data books are permitted in the examinations.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Determine thermal conductivity in metal bars, insulating powder, lagged pipe and composite slab.	L3
2. Evaluate the fin efficiency and fin effectiveness.	L1,L3
3. Evaluate convective het transfer coefficient by performing experiments in free and forced convections.	L3
4. Determine Stefan Boltzmann constant and emissivity of gray body.	L2
5. Demonstrate practical understanding on unsteady state heat conduction, Heat pipe and Two phase flow.	L1
6. Determine convective het transfer coefficient in drop and film wise condensation	L2
7. Determine Critical heat flux for pool boiling	L2
8. Analyze the performance of heat exchanger	L1, L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A361L.1	3	2	2	2	-	-	-	-	-	-	-	-	-	2	-
19A361L.2	3	3	3	2	-	-	-	-	-	-	-	-	-	2	-
19A361L.3	3	3	3	2	-	-	-	-	-	-	-	-	-	2	-
19A361L.4	3	3	2	-	-	-	-	-	-	-	-	-	-	2	-
19A361L.5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
19A361L.6	3	3	2	-	-	-	-	-	-	-	-	-	-	2	
19A361L.7	3	2	2	-	-	-	-	-	-	-	-	-	2	-	-
19A361L.8	3	3	2	2	-	-	-	-	-	-	-	-	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course	:	Metrology & Machine Tools Lab
Category	:	PC
Course Code	:	19A365L
Year	:	III Year
Semester	:	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
-	-	2	1

Course Objectives:
6. To learn the Step turning and taper turning and thread cutting on lathe machine
7. To learn the operations of Drilling, Tapping, Shaping, Slotting and milling.
8. To demonstrate the usage of metrology lab equipment.
9. To know the working principles of different instruments
10. To learn the measurement of the Angle and taper s by Bevel protractor, Sine bar, etc

List of Experiments: Machine Tools Lab
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.

List of Experiments: Metrology Lab
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.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Demonstrate knowledge of different machine tools used in machine shop.	L4
2. Perform step, taper turning, knurling and threading operations on lathe.	L3
3. Have Practical exposure on Flat Surface machining, Shaping, Slotting, Milling and grinding operations.	L3
4. Apply the procedures to measure length, width, depth, bore diameters,	L5

external tapers, tool angles, and surface roughness by using different instruments.

5. Measure the angle and taper using Bevel protractor and Sine bar   L4
6. Conduct different machine alignment tests   L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A365L.1	3	3	3	3	3	-	-	-	3	-	-	-	3	-	-
19A365L.2	3	2	-	-	2	-	-	-	2	-	-	-	1	2	3
19A365L.3	3	3	-	-	3	-	-	-	3	-	-	-	1	2	3
19A365L.4	3	3	-	3	3	-	-	-	3	-	-	-	3	1	-
19A365L.5	3	-	-	-	3	-	-	-	3	-	-	-	1	3	-
19A365L.6	3	-	-	-	3	-	-	-	3	-	-	-	1	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course : CAD/CAM
Category : PC
Course Code : 19A371T
Year : IV Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	-	-	2

Course Objectives:

- To understand the basic concepts of CAD/CAM and Transformations.
- To understand the different geometric modeling techniques like solid modeling, surface modeling, feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication
- To develop NC and CNC programs to manufacture industrial Components.
- To understand the importance of Group Technology and Flexible Manufacturing System
- To understand the elements of an automated manufacturing environment

Unit 1   Introduction To Computer Graphics   10
Introduction: Introduction to CAD and CAM- Elements of CAD-Computers in Industrial Engineering-Product Cycle-CAD/CAM Hardware-Basic Structure of CPU-Input and Output Devices-Display Devices (CRT and DVST)-Raster Scan Graphics Coordinate System-Representation of Line and Circles, Database Structure for Graphics Modeling-Transformation -2D and 3D

Unit 2   Curve Representation   10
Geometric Modeling-Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics, Parametric representation of synthetic curves: Hermite cubic curve, Bezier curve, B-Spleen curve-Representation of surface modelling, -Hermite bicubic surface patch-Bezier and B-spline Surfaces, Solid modelling techniques, CSG and B-rep.

Unit 3   Numerical Control   08
NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

Unit 4   Group Technology And Flexible Manufacturing System   10
Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.
Flexible Manufacturing System: Introduction to FMS – Material Handling System – Computer Control Systems – Human Labor in Manufacturing system – Applications – Advantages and Limitations

Unit 5 :   Computer Integrated Production Planning And Computer Aided Quality Control   10
Computer Aided Quality Control (CAQC): 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, and computer aided testing, integration of CAQC with CAD/CAM.

Prescribed Text Books:
1. P N Rao, CAD/CAM – Principle and Applications. 2010. ISBN: 9780070681934

Department of Mechanical Engineering

2. A Zimmer & P Groover, CAD/CAM. PE,PHI. ISBN: 9788177584165.
3. RadhaKrishnan and Subramaniah, CAD/CAM/CIM. New Age. 2008. ISBN: 8122422365, 9788122422368.

Reference Books:
1. Groover, P.E, Automation, Production systems & Computer integrated Manufacturing. ISBN-10: 0132393212.
2. Farid Amirouche, Principles of Computer Aided Design and Manufacturing. Pearson Hall. 2004. ISBN, 0130646318, 9780130646316.
3. CSP Rao, A text book of CAD/CAM, Hitech Publ. (2002) ISBN 81-7764-294-4

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify the importance of CAD/CAM in modern manufacturing systems and explain the hardware used for CAD/CAM systems.	L1&L2
2. Able to understand and develop the Mathematical representations of curves.	L2
3. Find the difference between conventional and NC techniques and to develop a simple program.	L3
4. Describe the use of GT and CAPP for the product development.	L3
5. To identify the various elements involved in the computer aided manufacturing system	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A371T.1	2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
19A371T.2	2	2	3	2	-	-	-	-	3	-	-	-	3	-	-
19A371T.3	-	-	3	2	1	-	-	-	3	-	-	-	3	-	-
19A371T.4	-	2	3	-	-	-	-	-	3	-	-	-	3	-	-
19A371T.5	-	-	3	-	-	-	-	-	3	-	-	-	-	-	-

Department of Mechanical Engineering

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course : Operations Research
Category : PC
Course Code : 19A372T
Year : IV B.Tech
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
2	1	0	3

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.

Unit 1   10
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 2   10
Transportation Problem: Formulation – Optimal solution, unbalanced transportation problem –Degeneracy.
Assignment Problem – Formulation – Optimal solution - Variants of Assignment Problem-Travelling Salesman problem

Unit 3   10
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 & m x n games -Graphical method, Dominance principle.

Unit 4   08
Waiting Lines: Introduction – Single Channel – Poisson arrivals – exponential service times – with infinite queue length models.
Simulation: Definition – Types of simulation models – phases of simulation– applications of simulation – Queuing problems – Advantages and Disadvantages – Simulation Languages.

Unit 5   10
Inventory: Introduction – Single item – Deterministic models – Purchase inventory models with one price break and multiple price breaks.
Dynamic Programming: Introduction – Bellman's Principle of optimality – Applications of dynamic programming-shortest path problem – linear programming problem.

Prescribed Text Books:
1. PS Gupta, DS Hira, Operations Research, S Chand Publications, 10th Edition, 2016, ISBN-13978-8121902816.

2. S.D. Sharma, Operations Research, Kedarnath and Ramnath Publications, 2012, ISBN-135551234001596

Reference Books:
1. Taha, Introduction to Operations Research. PHI, 10 th edition, 2016, ISBN-13978-0134444017
2. R. Panneerselvam, Operations Research. PHI Publ, 2nd edition, 2004, ISBN: 9788120319233

Course Outcomes:

Student will be able to	Blooms Level of Learning
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.	L3
2. Solve the special cases of LPP such as Transportation, Assignment and Travelling Salesmen problems.	L3
3. Find optimal replacement period of a machine or group of parts.	L3
4. Have knowledge of choosing the best strategy out of the available strategies which is an essential skill for any business manager to successfully face the competition.	L3
5. Understand and will apply the fundamentals of waiting lines in real life situations.	L3
6. Simulate queuing models	L3
7. Have aware of applying Dynamic Programming technique to solve the complex problems by breaking them into a series of sub- problems.	L3
8. Understand and will apply the fundamentals of inventory in real life situations.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A372T.1	3	3	-	1	-	-	-	-	-	-	-	-	2	-	-
19A372T.2	3	3	2	-	-	-	3	-	-	-	-	-	2	-	-
19A372T.3	3	3	2	-	-	-	3	-	-	-	-	-	2	-	-
19A372T.4	3	3		-	-	-	3	-	-	-	-	-	2	-	-
19A372T.5	3	3	2	-	-	1	3	-	-	-	-	-	2	-	-
19A372T.6	3	3	-	-	-	1	3	-	-	-	-	-	2	-	-
19A372T.7	3	3	-	-	-	-	3	-	-	-	-	-	2	-	-
19A372T.8	3	3	-	-	1	-	3	-	-	-	-	-	2	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   R&AC
Category   :   PE
Course Code   :   19A37AT
Year   :   IV Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To equip the students to understand vapour compression refrigeration cycle, vapor absorption refrigeration cycle and air conditioning equipment.
- To enable the students to design summer and winter air conditioning systems.
- To enable the students to understand the psychometric properties and their calculation using the psychometric charts and tables to design the comfort air conditioning system suitable to particular application.

Unit 1   Introduction To Refrigeration   09
Necessity and applications – Unit of refrigeration and C.O.P. – Different refrigeration methods - Air Refrigeration: Ideal and Actual cycles, Open and Dense air systems –- problems – Refrigeration needs of Aircrafts.

Unit 2   Vapour Compression Refrigeration   10
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. Refrigerants – Desirable Properties – Common refrigerants used – Nomenclature.

Unit 3   Vapor Absorption Refrigeration System   09
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 systems. Steam Jet Refrigeration System – Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

Unit 4   Introduction To Air Conditioning   10
Psychometric Properties & Processes – Characterization of Sensible and latent heat loads –– Need for Ventilation, Consideration of Infiltrated air – Heat Load concepts: 152 | P a g e 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 5 :   Air Conditioning Equipment   08
humidifiers – dehumidifiers – air filters, fans and blowers. Heat Pump – Heat sources – different heat pump circuits.

Prescribed Text Books:
1. CP Arora, Refrigeration and Air Conditioning. TMH, 2008, 3rd Ed. ISBN-10 : 0070083908
2. SC Arora & Domkundwar, A Course in Refrigeration and Air conditioning. Dhanpatrai. ISBN : 4567152026

Reference Books:
1. Manohar Prasad, Refrigeration and Air conditioning, Wiley Eastern Ltd., 2011. ISBN 10: 8122435033 / ISBN 13: 9788122435030

2. Arora, C. P. (2012), Refrigeration and Air Conditioning, 3rd edition, McGraw-Hill Education, 2012. ISBN 10: 9351340163 ISBN 13: 9789351340164

3. Dossat, Principles of Refrigeration. Pearson Edu., 4th Ed. ISBN-13: 9780132333719

4. P.L.Ballaney, Refrigeration and Air Conditioning. Khanna Publ. 1998.ISBN: 978-81-7409-136-9

5. R.C.Arora, Refrigeration and Air Conditioning. PHI, 2010. ISBN 10: 8120339150 / ISBN 13: 9788120339156

6. Eugene Silberstein , Refrigeration and Air Conditioning Technology, 7th Edition (International), Delmar publications, 2012. ISBN-10 : 1111644470; ISBN-13 : 978-1111644475

7. G H Hundy, A R Trott, T C Welch, Refrigeration, Air Conditioning and Heat Pumps, 5th edition, (International), Butterworth-Heinemann Publications, 2016. ISBN: 9780081006665, 0081006667

Tables/Codes: Thermal Engineering Data Book containing Refrigerant and Psychrometric property Tables and charts

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the basics of vapour compression refrigeration system	L2
2. Analyze different components of vapour compression refrigeration system and able to design the vapour compression refrigeration system for the given application by selecting the proper refrigerant.	L4
3. Analyze the vapour absorption refrigeration system.	L4
4. Estimate the different loads of air conditioning system and calculation of psychometric properties using psychometric chart and equations.	L3
5. Select the proper air conditioning equipment by knowing their purpose and characteristics.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37AT.1	3	2	1	-	1	1	-	-	-	-	-	-	-	-	-
19A37AT.2	3	3	2	1	2	1	2	-	1	-	-	2	-	1	-
19A37AT.3	3	3	2	1	2	1	2	-	1	-	-	2	-	1	1
19A37AT.4	3	3	2	2	2	1	2	-	1	-	-	2	-	1	1
19A37AT.5	3	2	1	-	1	1	-	-	-	-	-	-	-	1	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   :   Finite Element Methods
Category   :   PE
Course Code   :   19A37BT
Year   :   IV Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

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.

Unit 1   14
Introduction to finite element methods for solving field problems, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems, Potential energy and equilibrium.
One dimensional problem: Finite element modeling coordinates and shape functions. Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, solution for displacements, reaction, stresses, temperature effects.

Unit 2   08
Analysis of trusses: Stiffness Matrix for plane truss element. Stress Calculations and Problems.
Analysis of beams: Element Stiffness Matrix for two noded, two degrees of freedom per node beam element and simple problems.

Unit 3   08
Two dimensional problems: Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses. Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

Unit 4   12
Iso-Parametric Formulation: Concepts, sub parametric, super parametric elements, 2 dimensional 4 nodediso-parametric elements, and numerical integration.
Steady state heat transfer analysis: One dimensional analysis of slab and fin, two dimensional analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

Unit 5   06
Dynamic analysis: Formulation of finite element model, element –mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and Beam.

Prescribed Text Books:

1. Introduction to Finite elements in Engineering- Tirupathi.R. Chandrupatla and Ashok D. Belegundu-Pearson Education India -4th Edition 2015- ISBN-978-9332551824
2. Finite Element Analysis- Dr. S Senthil, R Paneerdhass – Lakshmi Publications-5th Edition 2013-ISBN-978-

9383103317

3. Finite Element Analysis in Engineering- S.Md. Jalaludeen- Anuradha Publications- 2016-ISBN-978-8184722376

Reference Books:

1. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993. ISBN-10 : 0072466855

2. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3rd Edition, John Wiley, New York, 1989. ISBN 13: 9780471503194

3. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, 1982. ISBN 978-0-9790049-5-7

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Identify mathematical model to solve common engineering problems by applying the finite element method and able to solve one dimensional problems like bars	L3, L4
2. Derive element matrices to find stresses in beams and trusses	L3
3. Formulate FE characteristic equations for two dimensional elements and analyze plain stress, plain strain, axi-symmetric problems.	L4
4. Formulate FE equations for iso-paramteric elements and heat transfer problems	L4
5. Solve dynamic problems where the effect of mass matters during the analysis	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37BT.1	3	3	1	1	3	-	-	-	1	1	-	1	3	-	2
19A37BT.2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	2
19A37BT.3	3	3	1	1	3	-	-	-	-	-	-	-	-	-	3
19A37BT.4	3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
19A37BT.5	3	3	-	-	-	-	-	-	-	-	-	-	3	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Unconventional machining process
Category : PE
Course Code : 19A37CT
Year : IV Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- 1. 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.
- 2. 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 & LSB.

Unit 1   Introduction   10
Need for non-traditional machining methods- Classification of modern machining processes – considerations in process selection. Importance of smart, HSTR and Composite materials in ucmp, Applications. Ultrasonic machining – Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent development, Hybrid technologies used in UCMP

Unit 2   Mechanical Processes   10
Abrasive jet machining, Water jet machining and abrasive water jet machining Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations. (AJM and WJM). Working Principles – equipment used – Process parameters –MRR-Variation in techniques used – Applications

Unit 3   Electro – Chemical Processes   10
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 – Fundamentals of chemical machining, advantages and applications.

Unit 4   Thermal Metal Removal Processes – I   10
General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes – 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 5   Thermal Metal Removal Processes –II   08
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. Chemical machining principle-maskants –etchants- applications. Magnetic abrasive finishing, Abrasive flow finishing.

Prescribed Text Books:

1. 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). ISBN, 0824773527.
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw- Hill, New Delhi (1980). ISBN: 0070965188, 9780070965188
3. Mc Geough, "Advanced Methods of Machining" Chapman and Hall, London (1998) 42 Industrial Robotics 3.0, ISBN 978-0-412-31970-9

Course Outcomes:

Student will be able to	Blooms Level of Learning
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.	L2,L3
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.	L2,L3
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.	L2,L3
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.	L2,L3
5. Understand the fundamental concepts of LBM, PAM and other surface finish process and can perform experiments on those processes and are able to apply these concepts in academic research.	L2,L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37CT .1	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
19A37CT.2	3	3	3	3	1	-	-	-	-	-	-	2	-	-	-
19A37CT .3	3	2	-	3	-	-	-	-	-	-	-	2	-	-	-
19A37CT .4	3	3	3	3	1	-	-	-	-	-	-	2	-	-	-
19A37CT .5	3	3	-	3	-	-	3	-	-	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Mechatronics
Category	:	PE
Course Code	:	19A37DT
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives: This course will

- Familiarize the technologies behind modern mechatronic systems.
- Explain fundamentals for the development of fully automated system.
- Develop a robotic or automated systems focusing on the hardware and software integration.
- Demonstrate the development of mechatronic system and MEMS.

Unit 1   Introduction   09

Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications–Computer numerical control(CNC) machines, Tool monitoring systems, Flexible manufacturing system(FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

Unit 2 :   Sensors   09

Static characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

Unit 3   Actuators   09

Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezo electric actuators, Shape memory alloys, Selection criteria for actuators.

Unit 4   Microprocessors, Micro controllers and Programmable Logic Controllers   09

Architecture of of Microprocessor, Micro controller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

Unit 5   Micro Electro Mechanical Systems(MEMS)   09

History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, and Applications: Labon chip.

Prescribed Text Books:

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, W. Bolton, 3/e Pearson Education Press, 2005. ISBN-10 : 0273742868; ISBN-13 : 978-0273742869
2. Devadas Shetty and Richard A Kolk, Mechatronic System Design, 2/e, Cengage learning, 2010. ISBN-10: 1-4390-6199-8
3. Clarence W. de Silva, Mechatronics an Integrated Approach, CRC Press, 2005. ISBN 9780849312748

Reference Books:

1. James J Allen, Micro Electro Mechanical Systems Design, CRC Press Taylor & Francis group, 2005. ISBN 0-8247-5824-2
2. Ganesh S Hedge, Mechatronics, Jones & Bartlett Learning, 2010. ISBN, 1934015296, 9781934015292

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Explain the role of mechatronics in industry and applications of mechatronics in automation industry.	L3
2. Know about the classification of sensors.	L4
3. Know about classification of actuators and also choose criteria for different actuators.	L4
4. Understand the architecture of microprocessors, microcontrollers and PLC	L1
5. Illustrate the application of MEMS in industry.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37DT.1	3	3	-	-	-	-	-	-	3	-	3	-	-	-	-
19A37DT.2	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
19A37DT.3	-	-	-	-	2	-	-	-	2	-	-	-	-	-	-
19A37DT.4	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
19A37DT.5	-	2	-	-	2	-	-	-	-	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Non-conventional sources of energy
Category   :   PE
Course Code   :   19A37ET
Year   :   IV Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

* To grasp the role and potential of new and renewable source

* To recognize the principle, storage and applications of solar energy

* To understand the sources and potentials of wind energy and also to comprehend the Principles of Bio-Conversion of bio-mass and bio-gas uses.

* To explain the principle, working procedure and types of geothermal energy, ocean energy and tidal & wave energy.

* To know the knowledge on direct energy conversion.

Unit 1   Principles Of Solar Radiation   09
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 2   Solar Energy Collectors   09
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, potential in India.

Unit 3   Wind Energy   08
Sources and potential in India, horizontal and vertical axis wind mills, 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, and economic aspects, potential in India

Unit 4   Geothermal Energy   08
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 5   Direct Energy Conversion   09
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

Prescribed Text Books:

1. Tiwari and MK.Ghosal, Renewable energy resources: Basic principles and applications, Narosa publications 2005, ISBN 10: 1842651250 ISBN 13: 9781842651254
2. G.D. Rai, Non-Conventional Energy Sources, khanna publications, 2011, ISBN 10: 8174090738, ISBN 13: 9788174090737

Reference Books:

1. Twidell & Weir, Renewable Energy Sources, Routledge , 3rd Ed.2015,ISBN 9780367200756
2. Non Conventional Energy Resources, B.H.Khan, McGrawHlll, 2015, ISBN 1259081397, 9781259081392

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Create awareness on role and potential of new and renewable source and basics of solar energy.	L2
2. acquire the knowledge on different types of collectors and storage systems of solar energy and their applications.	L2
3. Able to achieve sufficient knowledge on Wind energy and Bio-mass energy.	L2
4. Familiarize the student with the Geothermal and Ocean energy concepts and their potentiality	L2
5. Gain the knowledge on direct energy conversion	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37ET.1	3	2	-	-	-	3	3	-	-	-	-	3	-	-	-
19A37ET.2	3	3	-	1	3	3	-	-	-	-	-	3	-	-	-
19A37ET.3	3	2	3	-	-	3	3	-	-	-	-	3	-	-	-
19A37ET.4	3	3	-	-	3	3	-	-	-	-	-	3	-	-	-
19A37ET.5	3	3	-	-	3	3	-	-	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Mechanical Vibrations
Category : PE
Course Code : 19A37FT
Year : IV Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To understand the un-damped and damped free vibrations to mechanical systems.
- To know the sources of forced vibrations and Also transmissibility& isolation of vibrations.
- To understand the natural frequencies and modes of forced vibrations.
- To analyze the formulation and model analysis of vibrations and critical speeds of shafts.
- To learn the various vibration transducers and its applications

Unit 1   Single Degree Freedom Systems   09
Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, And torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient. Simple problems

Unit 2   Forced vibrations of Single Degree Freedom Systems   10
Forced vibrations of Single Degree Freedom Systems : Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping.

Unit 3   Two Degree Freedom Systems   08
Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

Unit 4   Multi Degree Freedom Systems& Whirling of shafts   10
Multi Degree Freedom Systems: Lagrangian method for formulation of equation of motion Influence co- efficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of free and forced vibrations.
Whirling of shafts: Critical speed of shafts, Rayleigh's upper bound approximation, Dunkerley's lower bound approximation, critical speed of shafts with damping.

Unit 5   Vibration measurement and Applications   10
Vibration measurement and Applications:Transducers: variable resistance transducers, Piezoelectric transducers, electro dynamic transducers and linear variable differential transformer transducer; Vibration pickups: vibrometer, accelerometer, velometer and phase distortion; Frequency-measuring instruments; Vibration exciters- Mechanical exciters and electro dynamic shaker

Prescribed Text Books:
1. Singrasu S. Rao, Mechanical Vibrations, 6/e, Pearson Education, 2018,ISBN-13:9780132128193
2. G.K.Groover, Mechanical Vibrations, 8/e, 2009, N.Chand & Bros, ISBN-13 :9788185240565
3. Rao.V.Dukkipati & J.Srinivas, PHI 2010, ISBN-13 :9788120345249

4. V.P.Singh, Mechanical Vibrations, Dhanapat Rai & Co, ISBN-13:5551234002564

Reference Books:
1. William Thomson, Theory of Vibrations with Applications, CRS Press , ISBN-13:9780748743803
2. L. Meirovich, Elements of Vibrations Analysis, Tata McGraw Hill, ISBN-13:9789339204716
3. S. Graham Kelly, Mechanical Vibrations, Tata McGraw Hill, 1996, ISBN-13:9781439062128

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Evaluate the natural frequencies and analyse the behaviour of the un-damped single degree freedom systems with damping.	L4, L6
2. Solve vibration problems with forcing functionand combine the transmissibility and isolation.	L3,L5
3. Analyze the natural frequencies and evaluate the modes of two degree freedom systems with and without damping.	L4,L6
4. Analyze the multi degree freedom systems using Stodola method, Holzer"s method and Matrix iteration method.Develop the natural frequencies with Rayleighs method and Dunkerleys method.	L4,L5
5. Identify various transducers to measure the vibrations and recommend the different vibration pickups and exciters for mechanical vibrations.	L2,L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37FT.1	3	3	-	-	2	-	-	-	-	-	-	-	3	-	-
19A37FT.2	-	-	3	3	-	-	-	-	-	-	-	-	-	2	-
19A37FT.3	-	3	2	-	3	-	-	-	-	-	-	-		3	-
19A37FT.4	3	3	-	-	3	-	-	-	-	-	-	-	2	3	-
19A37FT.5	-	-	-	3	-	3	-	-	-	-	-	-	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Total Quality Management
Category	:	PE
Course Code	:	19A37GT
Year	:	IV Year
Semester	:	I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To introduce the students, the basic concepts of Total Quality Management.
- To expose with various quality issues in Inspection.
- To gain Knowledge on quality control and its applications to real time.
- To know the extent of customer satisfaction by the application of various quality concepts.
- To understand the importance of Quality standards in Production.

Unit 1   Introduction   10

Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

Unit 2   Historical Review   09

Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

Unit 3   TQM Principles   08

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies

Unit 4   TQM Tools   09

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

Unit 5   Quality Systems   08

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Prescribed Text Books:
1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2018, ISBN: 9789332534452
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Education., 2012, ISBN: 1259001415, 9781259001413
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017, ISBN: 9781351407786

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, NewAge International, 1996, ISBN-10: 8122416802.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993, ISBN: 9780471939672.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015, ISBN, 0070241147, 9780070241145.
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995, ISBN: 9780749415617.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Develop an understanding on quality Management philosophies and frameworks.	L2
2. Adopt TQM methodologies for continuous improvement of quality.	L3
3. Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement.	L4
4. Apply benchmarking and business process reengineering to improve management processes.	L3
5. Determine the set of indications to evaluate performance excellence of an organization.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37GT.1	2	-	-	-	-	2	2	-	-	-	2	1	1	1	-
19A37GT 2	2	2	-	2	-	2	-	-	-	1	2	1	1	1	-
19A37GT 3	1	2	-	2	-	-	-	1	1	1	2	1	1	1	-
19A37GT 4	1	-	-	-	-	1	-	-	-	-	2	1	1	1	-
19A37GT 5	1	-	-	-	-	-	-	-	-	-	2	2	1	1	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : CNC and Adaptive Control
Category : PE
Course Code : 19A37HT
Year : IV Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To acquaint new technologies in machine tools
- To familiarize part programming mech
- To impart knowledge on CNC machine structure and system drivers
- To explain interpolation algorithms for control loops
- To cover latest developments in CNC system

Unit 1   08
CNC Technology: An overview: Introduction to NC/CNC/DNC machine tools, Classification of NC /CNC machine tools, Advantage, disadvantages of NC /CNC machine tools, Application of NC/CNC.
DNC systems: Classifications, Merits, Demerits and application.

Unit 2   08
Design of CNC: Constructional features of NC/CNC machine tools, C.N.C. tooling and fixturing system, Designation of axis in CNC systems.

Unit 3   10
Part programming: CNC programming and introduction, Manual part programming: Basic (Milling, turning etc..), Special part programming, Advanced part programming, Computer aided part programming (APT).

Unit 4   08
System Drives and devices: Hydraulic and pneumatic motors, and their features, Electrical motors AC/DC and their features.
Interpolators: Hardware Interpolators, Software Interpolators, NC/CNC controllers.

Unit 5   06
Adaptive control systems: Adaptive control with optimizations (ACO), Adaptive control with constraints (ACC).
Latest developments: Machining center, Turing center, Communication networking, recent developments of CNC systems, Virtual NC systems.

Prescribed Text Books:
1. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill International, Singapore, 2006. ISBN 0070607435
2. John Stenerson and Kelly Curran, Computer Numerical Control: Operation and Programming, PHI, New Delhi, 2009. ISBN 0130119806
3. TC Chang, RA Wysk and HP Wang, Computer Aided Manufacturing, PHI, New Delhi, 2009. ISBN 0131429191

Reference Books:
1. P. Radhakrishnan, S. Subramanyan& V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008. ISBN 9788122427110
2. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008. ISBN 8120304020

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Classify and distinguish NC, CNC and DNC systems	L3
2. Develop manual and APT part programs for 2D complex profiles and test the programs through simulation.	L3
3. Explain CNC machine structures and system drives.	L3
4. Develop interpolation algorithms for control loops.	L3
5. Explain latest developments in CNC system	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A37HT.1	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-
19A37HT.2	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-
19A37HT.3	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-
19A37HT.4	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-
19A37HT.5	3	3	-	2	2	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course : CAD/CAM Lab
Category : PC
Course Code : 19A371L
Year : IV Year
Semester : I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
0	-	2	1

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.

Part Modeling:
1. Sketcher
2. Part Modeling

Analysis:
1. Structural analysis
2. Thermal analysis

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: Use any convenient software for the content mentioned above

Course Outcomes:

Student will be able to   Blooms Level of Learning
1. Develop a part model to visualize the components.   L3
2. Analyze the Structural and Thermal analysis on the various engineering   L3
   structures or components.
3. Create NC code and automated tool paths for a given engineering component L3
   and machine the components.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A371L.1	3	3	3	3	3	3	-	-	3	3	-	3	-	-	2
19A371L.2	3	3	3	3	3	3	-	-	3	3	-	3	-	-	2
19A371L.3	3	3	3	-	3	-	-	-	3	3	-	3	-	-	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Instrumentation/Optimization lab with MATLAB software lab
Category   :   PC
Course Code   :   19A373L
Year   :   IV Year
Semester   :   I Semester

Lecture Hours	Tutorial Hours	Practical	Credits
0	-	2	1

Course Objectives:
- To understand the working of pressure gauge, LVDT, Strain gauge, transducers and anemometer
- To calibrate different types of thermocouple
- 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.

Instrumentation Lab
List of Experiments:
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 the measurement of Strain.
5. Calibration of Thermocouple for Temperature Measurement.
6. Calibration of Capacitive Transducer for Angular Measurement.
7. Calibration of Resistance Temperature Detector for Temperature Measurement.
8. Study and Calibration of a Rotometer for flow measurement
9. Study and Calibration of Photo and Magnetic Speed Pickups for the measurement of speed
10. Study of anemometer

Optimization lab with MATLAB software
List of Experiments:
1. Fundamental of numerical computing in MATLAB
2. Graphics in MATLAB / Graphical user interface
3. Programming in MATLAB – I (Logical operators, functions and script files)
4. Programming in MATLAB – II (Conditional statements and loops)
5. Optimization (Linear and Non-linear)

Course Outcomes:
Student will be able to   Blooms Level of Learning
1. Understand different types of instruments and transducers   L4
2. Understand the working principle of different types of transducers   L4
3. Have aware of the use of numerical methods in modern scientific computing   L4
   and finite precision computation
4. Express programming techniques for solving engineering problems   L4
5. Use math computations, simulation, modelling, data analysis and processing,   L4
   graphical visualization and algorithm development

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A373L.1	3	3	-	3	3	-	-	-	-	-	-	-	-	2	-
19A373L.2	3	3	-	3	3	-	-	-	-	-	-	-	-	2	-
19A373L.3	3	3	-	3	3	-	-	-	-	-	-	-	-	2	-
19A373L.4	3	3	-	3	3	-	-	-	-	-	-	-	-	2	-
19A373L.5	3	3	-	2	3	-	-	-	-	-	-	-	-	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Power Plant Engineering
Category : PE
Course Code : 19A38AT
Year : IV Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To understand the student present day energy demand.
- To understand the working and combustion phenomenon in steam power plant.
- 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.
- 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.

Unit 1 :   Introduction   09
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 2 :   Steam Power Plant -Combustion Process   09
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 3 :   Internal Combustion Engine Plant-Diesel Power Plant   09
Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, 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 4 :   Hydro Electric Power Plant   10
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.
Boiling water reactor - Pressurized water reactor - Gas cooled reactor - Fast breeder reactor - Liquid metal cooled reactor-reactor materials - Radiation shielding.

Unit 5 :   Power From Non-Conventional Sources   06
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, and 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.

Prescribed Text Books:
1. P.K.Nag, Power Plant Engineering. TMH, 4 th Ed.2014. ISBN: 9789339204044, 9339204042
2. P.C.Sharma, Power Plant Engineering. S.K.Kataria& sons ,2014. ISBN 10: 9350143844 / ISBN 13: 9789350143841
3. Arora and S. Domkundwar.A Course in Power Plant Engineering, DhanpatRai& co (p) Ltd, 6 th Ed.2011. ISBN : 8177001957, 9788177001952

Reference Books:
1. Rajput. R.K., A Text Book of Power Plant Engineering. LaxmiPubl, 2015, 5th Ed. ISBN 10: 8131802558 / ISBN 13: 9788131802557
2. Hegde R.K. Power Plant Engineering. Person Publ, 2015. ISBN: 9789332558243
3. C. Elanchezian and L.Sravana Kumar, Power Plant Engineering. I.K. books, 2010. ISBN: 9788189866303
4. A B Gill, Power plant Performance, Butterworth and Co, Ltd.2016. ISBN: 9781483100005

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Recognize the importance of power production suited to the demand. Student can have an idea of various power plants. Student can know the impact of power plants on the environment.	L2
2. Understand the latest high pressure boilers, concept of fluidized bed combustion and importance of handling and storage. Student can able to learn the waste heat recovery methods. In addition, student can know various cooling towers and its application.	L2
3. Grasp concepts of diesel power plant and gas turbine plants. Student can distinguish open cycle and closed cycle gas turbine cycles.	L2
4. Have knowledge on water power. Student can able to understand the methods of storing water and can have an idea over constructions of dams and spill ways. Student can enable to draw the layout of hydel power plant.	L2
5. Understand about the power plant economics.	L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A38AT.1	3	2	-	-	-	3	2	-	-	-	-	2	-	-	-
19A38AT.2	3	2	-	-	-	3	2	-	-	-	-	-	-	-	-
19A38AT.3	3	-	-	-	-	3	-	-	-	-	-	-	-	-	-
19A38AT.4	3	-	-	-	-	3	-	-	-	-	-	2	-	-	-
19A38AT.5	3	2	-	-	-	3	-	-	-	-	3	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Composite Materials
Category   :   PE
Course Code   :   19A38BT
Year   :   IV Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:

- To understand the mechanical behavior of composite materials
- To get an overview of the methods of manufacturing composite materials
- Basic knowledge of composites will allow engineers to understand the issues associated with using these materials, as well as gain insight into how their usage differs from metals, and ultimately be able to use composites to their fullest potential.

Unit 1 :   08
Introduction to composites: Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications

Unit 2 :   12
Manufacturing of composite materials: PMC's: bag moulding, compression moulding, pultrusion, filament winding. Processing of MMC – Liquid state processes – solid state processes – Insitu processes. Processing of CMC's: Sintering - Hot pressing-solgel
Hooke's Law for Different Types of Materials,Hooke's Law for a Two Dimensional Unidirectional Lamina - Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and Stiffness Matrix to Engineering Elastic Constants of a Lamina.

Unit 3 :   08
Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Strength Failure theories of an angle lamina- Maximum stress Failure Theory, Tsai–Hill Failure Theory, Tsai–Wu Failure Theory. Macro mechanical analysis of a laminate: Stress–Strain Relations for a Laminate, InPlane and Flexural Modulus of a Laminate

Unit 4 :   10
Micro-Mechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli – Longitudinal young's modulus, Transverse young's modulus, Major Poisson's ratio and In-plane shear modulus by Strength of Materials Approach

Unit 5 :   10
Macro mechanical Analysis of Laminates: Introduction, Laminate code, Stress-strain relations for a laminate, In-plane and flexural modulus of a laminate. Failure criterion of laminates.

Prescribed Text Books:
1. Mechanics of Composite Materials- Autar K. Kaw, 2/e, CRC Press, 2005. ISBN: ISBN 0-8493-1343-0
2. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998. ISBN 978-0-387-74365-3

3. Mechanics of Composite Materials, R. M. Jones, Mc Graw Hill Company, New York, 1999. ISBN 1-56032-712-X

Reference Books:
1. Engineering Mechanics of Composite Materials- Isaac and M Daniel, Oxford Univ. Press, 2005. ISBN: 9780195150971
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME, 1989. ISBN 0-87263-358-6
3. Mechanics of Composite Materials and Structures, Madhujit Mukhopadhyay, New York, 2005. ISBN 10: 8173714770 ISBN 13: 9788173714771

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Know the fundamental concepts of composite materials	L2
2. Explain various manufacturing methods of composites.	L3
3. Analyze the macro mechanics of a lamina.	L4
4. Understand failure theories, and to determine the strength of a lamina.	L2
5. Analyze the macro mechanics of a laminate and failure criterion.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A38BT.1	3	3	3	3	-	2	3	-	-	-	-	-	-	2	-
19A38BT.2	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
19A38BT.3	3	3	3	3	1	-	-	-	-	-	-	-	-	3	2
19A38BT.4	3	3	-	3	-	-	-	-	-	-	-	-	-	2	3
19A38BT.5	3	3	3	3	1	-	-	-	-	-	-	-	-	2	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Production and Operations Management
Category : PE
Course Code : 19A38CT
Year : IV Year
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	0	3

Course Objectives:
- To make the students understand the functions of production planning & control, goods and services, issues in product design and to provide knowledge of determining the accurate demand forecasting.
- To provide the knowledge on facilities location, various types layouts, computerized layout planning, and assembly line balancing techniques.
- To make the students understand the concepts of capacity planning and aggregate planning and their planning strategies.
- To make the students understand the concepts of capacity planning and aggregate planning and their planning strategies,
- Able to make knowledge on lean management, concepts of JIT, six sigma, quality control.

Unit 1   Production and Forecasting   10
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– Forecasting techniques – qualitative methods and quantitative methods – accuracy of forecasting methods.

Unit 2   Plant Layout   10
Factors affecting facilities location – Single facility location model – Types of facilities layouts: product layout process layout, group technology layout – Assembly line balancing – Computerized layout planning algorithms: ALDEP, CRAFT, and CORELAP.

Unit 3   Capacity Planning and Aggregate Planning   10
Capacity Planning – Plant capacity – strategies of capacity planning – equipment selection.
Aggregate Planning – Strategies of aggregate planning – O.R. models in aggregate planning – chase planning – expediting – controlling aspects.
MRP– Lot sizing techniques in MRP –Introduction to ERP – LOB (Line of Balance).

Unit 4   Scheduling   10
Job Sequencing – Johnson's rule, extension of Johnson's rule, Palmer's rule, and Graphical method.
Scheduling– Techniques – flow shop and job shop Scheduling.

Unit 5   Quality Management   08
Quality Management: Economics of quality assurance-Control charts for variables and for attributes-Acceptance sampling plans - Lean management- philosophy and creation of lean enterprise - JIT concepts - Kanban system - Total Quality Management-ISO 9000 series standards-Six sigma.

Prescribed Text Books:

1. S.N. Chary, *Production and Operations Management*. 5th edition McGraw Hill Edu. Pvt. Ltd, 2012. (ISBN 10: 1259005100ISBN 13: 9781259005107)
2. R. Panneerselvam, *Production and Operation Management.* PHI. 2012. (ISBN, 812034555, 9788120345553.)
3. Operations Management: Theory and Practice: B.Mahadevan Pearson.(ISBN: 9788131730706)

Reference Books:

1. Kanishka Bedi, Production & Operations Management. Oxford Univ. Press. (ISBN: 9780195690873)
2. Martin K. Starr and David W. Miller. Inventory Control Theory and practice. (ISSN: 0925-5273)
3. Buffa and Sarin . Modern Production / Operations Management 8ed ,Wiley.. (ISSN: 1059-1478)

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Describe the basic concepts of production systems, productivity, and design process new products including both goods and services, and determine the future demands by using forecasting techniques.	L1
2. Solve the facility location and layout planning problems using single facility location model, Assembly line balancing, and computerized techniques like CRAFT, CORELAP, and ALDEP.	L1
3. Apply the strategies of capacity planning and aggregate planning while solving O.R. models of production planning. and Lot sizing techniques in MRP, and recognize the importance of ERP and LOB.	L1
4. Produce optimal job sequences, can prepare the schedules of flow shop, job shop scheduling problems.	L1
5. Quality management ,Lean philosophy, creation of Lean enterprise with JIT, Kanban system, TQM elements and Six-Sigma quality control.	L1

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A38CT.1	3	3	3	-	3	-	-	-	3	-	3	-	2	-	-
19A38CT.2	3	3	3	-	3	-	-	-	3	-	3	-	2	-	-
19A38CT.3	3	3	3	-	-	-	-	-	3	-	3	-	2	-	-
19A38CT.4	3	3	3	1	3	-	-	-	3	-	3	-	2	2	-
19A38CT.5	-	3	3	-	3	1	1	-	3	1	3	-	2	2	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Supply chain Management
Category   :   PE
Course Code   :   19A38DT
Year   :   IV Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

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.
- To know the concept of sourcing and pricing of products.
- To get the awareness on Bullwhip effect and Technology in the Supply Chain

Unit 1   Introduction to SCM: 10
Fundamentals of supply chain, Objective of supply chain and importance, concepts and definitions, Supply chain stages and decision phases, process view of a supply chain. Supply chain flows. Competitive and supply chain strategies, strategic fit, Supply chain Drivers, Examples of supply chains

Unit 2   Designing the Supply Chain Network: 08
Distribution Networks (DN) – Role, Factors, Design of Distribution Networking, e-Business and the Distribution Network.
Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions. Models for facility location and capacity allocation.

Unit 3   Planning and Managing Inventories in a SCM: 10
The Role of cycle Inventory in a Supply Chain, Managing Multi-Echelon Cycle Inventory, Safety inventory determination. Optimum level of product availability, Managerial levers to improve supply chain profitability.
Transportation: Role of Transportation, Factors affecting transportation decisions. Modes of Transportation and their performance characteristics.

Unit 4 :   Sourcing Decisions in Supply Chain: 08
Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration, procurement, source planning and analysis.
Pricing and Revenue Management in SCM: Role of pricing and Revenue Management in the Supply Chain.

Unit 5   Managing Bullwhip Effect: 08
Co-ordination in a supply chain - Bullwhip effect. The Effect on performance of Lack of co-ordination, Obstacles to coordination. Managerial levers to achieve co-ordination.
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.

Prescribed Text Books:
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.McGraw Hill. 2007. ISBN-10 : 9780070666986
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. 1999. ISBN, 0967461901, 9780967461908
5. Donald J.Bowersox; sipply chain logistics management. Tata McGraw – Hill, 2008, ISBN: 978-0-07-066703-7.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understanding to align the management of Supply Chain with corporate goals and strategies.	L2
2. Apply problem solving and decision making frame works that propose defensible solutions to organizational opportunities, challenges, change and risk.	L3
3. Understand the fundamental role of logistics as it relates to inventory and transportation.	L4
4. Design co-ordinate and collaborative processes and activities emerging technologies.	L6
5. Apply knowledge to evaluate and mange an effective supply chain information systems.	L3

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A38DT.1	3	3	-	-	3	-	-	3	-	3	3	3	2	-	-
19A38DT.2	3	-	3	3	3	-	-	3	-	3	3	3	-	-	3
19A38DT.3	3	3	-	3	3	-	-	3	-	3	-	3	-	2	-
19A38DT.4	3	3	3	3	3	-	-	3	-	3	3	3	-	2	-
19A38DT.5	-	-	3	-	3	1	-	-	-	-	3	3	-	-	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course: Disaster Management
Category   :   OE
Course Code   :   19A18DT
Year   :   IV B. Tech
Semester   :   II Semester (Common to CE, ME, CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

Course Objectives:

- The course is intended to provide a general concept in the dimensions ofdisasters caused by nature beyond the human control as well as the disastersand environmental hazards induced by human activities with emphasis ondisaster preparedness, response and recovery.

Unit 1 :   09
Introduction - Concepts and definitions: disaster, hazard, vulnerability, risk, capacity, prevention, mitigation).

Unit 2 :   09
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 3 :   09
Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues;demographic aspects (gender, age, special needs); hazard locations; global andNational disaster trends; climate-change and urban disasters.

Unit 4 :   09
Disaster Risk Reduction (Drr) - Disaster management cycle–its phases; prevention, mitigation, preparedness, relief and recovery; structural andnon-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 ofgovernment, 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 5 :   09
Disasters, Environment and Development - Factors affecting vulnerability suchas impact of developmental projects and environmental modifications (includingof dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Prescribed Text Books:
1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
 4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
 5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority).
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministryof 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.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. The students increase the knowledge and understanding of the disaster phenomenon and, its factors.	L1
2. The students must learn various classification of disasters hazard and vulnerability profile of India.	L4
3. The students will learn impacts, global and national disaster trends	L2
4. The students will learn disaster management cycle and its phases and DRR programmes in India and activities of national disaster management academy.	L3
5. The students should be able to analyze factors affecting vulnerability of developmental projects and environmental modifications for sustainable development.	L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A18DT.1	-	-	-	-	2	1	-	2	2	2	-	-	-	-	-
19A18DT.2	1	-	-	-	-	-	-	2	3	3	-	2	-	-	-
19A18DT.3	1	-	-	-	-	3	-	3	2	2	-	-	-	-	-
19A18DT.4	-	-	-	-	-	-	-	3	3	3	-	2	-	-	-
19A18DT.5	1	-	-	-	-	-	2	3	-	-	-	3	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Building Planning and Construction
Category   :   OE
Course Code   :   19A18ET
Year   :   IV B. Tech
Semester   :   I Semester (Common to CE, ME, CSE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives:

- Teach to supervision of different types of masonry
- Illustrate the methodology in selection of materials, design and supervision of suitable type of floor and roof
- To ensure the student to be aware of building byelaws.
- To make the student to understand about principles of planning, standards and requirements of Residential building and Public building

Unit 1 :   Building Byelaws and Regulations   08
Introduction –Terminology –Objectives of building byelaws –Floor area ratio (FAR) –Floor space Index (FSI) – Principles underlying building byelaws –classification of buildings –Open space requirements –built up area limitations –Height of Buildings –Wall thickness –lighting and ventilation requirement.

Unit 2 :   *Residential buildings*   10
Minimum standards for various parts of buildings –requirements of different rooms and their grouping –characteristics of various types of residential buildings. Principles of planning- architectural principle, Aspects of planning within and with respect to surroundings, Modular planning concept.

Unit 3 :   Public buildings   10
Planning of Educational institutions, hospitals, dispensaries, Office buildings, banks, industrial buildings, hotels and motels, buildings for recreation. Elements of Perspective Drawing: Definition, concept and single and two point perspective

Unit 4 :   *Masonry & foundations*   09
  Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar masonry, cavity and partition walls.
  Foundations: Shallow foundations – Spread, combined, strap and mat foundations.

Unit 5 :   08
Building components: Lintels, Arches, and stair cases – Types. Different types of floors-Concrete, Mosaic, Terrazo floors, Pitched, flat and curved Roofs. Lean-to-Roof, Coupled Roofs, Trussed roofs- King and Queen Post Trusses. RCC Roofs.
Finishings: Damp proofing- materials used. Plastering, pointing, white washing and distempering – Painting – Constituents of a paint – Types of paints – Painting of new/old Wood – Varnish – Form work and scaffolding.

PrescribedText Books:

1. Building Planning & Drawing by Dr N. Kumaraswamy and A.Kameswara Rao, Charitor Publications.
2. Planning and Designing and Scheduling- Gurucharan Singh and Jagadish Singh – Standard Publishers.
3. Planning and Designing of Buildings – Y.S.Sane.
4. Building Construction by P.C. Varghese, Prentice-Hall of India private Ltd, New Delhi.
5. Building Construction by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.

Reference Text books:

1. Sikka, V.B. (2013), A Course in Civil Engineering Drawing, S. K. Kataria& Sons
2. R.Chudly "Construction Technology "– Volumes I and II" 2nd Edition, Longman, UK, 1987.

Course Outcomes:

Student will be able to   Blooms Level of Learning

1. Understand Building Byelaws & regulations.   L2

2. Understand principles of planning, standards and requirements for residential   L2
    building.

3. Understand principles of planning, standards and requirements for public   L2
    building.

4. Summarize different types of masonry and foundations   L3

5. Understand different types of building components and finishing works   L2

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A18ET.1	-	-	-	-	-	3	1	-	2	-	-	-		2	3
19A18ET.2	-	-	-	-	-	3	1	-	2	-	-	-		2	3
19A18ET.3	-	-	-	-	-	3	1	-	2	-	-	-		2	3
19A18ET.4	-	-	-	-	-	3	1	-	2	-	-	-		2	3
19A18ET.5	-	-	-	-	-	3	1	-	2	-	-	-		2	3

Title of the Course	Battery Energy Storage Systems
Category	OE
Course Code	19A28DT
Year	IV B. Tech
Semester	II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	1	-	3

Course Objectives:
1. To enable the student to understand the need for Energy Storage.
2. To learn sufficient knowledge about various Energy Storage Technologies.
3. To deal with grid connected Battery Energy Storage System.
4. To study the Challenges, Risk and Policy of Battery Energy Storage System.

Unit I   Introduction to Energy Storage for Power Systems   12

Emerging needs for Electrical Energy Storage -Role of Energy Storage Systems-Applications. Overview of energy storage technologies: Thermal, Mechanical, Chemical, Electrochemical, Electrical-Efficiency of Energy Storage Systems.

Unit II   Energy Storage Technologies   10

Storage Types - Components of a Battery Energy Storage System (BESS) - Energy Storage System Components - Grid Connection for Utility-Scale BESS Projects -Battery Chemistry Types -Lead–Acid (PBA) Battery - Nickel–Cadmium (Ni–Cd) Battery-Lithium-Ion (Li-Ion) Battery.

Unit III   Grid Applications of Battery Energy Storage Systems   10

Scoping of BESS Use Cases - General Grid Applications of BESS -Technical Requirements -Round-Trip Efficiency - Response Time - Lifetime and Cycling - Sizing - Operation and Maintenance.

Unit IV   Challenges and Risks   10

Grid Tariff Applications and Licensing Issues -Battery Safety - Challenges of Reducing Carbon Emissions - Battery Recycling and Reuse Risks -Examples of Battery Reuse and Recycling - Reuse of Electric Vehicle Batteries for Energy Storage - Recycling Process.

UNIT V   Policy Recommendations   10

Frequency Regulation - Renewable Integration -Distribution Grids -Transmission Grids - Peak Shaving and Load Leveling - Microgrids

Text Books:
1. YongpingZhai. *Handbook on Battery Energy Storage System*Asian Development Bank.2018.
2. James M. Eyer, Joseph J.Iannucci and Garth P. Corey .*Energy Storage Benefits and Market Analysis*, Sandia National Laboratories, 2004.
3. Jim Eyer, Garth Corey", *Energy Storage for the Electricity Grid*: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

Reference Books:
1. Doughty, D. H., and E. Peter Roth. 2012. A General Discussion of Li Ion Battery Safety. Electrochemical Society Interface 21 (2): 37–44. DOI: 10.1149/2.F03122if.
2. Electric Power Research Institute (EPRI). 2010. Electricity Energy Storage Technology Options: A White Paper Primer on Applications, Costs, and Benefits. Palo Alto, California, US. http://large. stanford.edu/courses/2012/ph240/doshay1/docs/EPRI.pdf

3. Enel Green Power. 2016. Integrating Renewable Power Plants with Energy Storage. 7 June. http://www.iefe.unibocconi.it/wps/wcm/connect/29b685e1-8c34-4942-8da3-6ab5e701792b/ Slides+Lanuzza+7+giugno+2016.pdf?MOD=AJPERES&CVID=lle7w78.

4. Initial Operating Experience of the La Ola 1.2-MW Photovoltaic System. Sandia National Laboratories Report SAND2011-8848. Kane, Mark. 2015. Bosch Cooperates With BMW And Vattenfall In Second Life Battery Project. Inside EVs 9 February. https://insideevs.com/bosch-cooperates-with-bmw-and-vattenfall-in-second-lifebattery-project/

Course outcomes: At the end of the course the student will be able to

1. Understanding the need of the Energy Storage Systems.
2. Study and analyse the function of each storage Technology, its Types.
3. Explore the Battery Energy Storage applications in Renewable energy systems and in Smart grid.
4. Study the Challenges, Risk and Policy recommendation of Battery Energy Storage Systems.

COs-POs-PSOs Mapping

Course Outcomes	Program Outcomes												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	2	1
19A28DT .1	2	-	-	1	-	-	1	-	1	-	-	-	1	-
19A28DT .2	2	2	1	1	-	-	1	-	-	-	-	-	1	-
19A28DT .3	2	1	1	1	-	-	1	-	2	-	-	-	1	1
19A28DT .4	2	1	1	1	-	-	2	-	1	-	-	-	2	1

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course   :   System modeling and Simulation
Category   :   OEC
Course Code   :   19A28ET
Year   :   IV Year
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	-	-	3

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

Unit 1   Introduction to simulation models   10
Basic Simulation Modeling, Systems, Advantages and disadvantages of simulation, Models and Simulation, Discrete Event Simulation, Simulation of Single Server Queuing System, Simulation of Inventory System, Alternative approach to Modeling and Simulation

Unit 2   Simulation software   10
Description of links and joints, Kinematic modeling of manipulator, Translation and Rotation Representation, Coordinate transformation, Denavit - Hartenberg (DH) notation, Examples of DH notation, Jacobian, Singularity, and Statics.

Unit 3   Trajectory Planning and Manipulator   08
Control Terminology, Steps in trajectory planning, Joint space techniques, path description, Use of polynomials as interpolating function, various trajectories, Introduction to Cartesian space techniques.

Unit 4   End effectors, sensors and vision system   08
Tools as end effectors, Robot Grippers - Types of Grippers, Design aspect for gripper, Force analysis for various basic gripper system. Sensors for Robots - Characteristics of sensing devices, Classification, applications and selection of sensors. Robotic vision system, image acquisition, spatial and amplitude digitization, image processing and analysis.

Unit 5   Robot programming and applications   10
Robot applications in material handling, machine loading/unloading, assembly, inspection and processing.
Robot Programming – Methods, Lead through methods, Robot Programming-Language overview, commands for elementary operations

Prescribed Text Books:
1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014. , ISBN - 0070140014
2. Ghosal, A., "Robotics", Oxford, New Delhi, 2006. ISBN - 9780195673913
3. Niku Saeed B., "Introduction to Robotics: Analysis, Systems, Applications", PHI, New Delhi. 2001. ISBN - 0130613096

Reference Books:
1. Tsuneo Yoshikawa, Foundations of Robotics, MIT Press. Roy. 2010. ISBN - 0262514583
2. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill. 2017, ISBN - 9780070482937

3. Mukherjee S., "Robotics and Automation", Khanna Publishing House, Delhi. 2017. 2017, ISBN - 9386173751

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Understand the concept of Robots, Structure and its specifications.	L2
2. Solve robot forward and inverse kinematic problems.	L5
3. Carry out trajectory planning and joint modeling for the simple robotic system.	L4
4. Identify appropriate end effectors and sensors for particular application	L4
5. Execute various steps robot programming and Knowledge will be gained on application of Robotics used in various sectors.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A36FT.1	3	3	3	-	-	3	3	3	-	-	-	-	-	-	-
19A36FT.2	2	2	2	-	-	2	-	2	-	-	-	-	-	-	-
19A36FT.3	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-
19A36FT.4	1	1	1	-	-	-	-	1	-	-	-	-	-	-	-
19A36FT.5	2	-	2	-	-	2	-	2	-	2	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)

Title of the Course : Introduction to Digital Design
Category : OE
Course Code : 19A48DT
Year : IV B.Tech.
Semester : II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: The course aims to provide the student with the ability

- To get the knowledge on Number Systems and codes.
- To gain the knowledge on Boolean algebra.
- To acquire the knowledge of various circuits in Digital design.

Unit 1 : Number systems, Codes & Boolean Algebra 14

Philosophy of number systems – r, (r-1)"s complement, representation of negative numbers, binary arithmetic, binary codes, error detecting & error correcting codes, hamming codes. Boolean algebra: Fundamental postulates of Boolean algebra, Basic theorems and properties, digital logic gates, properties of XOR gate, universal gates.

Unit 2 : Switching Functions and Their Minimization 14

Switching Functions-Canonical and Standard forms, algebraic simplification using Boolean theorems, two level & Multilevel Realization of Boolean Functions using Universal Gates. Minimization: K-Map methods, Prime implicants, don"t care combinations, Minimal SOP and POS forms, Tabular Method, Prime-Implicants chart, simplification rules

Unit 3 : Combinational Logic Design & Programmable Logic Devices 10

Design using conventional logic gates-Binary Adders, Subtractors, Ripple Adder, carry Look Ahead adder, Magnitude comparator, Encoder, Decoder, Multiplexer, De-Multiplexer, Code converters. PLD's: ROM, PROM, PLA, PAL, and Realization of Switching functions using PLD"s. Comparison between PLA, PAL, ROM.

Unit 4 : Sequential Circuits 9

Classification of sequential circuits (Synchronous, Asynchronous, Pulse mode, Level mode with examples),Basic flip-flops, Triggering and excitation tables, flip flop conversions, Steps in synchronous sequential circuit design, Design of modulo-N Synchronous counters – up/down counter, ring counter, Johnson counter

Unit 5 : FSM Minimization and ASM Chart 12

Finite state machine- capabilities and limitations, Mealy and Moore models and their conversions Sequence detector, Serial binary adder. Minimization of completely specified sequential machines-Partition techniques. Salient features of the ASM chart, Simple examples

Prescribed Text Books:
1. Morris Mano, Digital Design. Prentice Hall India, 3 rdEd.
2. ZVI Kohavi and Niraj K. Jha Switching & Finite Automata theory. Tata McGraw Hill, 3 rdEd.

Reference Text books:
1. Charles H. Roth, Fundamentals of Logic Design. Thomson Publications, 2004, 5 th Ed.
2. Fletcher, an Engineering Approach to Digital Design. Prentice Hall India.
3. Anand Kumar, Switching Theory and Logic Design. Prentice Hall India, 2008.

Course Outcomes:

Upon completion of the course, student can   Blooms Level of Learning

1. Understand different number systems conversions & Binary codes   L2
2. Simplify Boolean functions& realize them using digital logic gates.   L5
3. Design various combinational & sequential circuits.   L6
4. Understand the Minimization techniques of Finite State Machine & the   L2
   elements of ASM chart.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A48DT.1	2	3	2	-	2	-	-	1	-	-	2	-	3	-	-
19A48DT.2	2	2	2	-	-	1	-	1	-	-	2	-	2	2	-
19A48DT.3	2	2	2	-	-	1	-	1	-	-	2	-	-	3	-
19A48DT.4	2	2	2	-	-	1	-	1	-	-	2	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course   :   Industrial Electronics
Category   :   OE
Course Code   :   19A48ET
Year   :   IV B.Tech.
Semester   :   II Semester

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to
- Power quality terminology, power quality issues, classification
- Different sources of power quality disturbances
- Harmonic distortion; Principles for controlling harmonics
- Power quality measuring equipment; Power quality monitoring standards
- Impact of distributed generation on power quality

Unit 1 :   Introduction To Power Quality   08
Power Quality- definition, terminology, issues, evaluation procedure, responsibilities of the suppliers and users of electric power, power quality standards, CBEMA and ITI curves.

Unit 2 :   Power Quality Disturbances   10
General classes of power quality problems- Impulsive and oscillatory transients. Long duration voltage variations - over voltage, under voltage, sustained interruption. Short duration voltage variations-interruption, sag, swell and outage. Sources of sags and interruptions, estimating voltage sag performance overview of mitigation methods.

Unit 3 :   Fundamentals Of Harmonics   10
Harmonic distortion, voltage versus current distortion, harmonics versus transients, power system quantities under non-sinusoidal conditions, harmonic indices. Harmonic sources from commercial and industrial loads. Effects of harmonic distortion. Applied harmonics - harmonic distortion evaluation, principles of controlling harmonics, and devices for controlling harmonic distortion. Harmonic filter design and standards on harmonics.

Unit 4 :   Power Quality Monitoring   09
Power quality benchmarking, monitoring considerations, choosing monitoring locations, permanent power quality monitoring equipment, historical perspective of power quality measuring instruments. Power quality measurement equipment-types of instruments, assessment of power quality measurement data, power quality monitoring standards.

Unit 5 :   Distributed Generation And Grid Interconnection   08
Distributed generation -connection requirements and impacts on the network. Interaction and optimal location of DG-Eigen analysis and voltage interaction. Power quality in DG-Mitigation of voltage dip during motor start, harmonic effects with DG, voltage flicker and fluctuation. Islanding issues, distribution line compensation-heavy Load and Light load condition, real generation, protection issues for distributed generation, technologies for distributed generation, power quality impact from different DG types.

Prescribed Text Books:
1. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, Electrical Power Systems Quality, 3rd edition, TMH Education Pvt. Ltd., 2012.
2. ArindamGhosh, Gerard Ledwich, Power quality enhancement using custom power devices, Kluwer academic publishers, 2002

Reference Text books:
1. G.T. Heydt, Electric Power Quality, Stars in a circle Publications, 1991. USA.

2. SurajitChattopadhyaya, MadhuchhandaMitra, SamarjitSenugupta, Electrical Power Quality, Springer Dordrecht Heidelberg London New York.
3. Math H. J. Bollen, Understanding Power quality problems, IEEE Press, 2007.

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Demonstrate knowledge on sources of power quality disturbances and issues, power quality monitoring and measuring instruments, power quality standards, effect of distributed generation on power quality.	L1
2. Analyze various power quality issues.	L3
3. Design a suitable harmonic filter for commercial and industrial loads.	L4
4. Investigate various power quality issues and provide feasible solutions for improvement of power quality.	L5
5. Select and use appropriate equipment for monitoring and measurement of power quality.	L4

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19A48ET.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
19A48ET.2	2	3	-	-	-	-	-	-	-	-	-	-	3	-	-
19A48ET.3	1	2	3	-	-	-	-	-	-	-	-	-	3	-	-
19A48ET.4	3	3	-	-	3	-	-	-	-	-	-	-	-	3	-
19A48ET.5	2	2	-	-	3	-	-	-	-	-	-	-	-	3	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	:	Internet of Things	
Category	:	OE	
Course Code	:	19A58ET	
Year	:	IV B. Tech	
Semester	:	II Semester (Offered to CE, EEE, ME & ECE)	

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will able to
- To understand the terminology, technology and its applications of IoT.
- To know the concept of M2M (machine to machine) with necessary protocols.
- To memorize the software platforms which are used for developing the applications.
- To learn the concepts of python programming language which is used to develop the IoT projects.
- To know the hardware platforms which is necessary to develop the IoT applications.

Unit 1 :   Introduction to Internet of Things   08
Introduction to Internet of Things, History of IoT, Physical Design of IoT, Logical Design of IoT,
IoT Enabling Technologies, IoT Levels & Deployment Templates, Applications of IoT.

Unit 2 :   IoT and M2M& IoT Platforms Design Methodology   07
IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT.
IoT Platforms Design Methodology: Introduction, IoT Design Methodology.

Unit 3 :   The Wireless Embedded Internet   08
Introduction to 6LoWPAN,The 6LoWPAN Architecture ,The Basic 6LoWPAN Format, Addressing
MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol, Contiki and uIPv6,
Wireless RFID Infrastructure.

Unit 4 :   IoT Systems-Logical Design Using Python   08
Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions,
Modules, Packages and File Handling.

Unit 5 :   IoT Physical Devices and Endpoints   08
What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry
Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Devices.

PrescribedText Books:
1. Internet of Things, A Hands-On Approach, ArshdeepBahga, Vijay Madisetti, University Press,2015.
2. 6LoWPAN: The WirelessEmbedded Internet, Zach Shelby and CarstenBormann,Wiley publications, first edition,2009.(Unit III).

Reference Text books:
1. The Internet of Things Connecting Objects to the Web, HakimaChaouchi,Wiley publications,2010.
2. Designing the Internet of Things,Adrian McEwen, Hakim Cassimally, Wiley 2014.
3. Enterprise IoT, A Definitive Handbook by Naveen Balani.

Course Outcomes:
Student will be able to	Blooms Level of Learning
1. Understand the vision of IoT from a global context.	L1
2. Identify the difference between IoT and M2M communication.	L3
3. Determine the usage of 6LoWPAN and select the appropriate network protocols for IoT project.	L4

4. Create the IoT experiments with the help of Python programs.   L5
5. Design the IoT applications using Raspberry Pi kit.   L6

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A58ET .1	-	-	-	3	3	3	1	1	-	-	-	1
19A58ET .2	-	-			3	-	-	-	-	1	-	-
19A58ET 3	-	-	3	3	3	-	-	-	-	-	-	-
19A58ET 4	-	-	3	3	-	-	-	-	-	-	-	-
19A58ET 5	1	1	3	3	3	3	-	-	-	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET

(An Autonomous Institution)

Title of the Course	Web Programming
Category	OE
Course Code	19A58FT
Year	IV B. Tech
Semester	II Semester (Common to CE, EEE, ME, ECE)

Lecture Hours	Tutorial Hours	Practical	Credits
3	0	0	3

Course Objectives: This course will make the students
- Interpret and use HTML concepts in developing the web pages
- Use the CSS to design web pages.
- Interpret the JavaScript programming language
- Interpret the JavaScript framework using JQuery

Unit 1 :   09
Structuring Documents for the Web-A Web of Structured Documents, Introducing HTML5, Tags and Elements, Attribute Groups Core Attributes, Internationalization, Core Elements ,Basic Text Formatting, Understanding Block and Inline Elements, Grouping Content, Working with Lists, Text Processing tags, Links and Navigation :Basic Links, Understanding Directories and Directory Structures, Understanding URLs, Creating In-Page Links with the <a> Element.

Unit 2 :   Images, Audio, and Video, Tables, Forms   09
Images, Audio, and Video -Adding Images Using the <img> Element, Using Images as Links Adding Flash, Video, and Audio to Your Web Pages Tables: Introducing Tables, Basic Table Elements and Attributes, adding a Caption to a Table, Grouping Sections of a Table, Nested Tables, Accessible Tables. Forms: Introducing Forms, creating a Form with the <form> Element, Form Controls, Creating Labels for Controls and the <label> Element, Structuring Your Forms with <fieldset> and <legend> Elements, Focus, Disabled and Read-Only Controls, Sending Form Data to the Server, Creating More Usable Form Fields.

Unit 3 :   Cascading Style Sheets, Introduction to XML   09
Cascading Style Sheets: Introducing CSS, Where You Can Add CSS Rules, CSS Properties Controlling Text, Text Formatting, Text Pseudo-Classes, Styling Text, Selectors Lengths, Introducing the Box Model, An Example Illustrating the Box Model, Links, Backgrounds, Lists, Tables, And Miscellaneous Properties.
Introduction to XML: Difference between HTML and XML, Basic structure and Syntax of XML Document, DTD, sample examples.

Unit 4 :   Learning JavaScript   09
Learning JavaScript-Introduction to JavaScript, How to Add a Script to Your Pages, comments in JavaScript, Create an External JavaScript ,The Document Object Model, JavaScript Programming console, General Programming Concepts, Variables, Operators, String Operators (Using + with Strings), Functions, Conditional Statements, Looping, Events, Built-in Objects.

Unit 5 :   Working with jQuery   09
Working with jQuery: introduction to jQuery, adding jQuery to Your Page, jQuery Basics, jQuery and the DOM, Managing Events with jQuery, Ajax with jQuery, jQuery UI.

Prescribed Text Books:
1.   Beginning HTML and CSS Rob Larsen, Wrox Programmer to Programmer.

Reference Books:
1.   JavaScript and JQuery: Interactive Front-End Web Development, Jon Duckett, Wiley Publications
2.   Web Design with HTML, CSS, JavaScript and jQuery Set, Jon Duckett, Wiley Publications
3.   jQuery in Action, Bear Bibeault, Yehuda Katz, and Aurelio De Rosa, Third Edition, Manning Publications
4.   https://www.w3schools.com/

Course Outcomes:

Student will be able to	Blooms Level of Learning
1. Interpret and Use the fundamental HTML markups when designing web pages.	L2, L3, L5
2. Use and design the web pages with images, audio, videos, tables and form controls.	L3, L5
3. Use cascading style sheets and XML concepts to design web pages	L3, L5
4. Interpret and use JavaScript concepts in designing web pages	L2, L3, L5
5. Interpret and use JQuery concepts in designing web pages.	L2, L3, L5

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
19A534T.1	3	-	3	3	3	-	-	-	-	-	-	3
19A534T.2	-	-	3	3	3	-	-	-	-	-	-	3
19A534T.3	-	-	3	3	3	-	-	-	-	-	-	3
19A534T.4	3	-	3	3	3	-	-	-	-	-	-	3
19A534T.5	3	-	3	3	3	-	-	-	-	-	-	3