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

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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

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

  2ndSlab: 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

$i = 1,2,\ldots.p$ 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

$j = 1,2,\ldots$.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	Hours per week			Credits
				L	T	P	
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	Hours per week			Credits
				L	T	P	
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

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

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
Lab Courses							
8	HS	19AC51L	General Aptitude		-	2	1
9	PC	19A351L	Thermal Engineering Lab	-	-	2	1
				18	3	4	20

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	HS	19AC62L	Professional Communication Skills Lab	-	-	3	1.5
8	PC	19A361L	Heat Transfer Lab	-	-	2	1.5
9	PC	19A365L	Metrology& Machine Tools Lab	-	-	2	1
10	INTERN	19A366I	Innovative project / Socially relevant project / Entrepreneurship / Internship	-	-	-	2
				15	3	7	24

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

Open Elective Courses offered by Department of Mechanical Engineering

S. No.	Category	Course Code	Course Title	Offered by	Offered to
1	OEC	19A36ET	Introduction to Mechatronics	Dept. of ME	CE, EEE, ECE & CSE
2	OEC	19A36FT	Fundamentals of Robotics		
3	OEC	19A36GT	Non-Conventional Sources of Energy		
4	OEC	19A38ET	Entrepreneurship Development		
5	OEC	19A38FT	Optimization in Engineering		
6	OEC	19A38GT	Total Quality Management		

List of Value-Added Courses

Sl. No.	Courses
1	Safety In Industry
2	Testing Methods for 4 wheeler
3	Additive Manufacturing
4	Design of Experiments
5	Hands on CNC
6	Fundamentals of CFD
7	Hands on MATLAB
8	Manufacturing of Composites

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
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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 practical applications.	L3
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 applications of curve tracing.	L2

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, 2nd Edition, 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 manipulation of text data using files and structures.	L3
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
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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
(An Autonomous Institution)

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 situations.	L3

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

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

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 their operation and control aspects through practical investigations.	L3
2. Apply the conceptual knowledge of semiconductor devicesto analyze the electronic circuits through practical investigations.	L3
3. Apply ethics and norms of the engineering practices while exercising experimental investigations.	L3
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) - $\chi 2$ - test for goodness of fit - $\chi 2$ - 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
(An Autonomous Institution)

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
(An Autonomous Institution)

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
(An Autonomous Institution)

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	-	-