KIT - Kalaignarkarunanidhi Institute of Technology

(An Autonomous Institution)

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' GRADE & NBA (CSE, ECE, EEE, MECH, AERO & MBA)

An ISO 9001 : 2015 Certified Institution

Coimbatore - 641 402.

REGULATIONS, CURRICULUM & SYLLABUS - 2019

(For Students admitted from the Academic Year 2019-20 and onwards)

I to VIII Semester

BACHELOR OF ENGINEERING DEGREE

IN

DEPARTMENT OF AERONAUTICAL ENGINEERING

DEPARTMENT OF AERONAUTICAL ENGINEERING

Vision and Mission of the Department

Vision	
◎	To promote high quality in technical education with relevant research in the field of Aeronautical engineering to bring out skilled and employable professionals for the upliftment of society.

Mission	
◎	To provide competent education in the domain of Aeronautical engineering.
◎	To impart professional and ethical responsibilities, leadership and entrepreneurship qualities for the student's career development.
◎	To cultivate the state of art research facilities to analyze and evaluate new fields of Aeronautical engineering and impart societal responsibilities among the students.
◎	To collaborate with industries and professional bodies to mould the students as competent industry ready professionals.

Program Educational Objectives (PEO's)	
PEO 1	Graduates will have the ability to apply knowledge across the disciplines and in emerging areas of Aeronautical engineering with sound technical expertise to solve competitive problems of real world challenges
PEO 2	Graduates will apply their analyzing, design and manufacturing skills in Aeronautical engineering and technology for the upliftment of social well being of the nation.
PEO 3	Graduates will be competitive professionals in aeronautical industries by adopting life-long learning and quality management practices for the betterment of society and individual.

Programme Outcomes (PO's)	
Students graduating from Aeronautical Engineering should be able to	
PO 1	**Engineering Knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex Aeronautical engineering problems.
PO 2	**Problem Analysis :** Identify, formulate, review research literature, and analyze complex Aeronautical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design / Development of Solutions :** Design solutions for complex Aeronautical 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.

PO 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.
PO 5	**Modern Tool Usage :** Create, select, and apply appropriate techniques, resources, and modern Aeronautical engineering and IT tools including prediction and modelling to complex Aeronautical engineering activities with an understanding of the limitations.
PO 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.
PO 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.
PO 8	**Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and Team Work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 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.
PO 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.
PO 12	**Lifelong 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.

Program Specific Outcome (PSO's)	
Graduates of Aeronautical Engineering Programme should be able to	
PSO 1	Apply the principles of Aeronautical engineering to solve engineering problems by utilizing advanced technology in the field of aerodynamics, structures, propulsion and maintenance.
PSO 2	Analyze and design the manufacturing and management practices for the betterment of society and individual to become a competitive professional in Aeronautical field.

BoS Chairman

UG Regulations

1. SHORT TITLE AND COMMENCEMENT

- These Regulations shall be called the "KIT-Kalaignarkaraunanidhi Institute of Technology, Coimbatore, Regulations for the Award of B.E./B.Tech., Degree".
- They have been evolved, drafted and implemented after deliberations in and approvals from UGC, Anna University and Academic Council of the Institute, and are subject to change/modifications from time to time; (major modifications at a frequency of FOUR years in synchronization with the curriculum structure revision and minor changes as and when applicable).
- The latest/first version shall be applicable for the students enrolling for B.E/B.Tech degree programs at this Institute from Academic year 2019-2020 and onwards.

2. PREAMBLE

The regulations prescribed herein have been made by KIT, an autonomous institution, approved by AICTE,New Delhi and affiliated to the Anna University, Chennai, to facilitate the smooth and orderly conduct of its academic programmes and activities at the B.E/B.Tech., level. It is expected that the regulations will enable the students to take advantage of the various academic opportunities at the Institute and prepare themselves to face the challenges in their professional careers ahead. It may be noted that:

a. The provision made herein shall be applicable to all the B.E/ B.Tech. programmes offered at the institute, at present;

b. They shall also be applicable to all the new B.E /B.Tech. programmes which may be started at the Institute in the future;

c. Academic and non-academic requirements prescribed by the Academic Council have to be fulfilled by a student for eligibility towards award of B.E/B.Tech. Degree.

3. PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires :

Sl. No.	Name	Definition
1.	**Programme**	Refers to Degree Programme that is B.E./B.Tech. Degree Programme.
2.	**Discipline**	Refers to branch or specialization of B.E./B.Tech. Degree Programme, like Computer Science and Engineering, Mechanical Engineering etc.,
3.	**Course**	Refers to a theory or practical subject that is normally studied in a semester, like Mathematics, Physics, etc.,
4.	**Head of the Institution**	Refers to the Principal of the College.
5.	**Controller of Examinations (CoE)**	Refers to the authority of the college who is responsible for all activities of the Examinations.

6.	**Head of the Department (HoD)**	Refers to the Head of the Department concerned.
7.	**University**	Refers to Anna University, Chennai.
8.	**College (KIT)**	Refers to KIT-Kalaignarkarunanidhi Institute of Technology, Coimbatore.
9.	**Curriculum**	Refers to the various components/courses studied in each programme that provide appropriate outcomes (knowledge, skill and behavior/attitude) in the chosen branch of study.
10.	**T– P – TU – C**	Refers to Theory, Practical, TUtorial, and Credits respectively.
11.	**Humanities and Social Sciences (HS)**	Courses include English, Professional Ethics and Human Values, Communication skills etc.
12.	**Basic Sciences (BS)**	Courses include Mathematics, Physics, Chemistry, etc.,
13.	**Engineering Sciences (ES)**	Courses include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Civil / Computer Engineering etc.,
14.	**Professional Core (PC)**	Courses include the core courses relevant to the chosen specialization / branch.
15.	**Professional Elective (PE)**	Courses include the elective courses relevant to the chosen specialization / programme.
16.	**Open Elective**	Open Elective (OE) courses include the courses which a student can choose from the curriculum of other B.E. / B.Tech. programmes and courses offered by the Departments under the Faculty of Science and Humanities & Department of Management. These courses may be offered by internal/external experts.
17.	**Project Work (PW)**	Refers to the project done by a student or a group of students during final year.
18.	**Career Enhancement Courses (CEC)**	Includes Mini Project Work and/or Internship, Seminar, Professional Practices, Case Study, soft skills and Industrial / Practical Trainings etc.,

19.	**Academic Evaluation Committee (AEC)**	The committee includes Principal, CoE, HoD concerned (For details refer **Appendix V**)
20.	**Department Evaluation Committee (DEC)**	The committee included HoD (need basis), senior faculty member(s) of department from various levels, class advisor, Mentor of the students. (For details refer **Appendix V**)

4. ADMISSION

4.1 B.E. / B.Tech. Degree Programme (I Semester)

Candidates seeking admission to the first semester of the eight semester

The Candidates should have passed the Higher Secondary Examinations of (10+2) Curriculum (Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics and Chemistry as three of the four subjects of study under Part-III or any examination of any other University or authority accepted by the Syndicate of Anna University as equivalent thereto.

(OR)

Should have passed the Higher Secondary Examination of Vocational stream (Vocational groups in Engineering / Technology) as prescribed by the Government of Tamil Nadu.

4.2 Lateral Entry Admission

i. The candidates who possess the Diploma in Engineering / Technology awarded by the State Board of Technical Education, Tamilnadu or its equivalent are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. in the branch corresponding to the branch of study.

(OR)

ii. The candidates who possess the Degree in Science (B.Sc.,) (10+2+3 stream) with Mathematics as a subject at the B.Sc. Level are eligible to apply for Lateral entry admission to the third semester of B.E. / B.Tech. Such candidates may be two additional Engineering subject(s) in the **third and fourth semesters** as prescribed by the AEC, if necessary.

4.3 Re - admission

Students, who have discontinued for reasons other than disciplinary action, may be readmitted as per guidelines given by DoTE, Government of Tamilnadu and Anna University. Department Evaluation Committee (DEC) shall study and recommend on the exception and addition of courses to be registered for, by the student concerned during re-admission. The details shall be forward to Academic Evaluation Committee (AEC) for approval and the committee's decision shall be final.

5. PROGRAMMES OFFERED

B.E. / B.Tech. Programmes under the Faculty of Mechanical Engineering, Faculty of Electrical Engineering, Faculty of Information and Communication Engineering and Faculty of Technology. KIT offers 4 year (8 Semesters) B.E./B.Tech. Degree programme affiliated to Anna University, under Choice Based Credit System (CBCS) for students admitted from 2019 onwards in the following branches of Engineering and Technology as in Table 1.

Table 1. List of B.E. / B.Tech. programmes offered

B.E.	B.Tech
Aeronautical Engineering	Bio Technology
Agriculture Engineering	
Bio Medical Engineering	
Computer Science and Engineering	
Electronics and Communication Engineering	
Electrical and Electronics Engineering	
Mechanical Engineering	

6. ACADEMIC STRUCTURE OF PROGRAMMES

6.1 Medium of Instruction

The medium of instruction for the entire undergraduate programme will be English.

6.2 Categorization of Courses

Every B.E. / B. Tech. Programme will have a curriculum with syllabi consisting of theory and practical courses that shall be categorized as follows:

The typical curriculum structure for UG degree programmes are based on AICTE and Anna University and is given in Table 2.

Table 2: Curriculum Structure

Humanities and Social Sciences including Management Courses (HS)	Basic Sciences (BS)	Basic Engineering Sciences (ES)
Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)
Career Enhancement Courses (CEC)		

The course outcomes (CO's) are designed to align with the Programme Outcomes (PO's) and Programme Educational Objectives (PEO's) of the respective programmes.

In addition to the courses listed in the curriculum, the department can include elective courses offered by reputed Industry / Educational Institutions /Experts from time to time, approved by DEC/AEC and ratified by the Academic Council.

The credits earned through such courses shall be considered equivalent to Professional Elective (PE) credits or Open Elective (OE) credits as decided by the Department evaluation Committee (DEC) on a course to course basis.

Experts from the Industry / Institution may design such specialized elective courses based on the current technical skill requirements. The Department evaluation Committee (DEC) shall review and approve the course offered by the expert from the industry / Institution.

In addition to the courses that carry credits, all students are required to complete mandatory non-credit courses, if offered (eg.,Value education courses, and others).Credits will not be awarded but will be assessed and graded, and must be completed.

The following is the credit distribution of KIT based on the suggested AICTE distribution. (Table 3)

Table 3 : Credit Distribution

Category	Credit range
A - Foundation Courses	
Humanities and Social Sciences including Management Courses (HS)	6-9
Basic Sciences Courses (BS)	17-26
Basic Engineering Sciences (ES)	10-29
B - Professional Core Courses	
Professional Core Courses (PC)	62-87
C - Elective Courses	
Professional Electives (PE)	15-18
Open Electives (OE)	6-12
D - Project Work	
Project Work (PW)	11-13
E - Mandatory Courses Prescribed by AICTE/UGC	
Mandatory Courses (Induction Program, Environmental Sciences, Indian Constitution)	–
F - Career Enhancement Courses(CEC)	8
Total Credits	**165 - 174**

6.3 Number of courses per semester

Each semester curriculum shall normally have a blend of lecture courses not exceeding 8 and Laboratory courses and Career Enhancement Courses (CEC) not exceeding 7.However, the total number of courses per semester shall not exceed 15. The students can register for Professional Elective/Open Elective courses in any semester, starting from the third semester.

6.4 Credit Assignment

Each course offered is given a T-P-TU-C structure, depending on the number of lecture periods (T), number of periods for practical (P) and number of tutorial periods (TU) required per week for an efficient teaching – learning process. A student is expected to put-in his/her own efforts in proportion with periods spent in classroom, as defined in T-P-TU-C structure. On successful completion of the course a student is said to have earned a specified number of credits defined for each course. Each course is assigned certain number of credits based on the following table:

Table 4: Credit Assigned

Contact period per week	Credits
1 Lecture Period (**T** = Lectures given during class by the faculty)	1
1 Tutorial Periods (**TU** = Tutorial, also class based with more emphasis on problem solving)	1
2 Practical Period (**P**) (Laboratory Periods / CEC / Projects)	1

6.5 Career Enhancement Courses

6.5.1 Personality and Character Development

All students shall enroll, on admission, in any one of the personality and character development programmes (NCC / NSS / YRC) and undergo training and attends camp as prescribe by the respective officers/ coordinators. The training shall include classes on hygiene and health awareness and also training in first-aid.

National Cadet Corps (NCC) will have number of parades/camps specified by the NCC officer.

National Service Scheme (NSS) will have social service activities in and around the College / Institution.

Youth Red Cross (YRC) will have activities related to social services in and around College /Institutions. While the trainingactivities will normally be during weekends, the camp will normally be during vacation period.

6.5.2 Industrial Training / Internship

Students shall undergo industrial training/Internship if mandated in the curriculum for periods as specified in the curriculum during the summer/winter vacation, the training being taken on a continuous basis for the periods mentioned. The industry/organization is to be selected with the approval of the Department Evaluation Committee (DEC). Industrial training may also be referred to as "In-plant training".

The Industrial Training / Internship shall carry 100 marks and shall be evaluated through CIA only. The credit will be awarded to the student after the submission of Internship / Training report to the HoD. The report will be evaluated by a team of (DEC) faculty members nominated by the HoD for awarding the Credit. Based on the recommendation by the team, the student will be awarded credits and the results will be sent to the Controller of Examinations. The awarded credit will taken for CGPA calculation. The final year project period at industry / research organization will not be considered as industrial Training / internship.

6.5.3 Industrial Visit

Every student is required to go for at least one Industrial Visit every year starting from the second year of the Programme subject to the approval of the Head of the Department and Principal. The Heads of Departments shall ensure that necessary arrangements are made in this regard.

6.5.4 Professional Certificate Courses

Students have to undergo one credit courses offered by experts from industry / research organizations and approved by academic council. Students can register such courses from his / her second year of study as and when these courses are conducted by the departments. A student is also permitted to register for these courses of other departments.

If a student does not successfully complete the registered industry supported one credit courses in a semester, the registration of that course will be considered as cancelled. Further, it will not be treated as arrear and if he/she wishes, he/she can re-register for the same course in the ensuing semesters and successfully complete it as and when it is offered subsequently.

6.5.5 Online Courses

Students may be permitted to register for online courses (which are provided with certificate after evaluation of the performance, SWAYAM / NPTEL), during third to sixth semester of his / her study. On successful completion of the course, he / she has to submit the copy of the certificates to the Head of the Department. The assemment will not be calculated for CGPA.

6.5.6 Soft Skills

Every Student is required to go for two soft skill courses during first year of study. The soft skill course includes the communication skill, interpersonal skill and career development courses. One credit will be awarded for each soft skills courses and it will be included for SGPA/CGPA calculations.

6.5.7 Career Ability Course

The career Ability courses will be designed by the respective department with approval from DEC/AEC based on the industry requirements. One credit will be awarded for each soft skills courses and it will be included for SGPA / CGPA calculations.

6.5.8 Evaluation of One Credit Courses

Students can register for one credit courses in any semester when it is offered. Experts from the industry / Institution (KIT) may design such specialized one-credit courses based on the current technical skill requirements. The Department Evaluation Committee (DEC) shall review and approve the syllabus, course plan, and pedagogy and assessment pattern for the course. One credit courses can also be offered by internal experts i.e faculty members from other departments (not belonging to the specific discipline of the programme) also can offer such courses to the students with the approval of DEC.

A one - credit course shall carry 100 marks and shall be evaluated through Continuous Internal Assessment (CIA) only. The QP pattern and scheme will be decided by the course faculty and will be approved by the DEC/AEC.

The Head of the Department may identify a faculty member as the coordinator for the course. A committee consisting of the Head of the Department, faculty handling the course (if available), coordinator and a senior Faculty member nominated by the Head of the Department shall monitor the evaluation process.

The grades shall be assigned to the students by the above committee based on their performance and included in the calculation of CGPA.

6.5.9 Industry Supported Project Work

The students satisfying the following conditions shall be permitted to carry out their final semester Project work for six months in industry/research organization.

The student should not have current arrears and shall have CGPA of 8.0 and above until 5th semester. The student shall undergo the eighth semester courses in the sixth and seventh semesters. The Head of Department, in consultation with the faculty handling the said courses shall forward the proposal recommended by the Principal to CoE after approval from AEC at least four weeks before the commencement of the sixth semester of the programme.

6.6 Course Numbering Scheme

Each course is denoted by a unique code consisting of 9 alphanumeric characters. The details of the numbering scheme are in APPENDIX A

6.7 Credit Requirement for Programmes

The total number of credits that a student earns during the period of study is called the total credits. For the successful completion of the B.E/B.Tech programme, a regular student must earn 165-174 credits (varies with the programme) in minimum of eight semesters, while a lateral-entry student must earn 122-131 credits in a minimum of six semesters.

7 DURATION OF THE PROGRAMMES

7.1 The duration for the B.E./B.Tech. degree programmes shall extend over a period of 4 years (8 semesters) for the students admitted in the first semester but in any case not more than 7 years (14 semesters) and 3 years (6 semesters) for the students admitted in third semester (Lateral Entry Scheme) and not more than 6 years (12 semesters).

7.2 Each semester normally consists of 90 working days, including test and examination days. In any contingent situation, the number of working days per semester shall not be less than 65 days. The Principal is given the discretionary powers to decide the number of working days. In such contingencies, the Principal shall ensure that every faculty member teaches the full content of the specified syllabus for the course being taught.

7.2.1 Due to Pandemic / Abnormal situations the Scheme of Examinations and Evaluation will be followed as per the guidelines issued by the Government of Tamil Nadu and Anna University, Chennai.

7.3 The total period for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 7.1 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

7.4 For the purpose of regulations, the academic year will be divided into two semesters, the odd semester normally spanning from June to November and the even semester from December to May.

8. COURSE REGISTRATION

Each student, on admission shall be assigned to a mentor who shall advice and counsel the student about the details of the academic programme and choice of courses, considering the student’s academic background and career objectives. Some courses require students to register through a course registration process via online.

8.1 Course Registration

Each student on admission shall register for all the courses prescribed in the curriculum in the students first semester of the study.

The registration process for the courses offered in the online registration mode in the forthcoming semester, will commence preferably 10 working days prior to the last working day of the current semester.

A department shall offer a course only if a minimum number of students register for that course. This minimum number may vary from course to course and shall be specified by the department from time to time.

After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Internal Assessment Marks and appear for the End Semester Examination (ESE) or as specified in the curriculum.

8.2 Credits details for Course Registration

A student has to earn the total credits specified in the curriculum of the respective programme of study, in order to be eligible to obtain the degree. However, if the student wishes, then he/she is permitted to earn more than the total number of credits prescribed in the curriculum.

The number of credits, most students are expected to register for, in a semester, will be about 20-30 credits (excluding arrears). so that they complete the programme within the specified duration of the programme. The minimum credits a student can register for, in a regular semester shall be 12 and the maximum credit a student can register is 36(excluding arrears). Students shall register for project work in the 7th and 8th semester or 8th semester only.

8.3 Flexibility to Add / Drop courses

A student can add or drop the courses registered within the first 5 instructional days, from the commencement of a regular semester, subject to the availability of resources and the minimum / maximum number of credits required to be registered in a semester vide clause 8.2.

From semester 3 to 8, the student has the options for Adding/dropping an existing course. The total number of credits that a student can add/drop is limited to 6. Practical courses cannot be added / dropped.

8.4 Reappearance Registration

8.4.1 If a student fails in a theory or practical course, the student shall do reappearance registration for that course in the subsequent semester by retaining the Continuous Assessment Marks already earned.

8.4.2 If the theory course, in which the student has failed, is a Professional Elective or an Open Elective, the student may register for the same or any other Professional Elective or Open Elective course respectively in the subsequent semesters. Such changes can be done only with due approval by DEC.

8.4.3 The student who fails in Project work/ Seminar other than Practical courses shall register for the same in the subsequent semester and reappear for the End Semester Examination.

8.4.4 If a student is not eligible to appear for End Semester Examination of a course due to lack of attendance, the student has to register for that course again, when offered next, attend the classes and fulfill the attendance requirements. If the course, in which the student has lack of attendance, is an elective, the student may register for the same or any other elective in the subsequent semesters.

8.4.5 If a student has completed the 8 semesters and has obtained RA grade in one or more courses, he can register and appear for arrear examination directly whenever conducted next.

8.4.6 A student who has already appeared for a course in a semester and passed the examination is not entitled to reappear the same course for improvement of Grade/ Marks.

9. REQUIREMENTS FOR APPEARING FOR CIA, ESE

9.1 A student who has fulfilled the following conditions shall be deemed to be eligible to appear for the CIA-1, CIA-2, CIA-3 and ESE. Ideally, every student is expected to attend all the classes and earn 100% attendance. Students who have earned not less than 75% attendance course wise taking into account the number of periods required for that course as specified in the curriculum. Table 5 illustrates the mandatory attendance requirement for CIA-1, CIA-2, CIA-3 and ESE.

Table 5: Mandatory Attendance Requirement for CIA-1, CIA-2, CIA-3 and ESE.

Test / Examination Type	Period of Calculation	Minimum % of attendance required
Continuous Internal Assessment Test - 1 (CIA-1)	**First Semester** From the date of joining of course to three working days before the start of CIA - 1	60%
	Second to Eighth semester From the date of commencement of the class to one week before the start of CIA - 1	75%
Continuous Internal Assessment Test - 2 (CIA-2)	From the date of joining (1stsemester) / date of commencement of class (2nd to 8th Semester) to one week before the start of CIA - 2	75% (for students maintaining 80% or more attendance between CIA 1 and CIA-2, but falls short of the 75% cumulative requirement, the requirement may be relaxed if recommended by the AEC)
Continuous Internal Assessment Test - 3 (CIA-3)	From the date of joining (1st semester)/date of commencement of class (2nd to 8th Semester) to one week before the start of CIA - 3	75% (for students maintaining 80% or more attendance between CIA-2 and CIA 3, but falls short of the 75% cumulative requirement, the requirement may be relaxed if recommended by the AEC)
End Semester Examination (ESE)	From the date of joining (1st semester) / date of commencement of class (2nd to 8th Semester) to the last day of instruction.	75%

9.1.1 Students having a CGPA of 8.50 and above and with no standing arrears will be exempted from the minimum attendance requirements (from 7th Sem. onwards).

9.1.2 A student shall normally be permitted to appear for End Semester Examination of the course if he / she has satisfied the attendance requirements (vide Clause -9.1). He /she is eligible to register for ESE in that semester by paying the prescribed fee.

9.1.3 A Candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester. Ideally every student is expected to attend all classes of all the courses and secure 100% attendance. However, in order to give provision for certain unavoidable reasons such as Medical / participation in sports, the student is expected to attend atleast 75% of the classes. Therefore, he/she shall secure not less than 75%.

9.1.4 However, a candidate who secures overall attendance between 65% and 74% in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) / Participation in Sports events may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate attested by the Head of the Institution. The same shall be forwarded to the Controller of Examinations for record purposes.

9.1.5 Candidates who secure less than 65% overall attendance and candidates who do not satisfy the clause 9.1.3 and 9.1.4 shall not be permitted to write the semester examination at the end of the semester and not permitted to move to the next semester. They are required to repeat the incomplete semester in the next academic year, as per the norms prescribed.

9.1.6 The students who are consistently good in academics ONLY be considered for the grant of ODL under Co-curricular activities by the competent authorities. The following activities shall be considered for the sanction of ODL;

- Sports and Games: TIES, Inter Collegiate, Inter Zonal, Inter University, State Level, National Level and Open Tournaments.
- NCC: Camps and expeditions, NSS camps
- Cultural Programme at State, National and International Level
- Seminar / Symposia: Paper presentation/Quiz
- Leadership courses organized by other organizations & Alumni Association activities, Association activities, Placement activities.
- Training programs/Internship at industries and Higher learning Institutions
- Personal damage incurred during the extracurricular activities
- The ODL requisition letter shall be forwarded to the Principal through the HoD of the student by the staff-in-charge of the respective activities before completion of every activity.

- The ODL sanctioned letters shall be submitted to the Department Office. The faculty-in-charge of the department office will check the eligibility for the award of attendance at the end of semester and the same may be submitted to DEC for approval.

9.1.7 The student should register all the courses of current semester and all the arrear courses in the previous semesters. If any student fails to register and pay the examination fees within the due date, he/she shall not be permitted to attend the End Semester Examinations. However, he/she will be permitted to continue their studies in the next higher semester, provided that the student satisfies the requirements as stipulated in this clause of this regulation.

9.1.8 Those students who are not deemed to have completed the semester with references to the conditions specified above shall undergo the semester again in all the courses in the respective semester during next academic year. He/she shall seek re-admission as per the norms of the affiliating University/DOTE (Directorate of Technical Education). The days of suspension for a student on disciplinary grounds will be considered as days of absence for calculating the percentage of attendance for each individual course.

10. PROVISION FOR WITHDRAWAL FROM EXAMINATION

A student may, for valid reasons (medically unfit / unexpected family situations/Sports person representing Tamilnadu / India with prior permission for participation from Principal / CoE / DEC), be granted permission to withdraw (after registering for the examinations) from appearing for any course or courses in the End Semester Examination of a particular semester. The student may withdraw by following the due process of the CoE's office before the commencement of examination. This facility can be availed only once during the entire duration of the degree programme.

Withdrawal from ESE will be valid only if the student is, otherwise, eligible to write the examination and the application for withdrawal is made to the CoE, prior to the examination in the course or courses concerned. The application for withdrawal should be recommended by the Head of the Department concerned and approved by the Head of the Institution.

11. TEMPORARY BREAK OF STUDY FROM A PROGRAMME

11.1 Break of study is normally not permitted. However, if a student intends to temporarily discontinue the programme in the middle of a semester / year for valid reasons (such as Internships, accident or hospitalization due to prolonged ill health) and wishes to re-join the programme in the next academic year, he / she shall apply in advance to the Principal through the Head of the Department, stating the reasons. The application shall be submitted not later than the last date for registering for the semester examinations. Break of study is permitted only once during the entire period of the degree programme.

11.2 The student permitted to re-join the programme after the break shall be governed by the rules and regulations in force, at the time of re-joining.

11.3 The duration specified for passing all the courses for the purpose of classification of degree(vide clause 19) shall be increased by the period of such break of study permitted(vide clause 11)

11.4 If a student is detained for want of requisite attendance, academic progress and good conduct, the period spent in that semester shall not be considered as permitted Break of Study and Clause 11.3 is not applicable for such cases.

12. ASSESSMENT PROCEDURES FOR AWARDING MARKS

The total marks for each course generally (Theory, Practical, Project Work) will be 100, comprising of two components namely Continuous Internal Assessment (CIA) and End Semester Examination (ESE). However, there could be some open elective courses, human excellence courses, one credit industry courses, add-on courses and Mandatory courses that have only continuous assessment for 100 marks without an End Semester Examination. The Department Consultative Committee (DCC) has to approve such courses every semester. The scheme of assessment may also be decided by the faculty handling the course concerned with the approval from DCC and shall be made available to the students during the online course registration. Each course shall be evaluated for a maximum of 100 marks as illustrated in **Table - 6.**

Table - 6 : Course Evaluation

S. No.	Category of course	Continuous Internal Assessment	Semester End Examinations
1.	Theory Courses	40 Marks	60 Marks
2.	Laboratory Courses		
3.	Project Work		
4.	CCA (Technical Seminar / Soft Skill / Industry oriented one credit courses)	100 Marks	–

The End Semester Examination (theory and practical) of 3 hours duration shall ordinarily be conducted between October and December during the odd semesters and between April and June during the even semesters.

The End Semester Examination for project work shall consist of evaluation of the final report submitted by the student or students of the project group (of not exceeding 4 students) by an external examiner and an internal examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner, the supervisor of the project group and an internal examiner.

For the End Semester Examination in both theory and practical courses including project work the internal and external examiners shall be appointed by the Controller of Examinations.

13. MARKS DISTRIBUTION

13.1 Attendance Mark

Marks are awarded for the attendance earned by the students for individual courses as per the following table.

Attendance Range in %	Marks to be earned by the students
96 - 100	5
91 - 95	4
86 - 90	3
81 - 85	2
75 - 80	1

13.2 Question paper pattern

a. Table 7.1 Continuous Internal Assessment (CIA 1, CIA -2 and CIA-3)

2 Marks	12 Marks	Total marks
7	3 (3 out of 5)	50

b. Table 7.2 End Semester Examinations

<table>
<tr><th>2 Marks</th><th>13 Marks</th><th>15 marks</th><th>Total Marks</th></tr>
<tr><td>10</td><td>5
(Either or Type)</td><td>1
(Either or Type)</td><td>100</td></tr>
<tr><th colspan="4">For Mathematics paper only</th></tr>
<tr><td>2 Marks</td><td colspan="2">16 Marks</td><td>Total Marks</td></tr>
<tr><td>10</td><td colspan="2">5</td><td>100</td></tr>
<tr><th colspan="4">For Engineering Graphics only</th></tr>
<tr><td colspan="3">20 Marks</td><td>Total Marks</td></tr>
<tr><td colspan="3">5</td><td>100</td></tr>
</table>

13.3 Theory Courses

Continuous Internal Assessment tests are conducted by the Office of the Controller of Examination. Continuous Internal Assessment comprises three Continuous assessment tests, Assignment / Class test / Presentation / Online Test / Mini projects / Tutorials and Attendance. By adopting this method, the students will go through a continuous and systematic study pattern. The Corresponding weightages are given below.

Table 8 : Continuous Internal Assessment Test for UG Theory Courses

Particulars	Syllabus	Duration	Exam Mark	Internal Mark
Continuous Internal Assessment 1	1.5 Units	1.5 hours	50 marks	10
Continuous Internal Assessment 2	1.5 Units	1.5 hours	50 marks	10
Continuous Internal Assessment 3	1.5 Units	1.5 hours	50 marks	10
Assignment / Class Test / Online Test / Mini Project / Tutorial / Presentation/ Online course/Certificate Course				5
Attendance				5
Total				40

13.4 CRITERIA FOR ASSESSMENT FOR LAB COURSES

Every exercise / experiment in all practical courses shall be evaluated on a continuous basis. The criteria for Continuous Assessment (for each cycle of exercise/experiment) are given in Table 9

Table 9: Assessment for Lab Courses

Sl. No.		Description	Weightage
1.	Continuous Internal Assessment Marks (CIAM)		
	a.	Average of Experimental Report / Workbook	25
	b.	Model examination	10
	c.	Attendance	5
	Total CIAM		**40**
2.	Semester End Exam Marks (ESEM)		
	a.	Lab Examination with Viva Voce	60
	Total ESM		**60**
		Total Marks	**100**

13.5 PROJECT WORK

For final year Project Work out of 100 marks, the maximum marks for Continuous Assessment is 40 marks and that for the End Semester Examination (project report evaluation and viva-voce examination) is 60 marks. Project work may be assigned to a single student or to a group of students not exceeding 4 per group, under the supervision of faculty guide(s).

The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three faculty members in the review committee. There shall be three reviews (as per **Table - 10**) in total, during the semester by a review committee. The student shall make presentation on the progress made before the committee.

Interim project report shall be submitted before the project reviews with the approval of the guide. The Project Report, prepared according to the approved guidelines and duly signed by the guide and the Head of the Department, shall be submitted to the department as per the timeline announced by the department. The End Semester Examination for project work shall consist of evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted separately for each student, by a committee consisting of the external examiner, and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work.

The Continuous Internal Assessment Marks (CIAM) and End Semester Examinations Marks (ESEM) for Project Work and the Viva-Voce Examination will be distributed as indicated in **Table - 10**.

Table - 10 : CIAM and ESEM break-up for project work

Sl.No.	Review No.		Description	Marks	Total Marks
1.	**Continuous Internal Assessment Marks**				
	a.	Review 1	Review Committee	5	10
			Guide	5	
	b.	Review 2	Review Committee	7	15
			Guide	8	
	c.	Review 3	Review Committee	7	15
				8	
Total CIAM					**40**
2.	**End Semester Examinations Marks**				
	a.	Evaluation of final report and viva-voce	Internal Examiner	10	**50**
			External Examiner	40	
	b.	Outcome*	Publication of papers / prototype / patents etc.,	10	10
Total ESEM					**60**
Total Marks					**100**

Review committee consists of internal faculty members nominated by the Head of the Department. The guide of student being examined shall not be part of the committee.

* Outcome – in terms of paper publication, patents, product development and industry projects shall be awarded by both internal and external examiners, based on the document proofs submitted by the student concerned.

If a student fails to submit project report / does not appear for the ESE /fails in the End Semester Examination (ESE), he/she is deemed to have failed in the project work and shall have to re-register for the same when offered next.

14. PASSING REQUIREMENTS

14.1 A student is declared to have successfully passed a theory based course if he / she has secured:

- A minimum of 45% marks in the End Semester Examinations.
- A minimum of 50% marks on combining both Continuous Internal Assessment Marks (CIAM) and End Semester Examination Marks (ESEM).

14.2 A student is declared to have successfully passed a practical / project based course if he/she has secured :

- A minimum of 45% marks in the End Semester Examinations.
- A minimum of 50% marks on combining both Continuous Internal Assessment Marks (CIAM) and End Semester Examination Marks (ESEM).

14.3 For a student who does not meet the minimum passing requirements, the term "RA" against the course will be indicated in his/her grade sheet. He/she shall reappear in the subsequent examinations for the course as arrear or re-register for the course when offered .

14.4 For a student who is absent for end-semester theory / practical / project viva-voce, the term "RA" will be indicated against the corresponding course. He/she shall reappear for the End Semester Examination of that course as arrear in the subsequent semester or when offered next.

14.5 The letter grade "W" will be indicated for the courses for which the student has been granted authorized withdrawal (refer Clause 10).

14.6 For mandatory courses (non-credit), the student must satisfy the minimum attendance requirement & passing criteria as specified for the course as detailed in Section 16.2.

15. METHODS FOR REDRESSAL OF GRIEVANCES IN EVALUATION

Students who are not satisfied with the grades awarded in the End Semester Examination of Theory for regular and arrear exams can seek redressal as illustrated in Table 11.

Table - 11 : Grievance Redressal Mechanism

Sl. No.	Redressal Sought	Methodology	
		Regular Exam	Arrear Exam
1.	Revaluation	Apply for photo copy of answer book Then apply for revaluation after course expert recommendation	
2.	Challenge of Evaluation	Apply for photo copy of answer book Then apply for revaluation after course expert recommendation Next apply for challenge of evaluation	
Note: All applications to be made to COE along with the payment of the prescribed fee.			

Challenge of Evaluation – Flow Process

Table - 12 : Evaluation – Flow Process

Step 1	A student can make an appeal to the CoE for the review of answer scripts after paying the prescribed fee
Step 2	CoE will issue the photocopy of answer scripts to the student
Step 3	The faculty who had handled the subject will evaluate the script and HoD will recommend
Step 4	A committee consisting of 2 evaluators appointed by CoE will review and declare the result
Step 5	If the result is in favour of the student, the fee collected will be refunded to the student
Step 6	The final mark will be announced by CoE.

16. LETTER GRADE

Absolute grading system is adopted in converting marks to grads

16.1 Absolute Grading Policy

All assessments of a course will be evaluated on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Table - 13 : Absolute Grading - Letter Grade and its Range

Sl.No.	Range of percentage of total marks	Letter Grade	Grade Points
1.	91 - 100	O (Outstanding)	10
2.	81 – 90	A+ (Excellent)	9

3.	71 – 80	A (Very Good)	8
4.	61 – 70	B+ (Good)	7
5.	50 – 60	B(Average)	6
6.	<50	RA (Re-appearance)	0
7.	Shortage of Attendance	RA (Re-appearance due to shortage of attendance)	0
8.	Absent	RA (Re-appearance due to absence	0
9.	Withdrawal from examination	W	0
10.	Pass in Mandatory non-credit courses	P	0
11.	Fail in Mandatory non-credit courses	F	0

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: "O", "A+", "A", "B+","B". 'RA' indicates that Reappearance is mandatory for that course concerned. 'SA' denotes shortage of attendance (as per Clause 9) and hence prevented from writing the End Semester Examination. P and F are grades for mandatory, but non-credit courses.

16.2 Grading for Mandatory Courses

Mandatory Courses are courses that are required to be completed to fulfill the degree requirements (e.g. Human excellence, Environmental science, etc.). They are normally non – credit based. These courses will not be taken in to consideration for the SGPA / CGPA calculations. Each of these courses is assessed continuously and internally for a total mark of 100. The pass mark is 50%. Students, who fail to pass this course, are required to repeat the course, when offered next.

16.2.1 For Mandatory non-credit courses the student must satisfy the minimum attendance requirement & passing criteria as specified for the course. These courses do not carry credits but needs to be completed to fulfill the degree requirements.

16.2.2 For the Mandatory non-credit courses student completing the course will be awarded Pass grade (P) and those who fail to satisfy the attendance requirement or fail to satisfy the minimum passing requirement of 50% marks, will be awarded Fail (F) grade and the student must re-register for the course when it is offered next.

16.2.3 Grade Sheet

After the results are declared, grade sheets will be issued to each student, which will contain the following details:

- The College Name and Affiliating University.
- The list of courses registered during the semester and the grades scored.
- The Semester Grade Point Average (SGPA) for the semester.
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

On completion of a semester, each student is assigned a Semester Grade Point Average which is computed as below for all courses registered for, by the student during that semester.

$$\text{Semester Grade Point Average} = \frac{\sum (C_i \times GP_i)}{\sum C_i}$$

where $\mathbf{C_i}$ is the credit for a course in that semester and $\mathbf{GP_i}$ is the Grade Point earned by the student for that course. The **SGPA** is rounded off to two decimals.

The overall performance of a student at any stage of the Degree programme is evaluated by the **C**umulative **G**rade Point **A**verage **(CGPA)** up to that point of time.

$$\text{Cumulative Grade Point Average} = \frac{\sum (C_i \times GP_i)}{\sum C_i}$$

where $\mathbf{C_i}$ is the credit for each course in each of the completed semesters at that stage and $\mathbf{GP_i}$ is the grade point earned by the student for that course. The **CGPA** is rounded off to two decimals.

16.2.4 FORMULA FOR CALCULATING PERCENTAGE

CGPA x 10 = % of Marks

17. ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided the student has

i. Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.

ii. Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 8 semesters within a maximum period of 7 years and 6 years in the case of Lateral Entry reckoned from the commencement of the first (third in the case of Lateral Entry) semester to which the candidate was admitted.

iii. Successfully passed any additional courses prescribed by the Academic council

iv. Successfully completed the NCC / NSS / NSO / YRC requirements.

v. Successfully passed any additional courses prescribed by the Department & concerned whenever readmitted under regulations 2019 (R19) (vide Clause 4.3)

vi. No disciplinary action pending against the student.

vii. The award of Degree must have been approved by the Academic Council of KIT.

19. CLASSIFICATION OF B.E. / B.TECH DEGREE

The degree awarded to eligible students will be classified as given in **Table 14.**

Table - 14: Classification of the B.E. / B.Tech. Degree

Sl.No.	Class Awarded	Criteria
1.	First class with distinction	A student who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction: ⊙ Should have passed the examination in all the courses of all the 8 semesters and 6 semesters in the case of Lateral Entry) in the student's First Appearance within five years and Four years in the case of Lateral Entry).
		⊙ Withdrawal from examination will not be considered as an appearance. ⊙ Should have secured a CGPA of not less than 8.50. ⊙ One year authorized break of study (if availed of) is included in the five years and (four years in the case of lateral entry) for award of First class with Distinction. ⊙ Should NOT have been prevented from writing End Semester Examination due to lack of attendance in any semester.
2.	First Class	A student who satisfies the following conditions shall be declared to have passed the examination in **First class :** ⊙ Should have passed the examination in all the courses of all eight semesters and 6 semesters in the case of Lateral Entry) **within Six years**. and Five years in the case of Lateral Entry). ⊙ One year authorized break of study (if availed of) or prevention from writing the End Semester Examination due to lack of attendance (if applicable) is included in the duration of six years and five years in the case of lateral entry) for award of First class. ⊙ Should have secured a CGPA of not less than **7.00**.

3.	Second Class	All other students (not covered in clauses Sl.No.1 and 2 under clause 18) who qualify for the award of the degree (vide Clause 19) shall be declared to have passed the examination in Second Class.

Note : A student who is absent for the End Semester Examination in a course / project work Viva Voce after having registered for the same will be considered to have appeared for that examination (except approved withdrawal from End Semester Examinations as per Clause 9) for the purpose of classification.

19. AWARD OF DEGREE

The Academic Council of the institution will approve the award of Degree to all eligible students. The degree will be issued by Anna University, Chennai and the consolidated Grade Sheet will be issued by the institution. The consolidated grade sheet will specify any specializations and distinctions that the student has earned during the course of the study.

20. FACULTY MENTOR

To help the students in palnning their courses of study and for general advice on the academic progarmme, the Head of the Department will attach a certain number of students (maximum 25) to a faculty member of the department. He/She shall function as Faculty Mentor for these students throughout their period of study. The faculty mentor shall,

- Advice the students in registering and reappearance registering of courses
- Monitor their attendance, academic progress and discipline of the students
- Counsel periodically or during the faculty mentor meeting scheduled in the class time table.
- Inform the students about the various facilities and activities available to enhance the student's curricular and co-curricular activities.
- If necessary, the faculty mentor may also discuss with or inform the parents about the progress of the students through Head of the Department or in Parent-Teacher meeting.

21. CLASS COMMITTEE

The objective of the Class Committee is to improve the teaching-learning process.

The functions of the class committee include:

- Resolving difficulties experienced by students in the classroom and in the laboratories.
- Clarifying the regulations of the degree programme and the details of rules therein.
- Discussing the progress of academic schedule and deviations if any.
- Evaluating the performance of the students of the class after each test and finding the ways and means of improvement.
- Every class in first year of study shall have a class committee consisting of faculty members who are teaching in that class, student representatives (cross section of students from boys and girls) and a chairperson who is a faculty not handling the course for the class.

- From III semester onwards, Class committee comprises of all the faculty members who are handling courses in that particular semester and two student representatives from each course. A chairperson who is a faculty not handling course for that particular semester, nominated by the Head of the Department shall coordinate the activities of this committee.
- The class committee shall be constituted by the Head of the Department/Chief Tutor on the first week of commencement of the semester.
- The class committee shall meet three times in a semester as specified in the academic calendar.
- The Principal may participate in any class committee of the institution.
- During these meetings, the representative of the class shall meaningfully interact and express the opinions and suggestions of the other students of the class to improve the effectiveness of the teaching-learning process.
- The Chairperson is required to prepare the minutes of the meeting, signed by the members and submit the same to Head of the Department within five working days of the meeting. Head of the Department will in turn consolidate and forward the same to the Principal, within 10 working days of the meeting.
- In each meeting, the action taken report of the previous meeting is to be presented by the Chairperson of the class committee.

22. COMMON COURSE COMMITTEE

- A theory course handled by more than one teacher shall have a “Common Course Committee” comprising of all teachers teaching that course and few students who have registered for that course. There shall be two student representatives from each batch of that course. One of the teachers shall be nominated as Course Coordinator by the HoD concerned and duly approved by the Principal
- The first meeting of the Common Course Committee shall be held within fifteen days from the date of commencement of the semester. The nature and weightage of the continuous assessments shall be decided in the first meeting, within the framework of the Regulations. Two or three subsequent meetings in a semester may be held at suitable intervals. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to the whole batch.
- In addition, the “Common Course Committee” (without the student representatives) shall meet to ensure uniform evaluation of continuous assessments after arriving at a common scheme of evaluation for the assessments.
- Wherever feasible, the common course committee (without the student representatives) shall also prepare a common question paper for the continuous assessment tests. The question paper for the End Semester Examination is common and shall be set by the Course Coordinator in consultation with all the teachers or the external member as appointed by the Controller of Examinations.

23. DETAILS OF FACULTY PEDAGOGICAL AND STUDENT ASSESSMENT RECORD

Every teacher is required to maintain a Faculty Record Book/ course file consisting of the following details as shown below;

- Time-table, course syllabus, program outcomes, course outcomes.
- Details of attendance of each student marked in each theory/practical/project work class.
- CIA marks,Details of Assignment/ seminar given, course delivery details, corrective and preventive actions on test performance of students and any other additional details.

The record book should be submitted to the HOD periodically (at least three times in a semester) for checking the syllabus covered, the test marks and attendance. The HOD shall put his/her signature and date in the record book after due verification. At the end of the semester, the record book shall be verified by the Principal who will also ensure safe custody of the document for at least four years. The university or any inspection team appointed by the University / UGC / AICTE may verify the records of attendance and assessment of both current and previous semesters.

24. DISCIPLINE

Every student is required to maintain discipline and decorum both inside and outside the institution campus. They shall follow all the rules and regulations and should not indulge in any activity which can tarnish the reputation of the University or Institution. The Principal shall refer any act of indiscipline by students to the Discipline and Welfare Committee and other appropriate committees for action.

25. REVISION OF REGULATIONS AND CURRICULUM

The institution may from time to time revise, amend or change the Regulations,scheme of Examinations and syllabi, if found necessary. Academic Council assisted by Board of Studies and Standing Committee will make such revisions / changes.

Note : Any ambiguity in interpretation of this regulation is to be put up to the Standing Committee, whose decision will be final.

26. SPECIAL CASES

In the event of any clarification in the interpretation of the above rules and relations, they shall be referred to the Standing Committee. The standing committee will offer suitable interpretations/clarifications/ amendments required for special case on such references and get them ratified in the next meeting of the Academic Council. The decision of the Academic Council is final.

ANNEXURE - I

COURSE NUMBERING SCHEME

<table>
<tr><td>B</td><td>1</td><td>9</td><td>M</td><td>E</td><td>T</td><td>7</td><td>0</td><td>9</td></tr>
<tr><td>Programme</td><td colspan="2">Regulation</td><td colspan="2">Department Code</td><td>Course Type</td><td>Semester</td><td colspan="2">Sequence Number</td></tr>
</table>

Programme : Bachelor Degree (B.E. / B.Tech) - B Masters Degree (M.E. / M.Tech) - M **Regulation :** R – 19 **Department Code** AE - Aeronautical Engineering AG - Agricultural Engineering BT - Bio Technology BM - Bio Medical Engineering CS - Computer Science and Engineering EC - Electronics and communication Engineering EE - Electrical and Electronics Engineering ME - Mechanical Engineering CA - Computer Application MB - Management Studies CH - Chemistry EN - English PH - Physics MA - Mathematics MC - Mandatory Course CE - Career Enhancement	**Course Type** T - Theory P - Practical / Project/ Internship E - Elective O - Open Elective C - One Credit Courses N - Online courses S-Special Electives **Semester** 1 - First Semester 2 - Second Semester 3 - Third Semester 4 - Fourth Semester 5 - Fifth Semester 6 - Sixth Semester 7 - Seventh Semester 8 - Eighth Semester **Sequence Number** 00-99

ANNEXURE - II

POLICY ON MALPRACTICES

GENERAL

- It shall be the endeavour of all concerned to prevent, control and take remedial action to bring about the occurrences of malpractices to “Zero” in Examinations (both Internal and External), Assignments and in all Academic class works.
- Therefore, a comprehensive approach to the malady of malpractices has to be adopted to create a mindset of integrity and honesty, and at the same time take sufficiently stern action to make it clear that such attempts are fraught with comparably very high risk.
- In keeping with this stance, the following measures are to be taken by all concerned from class room level to the Examination Halls:

A. PREVENTION (This is the best method of tackling this malady)

a. Class room level:

All faculty members are to involve themselves in a psychological growth of students by personal example and self-respect and strive towards

- Developing a sense of honour in the minds of students so that they look down upon earning undeserved marks.
- Imbibing a sense of self-respect and internal dignity that prevents him/her from succumbing to the temptation of easy marks by cheating.
- Generating an awareness of the risks to their character and career if convicted, while also explaining the process and strict rules and regulations adopted by the educational system to prevent malpractices.
- Taking stern view of copied assignments and attempts at malpractices in internal examinations also merits equal seriousness as external examinations.
- Setting sufficiently strong deterrent rules in place and regulations like intimation to parents and warning to students in the presence of parents etc. even in case of efforts at malpractices in internal tests and/or repeated acts despite warnings in case of assignments also.

Examination Halls

Detailed instructions on Invigilation, question paper setting and evaluation and such other instructions will be issued for Invigilation, vigilance, which are to be brought to the notice of all students prior to the examinations.

B. PENAL ACTION FOR MALPRACTICES

All instances of malpractices will be forwarded to the Principal/ Chief Superintendents. The offences will be investigated by a Standing Enquiry Committee constituted by Principal, The committee is to summon and give the student an opportunity to present / plead his/her case. The Committee may also summon anybody else, if it so deems necessary for the conduct of enquiry, in the interest of proper investigation and dispensation of the case. The tenure of the committee would be a complete Academic year.

The Committee is to be guided by the following :

- The seriousness of the malpractice, in terms of deviousness, and culpability/ criminality of motive
- The seriousness in terms of effort and degree of deviousness and culpability / criminality of effort
- Any FIR / Police case that has been registered in the first instance by the Principal/ Chief Superintendent
- Any other special consideration either mitigating or to the contrary.

C. PENALTY FOR OFFENSES

The penalties awarded will depend on the seriousness of the Offence. A list of Offences and penalties are placed at Annexure III.

The Enquiry Report with findings and recommendations of the Committee are to be forwarded to the Controller who will undertake necessary follow up action. Based on the recommendations of the Controller of Examinations, the Principal is empowered to award penalties for offences classified as belonging to categories 1 to 7 of the offence table. The cases falling in categories from S.No. 8 onwards are to be put up to the Principal for consideration and award of suitable penalty.

ANNEXURE - III

Sl.No.	Nature of Malpractice	Maximum Punishment
1.	Appeal by the candidate in the answer script to show mercy by way of awarding more than deserving marks.	Fine of Rs. 1000/- per subject.
2.	The candidate writing his/her name in the answer script.	
3.	The candidate writing his/her registration number/college name in places other than specified in the answer script	
4.	Any special marking in the answer script by the candidate.	
5.	The candidate communicating with neighbouring candidate orally or non- verbally; the candidate causing suspicious movement of his/her body.	
6.	Irrelevant writing by the candidate in the answer script.	
7.	The candidate writing answer on his/her question paper or making use of his/her question paper for rough work	
8.	The candidate possessing cell phones / programmable calculator(s)/any other electronic storage device(s) **gadgets**	Invalidating the examination of the particular subject written by the candidate
9.	The candidate possessing cell phones/ programmable calculator(s)/any other electronic storage device(s) **gadgets**	Invalidating the examination of the particular subject written by the candidate

<table>
<tr><td>10.</td><td>The candidate possessing any incriminating material(s) (whether used or not). For example:-Written or printed materials, bits of papers containing written information, writings on scale, calculator, handkerchief, dress, part of the body, Hall Ticket, etc.</td><td rowspan="8">Invalidating the examination of the subject concerned and all the theory and the practical subjects of the current semester registered by the candidate.
Further the candidate is not considered for revaluation of answer scripts of the arrears-subjects.
If the candidate has registered for arrears – subjects only, invalidating the examinations of all the arrears – subjects registered by the candidate.</td></tr>
<tr><td>11.</td><td>The candidate possessing cell phone(s)/ programmable calculator(s)/any other electronic storage device(s) gadgets and containing incriminating materials (whether used or not).</td></tr>
<tr><td>12.</td><td>The Candidate possessing the question paper of another candidate with additional writing on it.</td></tr>
<tr><td>13.</td><td>The candidate passing his/her question paper to another candidate with additional writing on it</td></tr>
<tr><td>14.</td><td>The candidate passing incriminating materials brought into the examination hall in any medium (hard/soft) to other candidate(s).</td></tr>
<tr><td>15.</td><td>The candidate copying from neighbouring candidate.</td></tr>
<tr><td>16.</td><td>The candidate taking out of the examination hall answer booklet(s), used or unused</td></tr>
<tr><td>17.</td><td>Appeal by the candidate in the answer script coupled with a promise of any form of consideration.</td></tr>
<tr><td>18.</td><td>Candidate destroying evidence relating to an alleged irregularity.</td><td>Invalidating the examinations of the subject concerned and all the theory and the practical subjects of the current semester registered by the candidate.
Further the candidate is not considered for revaluation of answer scripts of the arrears-subjects.
If the candidate has registered for arrears – subjects only, invalidating the examinations of all the arrears – subjects registered by the candidate.</td></tr>
</table>

<table>
<tr><td></td><td>.</td><td>Additional Punishment :
i. If the candidate has not completed the programme, he/she is debarred from continuing his/her studies for one year i.e., for two subsequent semesters. However the student is permitted to appear for the examination in all the arrears-subjects during the debarred period.
ii. If the candidate has completed the programme, he/she is prevented from writing the examinations of the arrears - subjects for two subsequent semesters.</td></tr>
<tr><td>19.</td><td>Vulgar/offensive writings by the candidate in the answer script.</td><td rowspan="3">Invalidating the examinations of all the theory and practical subjects of the current semester and all the arrears –subjects registered by the candidate.</td></tr>
<tr><td>20.</td><td>The candidate possessing the answer script of another candidate</td></tr>
<tr><td>21.</td><td>The candidate passing his /her answer script to another candidate</td></tr>
<tr><td>22.</td><td>Involved in any one or more of the malpractices of serial no. 8 to 21 for the second or subsequent times.</td><td rowspan="2">Invalidating the examinations of all the theory and practical subjects of the current semester and all the arrears –subjects registered by the candidate.
Additional Punishment :
i. If the candidate has not completed the programme, he/she is debarred from continuing his/her studies for one year i.e., for two subsequent semesters. However the student is permitted to appear for the examination in all the arrears-subjects during the debarred period.
ii. If the candidate has completed the programme, he/she is prevented from writing the examinations of the arrears - subjects for two subsequent semesters.</td></tr>
<tr><td>23.</td><td>The candidate substituting an answer book let prepared outside the examination hall for the one already distributed to the candidate</td></tr>
</table>

<table>
<tr><td>24.</td><td>The candidate indulge in any disruptive conduct including, but not limited to, shouting, assault of invigilator, officials or students using abusive and /or threatening language, destruction of property.</td><td rowspan="3">Invalidating the examinations of all the theory and practical subjects of the current semester and all the arrears –subjects registered by the candidate.
Additional Punishment :
i. If the candidate has not completed the programme, he/she is debarred from continuing his/her studies for two years i.e., for four subsequent semesters. However the student is permitted to appear for the examination in all the arrears-subjects during the debarred period.
ii. If the candidate has completed the programme, he/she is prevented from writing the examinations of the arrears-subjects for four subsequent semesters.</td></tr>
<tr><td>25.</td><td>The candidate harass or engage others to harass on his/her behalf an invigilator, official, witnesses or any other person in relation to an irregularity by making telephone calls, visits, mails or by any other means.</td></tr>
<tr><td>26.</td><td>Candidate possessing any firearm/weapon inside the examination hall.</td></tr>
<tr><td>27.</td><td>Cases of Impersonation</td><td>i. Handing over the impersonator to the police with a complaint to take appropriate action against the person involved in the impersonation by the Chief Supt.
If a student of this University is found to impersonate a ‘bonafide student’, the impersonating student is debarred from continuing his/her studies and writing the examinations permanently. He/she is not eligible for any further admission to any programme of the University.
Debarring the ‘bonafide student’ for whom the impersonation was done from continuing his/her studies and writing the examinations permanently. He/she is not eligible for any further admission to any programme of the University.</td></tr>
</table>

APPENDIX - IV

Process to Consider the Application for Revocation of Detainment

The process to consider the application for revocation of detainment on account of lack of attendance in 3 or more courses, due to genuine reasons (viz. sports participation, NCC, Medical Grounds etc.) is as follows:

The student submits an application for consideration via a request letter to the CoE,not later than 3 days from the last working day, along with the HoD's recommendation, Class Advisor's report and Mentor's recommendation. A committee consisting of the Principal, CoE, HoD (Respective Department) and HoD's-2 from departments other than the student's own. The committee shall meet within 4 working days,to consider the case. Stakeholders may be called to be present in the meeting as may be required, and Decision arrived at.The decision approved by Principal shall be final.

APPENDIX - V

Academic Evaluation Committee (AEC)

The committee includes the Principal, CoE, HoD concerned. The committee meets to carry out business related to academic matters which require central decision making and approval viz. retest approval of missed CIA, addressing the feedback collected from the various departments' class committee meetings.

Department Evaluation Committee (DEC)

The committee includes HoD (need basis), and a few faculty members of the department from various levels. The committee meets to carry out business related to academic matters that can be addressed within the department viz. course equivalence of common courses for readmitted students; approval of new courses to be offered by the department; consider and approve the credit equivalence of courses offered by industry, review the course offerings; consider the merit of applications involving lack of attendance in PE/OE courses to take up another PE or OE; approve CIAM only courses every semester; approve scheme of assessment for each course; Approval for and Mapping credits of certification courses; approval of list of nationally or internationally recognized professional certification courses with prometric testing.

Curriculum

Conceptual Frame work

(For Students admitted from the Academic Year 2019–20 and onwards)

Semester	Level of Course	Hrs. / Week	No of Courses	Range of Credits / Courses	Total Credits
PART – I					
A – Foundation Courses					
I to II	Humanities and Social Sciences **(HS)**	1- 3	5	1 - 3	11
I to IV	Basic Sciences **(BS)**	3 - 4	6	2 - 4	25
I to III	Engineering Sciences **(ES)**	3 - 6	8	2 - 4	19
B – Professional Core Courses					
II to VII	Professional Core **(PC)**	3 - 4	30	2 - 4	71
C – Elective Courses					
V to VIII	Professional Elective **(PE)**	3	6	3	18
V to VIII	Open Elective **(OE)**	3	4	3	12
D – Project Work					
V, VII & VIII	Project Work **(PW)**	4 - 16	3	2 - 8	12
E – Mandatory Courses Prescribed by AICTE / UGC (Not to be Included for CGPA)					
I, III & IV	Mandatory Course **(MC)**	3	4	NC	NC
Total Credit					**168**
PART II – Career Enhancement Courses (CEC)					
II	Soft Skills - I	2	1	1	1
III	Soft Skills - II	2	2	1	1
	Professional Certificate Course - I	2		1	1
IV	Career Ability Course - I	2	1	-	-
	NPTEL Online Certificate Courses	-	-	-	-
V	Career Ability Course - II	2	3	-	-
	Professional Certificate Course - II	2		1	1
	Summer Internship	-		1	1
VI	Career Ability Course - III	2	1	-	-
	NPTEL Online Certificate Courses	-	-	-	-
Total Credit					**05**
Total Credit to be Earned					**173**
PART III (Additional Credit Course - Not to be Included for CGPA)					
III	Problem Solving and Python Programming	20 - 30	1	-	**1**
IV	Non Destructive Testing (NDT)	20 - 30	1	-	**1**
V	Basics of Automation	40 - 60	1	-	**1**
VI	CNC Certification Programme	40 - 60	1	-	**1**
VII	Robotics and Embedded Systems	30 - 40	1	-	**1**

BoS Chairman

Scheme of Instructions and Examinations

(For Students admitted from the Academic Year 2019-20 and onwards)

Semester - I

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
Induction Programme											
B19ENT101	Functional English	**HS**	3	3	0	0	**3**	40	60	100	**3**
B19MAT101	Matrices and Differential Calculus	**BS**	4	3	0	1	**3**	40	60	100	**4**
B19CHT101	Engineering Chemistry	**BS**	3	3	0	0	**3**	40	60	100	**3**
B19CST102	Problem Solving and Programming using C	**ES**	3	3	0	0	**3**	40	60	100	**3**
B19MET101	Engineering Graphics	**ES**	6	2	4	0	**3**	40	60	100	**4**
B19CHP101	Chemistry Laboratory	**BS**	4	0	4	0	**3**	40	60	100	**2**
B19CSP102	Problem Solving and Programming using C Laboratory	**ES**	4	0	4	0	**3**	40	60	100	**2**
B19MCP101	Life Skills	**MC**	2	0	2	0	**-**	100	-	100	**NC**
Total Contact Hours/Week			**29**	**14**	**14**	**1**	**Total Credits**				**21**

Semester - II

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19ENT201	Professional English	**HS**	3	3	0	0	**3**	40	60	100	**3**
B19MAT201	Integral Calculus and Complex Analysis	**ES**	4	3	0	1	**3**	40	60	100	**4**
B19PHT101	Engineering Physics	**BS**	3	3	0	0	**3**	40	60	100	**3**
B19EET202	Basic Electrical, Electronics and Instrumentation Engineering	**ES**	3	3	0	0	**3**	40	60	100	**3**
B19MET201	Engineering Mechanics	**ES**	3	2	0	1	**3**	40	60	100	**3**
B19HST201	தமிழர்மரபு / Heritage of Tamils	**HS**	1	1	0	0	**3**	40	60	100	1
B19PHP101	Physics Laboratory	**BS**	4	0	4	0	**3**	40	60	100	**2**
B19MEP201	Basic Workshop Practices Laboratory	**ES**	4	0	4	0	**3**	40	60	100	**2**
B19EEP202	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	**ES**	4	0	4	0	**3**	40	60	100	**2**
B19CEP201	Soft Skills -1	**CEC**	2	0	2	0	**-**	100	-	100	**1**
Total Contact Hours/Week			**30**	**14**	**14**	**2**	**Total Credits**				**24**

BoS Chairman

Semester - III

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19MAT303	Transforms and Partial Differential Equations	**BS**	4	3	0	1	**3**	40	60	100	**4**
B19AET301	Fundamentals of Aerospace Engineering	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19AET302	Aero Engineering Thermodynamics	**PC**	4	3	0	1	**3**	40	60	100	**4**
B19AET303	Strength of Materials	**ES**	3	2	0	1	**3**	40	60	100	**3**
B19AET304	Fluid Mechanics and Machinery	**ES**	3	2	0	1	**3**	40	60	100	**3**
B19MCT302	Indian Constitution	**MC**	3	3	0	0	**-**	100	-	100	**NC**
B19HST301	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	**HS**	1	1	0	0	**3**	40	60	100	1
B19AEP301	Strength of Material and Fluid Mechanics and Machinery Laboratory	**ES**	4	0	4	0	**3**	40	60	100	**2**
B19AEP302	Thermodynamics Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19CEP301	Soft Skills -II	**CEC**	2	2	-	0	**-**	100	-	100	**1**
B19CEP302	Professional Certificate Course - I (UAV Systems and its application)	**CEC**	2	0	2	0	**-**	100	-	100	**1**
Total Contact Hours/Week			**32**	**18**	**10**	**4**	**Total Credits**				**24**

In plant Training – Minimum ONE WEEK has to be completed (Review will be conducted in the time of semester 4 and it will be included in the 4th semester Mark Statement)

Semester - IV

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19MAT402	Numerical Methods	**BS**	4	3	0	1	**3**	40	60	100	**4**
B19AET401	Low Speed Aerodynamics	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19AET402	Aircraft Structures –I	**PC**	3	2	0	1	**3**	40	60	100	**3**
B19AET403	Air Breathing Propulsion	**PC**	3	2	0	1	**3**	40	60	100	**3**
B19AET404	Aircraft Systems and Instruments	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19MCT301	Environmental Sciences	**MC**	3	3	0	0	**-**	100	-	100	**NC**
B19AEP401	Aerodynamics Laboratory	**PC**	4	0	4	0		40	60	100	**2**
B19AEP402	Aircraft Component Drawing Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19CEP401	Career Ability Course- I	**CEC**	2	0	2	0	**-**	100	-	100	**NC**
B19CEP402	In plant Training	**CEC**	-	-	-	-	**-**	-	-	-	**NC**
B19CEP403	Online Certification Courses	**CEC**	-	-	-	-	**-**	-	-	-	**NC**
Total Contact Hours / Week			**29**	**16**	**10**	**3**	**Total Credits**				**20**

Summer Internship-Duration 15 days (Review will be conducted in first week of Sem V and its credit will be included in Sem V) **Online Certificate Courses (like NPTEL, Swayam, Coursera, Udemy)** has to be completed within second year (NC)

BoS Chairman

Semester - V											
Course Code	**Course Name**	**Category**	**Instructional Hours**				**Assessment**				**Credit**
			Contact Periods	**T**	**P**	**TU**	**Hours of Exam. (ESE)**	**CIA**	**ESE**	**Total**	
B19AET501	Aircraft Performance	**PC**	4	3	0	1	**3**	40	60	100	**4**
B19AET502	Aircraft Structures - II	**PC**	3	2	0	1	**3**	40	60	100	**3**
B19AET503	High Speed Aerodynamics	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19AET504	Rocket and Spacecraft Propulsion	**PC**	3	3	0	0	**3**	40	60	100	**3**
	Professional Elective - I	**PE**	3	3	0	0	**3**	40	60	100	**3**
	Open Elective – I	**OE**	3	3	0	0	**3**	40	60	100	**3**
B19AEP501	Aircraft Structures Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19AEP502	Propulsion Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19AEP503	Mini project	**PW**	4	0	4	0	**-**	100	-	100	**2**
B19CEP501	Career Ability Course-II	**CEC**	2	0	2	0	**-**	100	-	100	**NC**
B19CEP502	Professional Certificate Course-II (Surface Modelling and Assembly)	**CEC**	2	0	2	0	**-**	100	-	100	**1**
B19CEP503	Summer Internship	**CEC**	0	-	-	-	**-**	100	-	100	**1**
Total Contact Hours / Week			**35**	**17**	**16**	**2**	**Total Credits**				**27**

Semester - VI											
Course Code	**Course Name**	**Category**	**Instructional Hours**				**Assessment**				**Credit**
			Contact Periods	**T**	**P**	**TU**	**Hours of Exam. (ESE)**	**CIA**	**ESE**	**Total**	
B19AET601	Finite Element Methods	**PC**	3	2	0	1	**3**	40	60	100	**3**
B19AET602	Composites Materials and Structures	**PC**	3	3	0	0	**3**	40	60	100	**3**
B19AET603	Aircraft Stability and Control	**PC**	3	3	0	0	**3**	40	60	100	**3**
	Professional Elective-II	**PE**	3	3	0	0	**3**	40	60	100	**3**
	Professional Elective-III	**PE**	3	3	0	0	**3**	40	60	100	**3**
	Open Elective-II	**OE**	3	3	0	0	**3**	40	60	100	**3**
B19AEP601	Aero Engine and Airframe Structural Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19AEP602	Computer Aided Simulation Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19AEP603	Aircraft Design Laboratory	**PC**	4	0	4	0	**3**	40	60	100	**2**
B19CEP601	Career Ability Course-III	**CEC**	2	0	2	0	**-**	100	-	100	**NC**
B19CEP602	Online Certification Courses	**CEC**	-	-	-	-	**-**	-	-	-	**NC**
Total Contact Hours/Week			**32**	**16**	**14**	**2**	**Total Credits**				**24**
Online Certification Courses (like NPTEL) has to be completed within third year (NC)											

BoS Chairman

Semester - VII												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AET701	Avionics	PC	3	3	0	0	3	40	60	100	3
B19AET702	Computational Fluid Dynamics	PC	3	3	0	0	3	40	60	100	3
	Professional Elective-IV	PE	3	3	0	0	3	40	60	100	3
	Professional Elective-V	PE	3	3	0	0	3	40	60	100	3
	Open Elective - III	OE	3	3	0	0	3	40	60	100	3
B19AEP701	Aircraft Systems Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AEP702	Flight Integration Systems and Control Laboratory	PC	4	0	4	0	3	40	60	100	2
B19AEP703	Project Phase-I	PW	4	0	4	0	3	40	60	100	2
Total Contact Hours / Week			27	15	12	0	Total Credits				21

Semester - VIII												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
	Professional Elective – VI	PE	3	3	0	0	3	40	60	100	3
	Open Elective-IV	OE	3	3	0	0	3	40	60	100	3
B19AEP801	Project Work	PW	16	0	16	0	3	40	60	100	8
Total Contact Hours / Week			22	6	16	0	Total Credits				14

HUMANITIES AND SOCIALSCIENCES (HS)												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19ENT101	Functional English	HS	3	3	0	0	3	40	60	100	3
B19ENT201	ProfessionalEnglish	HS	3	3	0	0	3	40	60	100	3
B19HST201	தமிழர்மரபு / Heritage of Tamils	HS	1	1	0	0	3	40	60	100	1
B19HST301	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology	HS	1	1	0	0	3	40	60	100	1

BoS Chairman

BASIC SCIENCES (BS)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19MAT101	Matrices and Differential Calculus	BS	4	3	0	1	3	40	60	100	4
B19CHT101	Engineering Chemistry	BS	3	3	0	0	3	40	60	100	3
B19CHP101	Chemistry Laboratory	BS	4	0	4	0	3	40	60	100	2
B19MAT201	Integral Calculus and Complex Analysis	BS	4	3	0	1	3	40	60	100	4
B19PHT201	Engineering Physics	BS	3	3	0	0	3	40	60	100	3
B19PHP201	Physics Laboratory	BS	4	0	4	0	3	40	60	100	2
B19MAT303	Transforms and Partial Differential Equations	BS	4	3	0	1	3	40	60	100	4
B19MAT402	Numerical Methods	BS	4	3	0	1	3	40	60	100	4

ENGINEERING SCIENCES (ES)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19CST101	Problem Solving and Programming using C	ES	3	3	0	0	3	40	60	100	3
B19MET101	Engineering Graphics	ES	6	2	4	0	3	40	60	100	4
B19CSP102	Problem Solving and Programming using C Laboratory	ES	4	0	4	0	3	40	60	100	2
B19EET202	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	0	0	3	3	40	60	100	3
B19MET201	Engineering Mechanics	ES	3	2	0	1	3	40	60	100	3
B19EEP202	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ES	4	0	4	0	3	40	60	100	2
B19MEP201	Basic Workshop Practices Laboratory	ES	4	0	4	0	3	40	60	100	2
B19AET303	Strength of Materials	ES	3	2	0	1	3	40	60	100	3
B19AET304	Fluid Mechanics and Machinery	ES	3	2	0	1	3	40	60	100	3
B19AEP301	Strength of Material and Fluid Mechanics and Machinery Laboratory	ES	4	0	4	0	3	40	60	100	2

BoS Chairman

PROFESSIONAL CORE (PC)												
Course Code	Course Name	Category	Instructional Hours				Assessment					Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total		
B19AET301	Fundamentals of Aerospace Engineering	PC	3	3	0	0	3	40	60	100		3
B19AET302	Aero Engineering Thermodynamics	PC	4	3	0	1	3	40	60	100		4
B19AEP302	Thermodynamics Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AET401	Low Speed Aerodynamics	PC	3	3	0	0	3	40	60	100		3
B19AET402	Aircraft Structures - I	PC	3	3	0	0	3	40	60	100		3
B19AET403	Air Breathing Propulsion	PC	3	2	0	1	3	40	60	100		3
B19AET404	Aircraft Systems and Instruments	PC	3	2	0	1	3	40	60	100		3
B19AEP401	Aerodynamics Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AEP402	Aircraft Component Drawing Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AET501	Aircraft Performance	PC	4	3	0	1	3	40	60	100		4
B19AET502	Aircraft Structures – II	PC	3	2	0	1	3	40	60	100		3
B19AET503	High Speed Aerodynamics	PC	3	3	0	0	3	40	60	100		3
B19AET504	Rocket and Spacecraft Propulsion	PC	3	3	0	0	3	40	60	100		3
B19AEP501	Aircraft Structures Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AEP502	Propulsion Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AET601	Finite Element Methods	PC	3	2	0	1	3	40	60	100		3
B19AET602	Composite Materials andStructures	PC	3	3	0	0	3	40	60	100		3
B19AET603	Aircraft Stability and Control	PC	3	3	0	0	3	40	60	100		3
B19AEP601	Aero Engine and Airframe structural Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AEP602	Computer Aided Simulation Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AEP603	Aircraft Design Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AET701	Avionics	PC	3	3	0	0	3	40	60	100		3
B19AET702	Computational Fluid Dynamics	PC	3	3	0	0	3	40	60	100		3
B19AEP701	Aircraft Systems Laboratory	PC	4	0	4	0	3	40	60	100		2
B19AEP702	Flight Integration Systemsand Control Laboratory	PC	4	0	4	0	3	40	60	100		2

BoS Chairman

PROFESSIONAL ELECTIVES (PE)

Semester – V

Elective – I

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AEE501	Mechanics of Machines	PE	3	3	0	0	3	40	60	100	3
B19AEE502	Principles of Industrial Management	PE	3	3	0	0	3	40	60	100	3
B19AEE503	Control Engineering	PE	3	3	0	0	3	40	60	100	3
B19AEE504	Heat Transfer	PE	3	3	0	0	3	40	60	100	3
B19AEE505	Experimental Stress Analysis		3	3	0	0	3	40	60	100	3

Semester - VI

Elective – II

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AEE601	Space Mechanics	PE	3	3	0	0	3	40	60	100	3
B19AEE602	Patent filing and grants	PE	3	3	0	0	3	40	60	100	3
B19AEE603	Fundamentals of Nano sciences in Aircraft Application	PE	3	3	0	0	3	40	60	100	3
B19AEE604	Cryogenics Engineering	PE	3	3	0	0	3	40	60	100	3
B19AEE605	Aircraft General Engineeringand Maintenance Practices	PE	3	3	0	0	3	40	60	100	3

Semester - VI

Elective – III

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AEE606	Vibration and Elements ofAero elasticity	PE	3	3	0	0	3	40	60	100	3
B19AEE607	Airline and airport Management	PC	3	2	0	1	3	40	60	100	3
B19AEE608	UAV & MAV Systems	PE	3	3	0	0	3	40	60	100	3
B19AEE609	Aircraft Materials	PE	3	3	0	0	3	40	60	100	3
B19AEE610	Experimental Aerodynamics	PE	3	3	0	0	3	40	60	100	3

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Semester - VII											
Elective – IV											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AEE701	Helicopter Theory	PE	3	3	0	0	3	40	60	100	3
B19AEE702	Crisis Management in Aircraft Industry	PE	3	3	0	0	3	40	60	100	3
B19AEE703	Navigation, Guidance and Control of Aerospace Vehicles	PE	3	3	0	0	3	40	60	100	3
B19AEE704	Non Destructive Testing and Evaluation	PE	3	3	0	0	3	40	60	100	3
B19AEE705	Airframe Maintenance and Repair	PE	3	3	0	0	3	40	60	100	3

Semester - VII											
Elective – V											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AEE706	Theory of Elasticity	PE	3	3	0	0	3	40	60	100	3
B19AEE707	Air Traffic Control andPlanning	PE	3	3	0	0	3	40	60	100	3
B19AEE708	Computer Integrated Manufacturing and Systems	PE	3	3	0	0	3	40	60	100	3
B19AEE709	Fatigue and Fracture	PE	3	3	0	0	3	40	60	100	3
B19AEE710	Aero Engine Maintenance and Repair	PE	3	3	0	0	3	40	60	100	3

Semester - VIII											
Elective – VI											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AEE801	Structural Dynamics	PE	3	3	0	0	3	40	60	100	3
B19AEE802	Civil Aviation Rules and Regulation	PE	3	3	0	0	3	40	60	100	3
B19AEE803	Rockets and Missiles	PE	3	3	0	0	3	40	60	100	3
B19AEE804	Hypersonic Aerodynamics	PE	3	3	0	0	3	40	60	100	3
B19AEE805	Wind Tunnel Techniques	PE	3	3	0	0	3	40	60	100	3

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OPEN ELECTIVES (OE)												
Semester – V												
Elective – I												
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AGO501	Environment and Agriculture	OE	3	3	0	0	3	40	60	100	3
B19BMO501	Introduction to Medical Physics	OE	3	0	3	0	3	40	60	100	3
B19BTO501	Food Processing and Preservation	OE	3	0	3	0	3	40	60	100	3
B19CSO501	Fundamentals of DBMS	OE	3	3	0	0	3	40	60	100	3
B19ECO501	Logic and Distributed control system	OE	3	3	0	0	3	40	60	100	3
B19EEO501	Rotating Machines and Transformers	OE	3	3	0	0	3	40	60	100	3
B19MEO501	Robotics	OE	3	3	0	0	3	40	60	100	3

Semester – VI											
Elective – II											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AGO601	Integrated Water Resources Management	OE	3	0	3	0	0	40	60	100	3
B19BMO601	Introduction to Biomedical Engineering	OE	3	3	0	0	3	40	60	100	3
B19BTO601	Basic Bioinformatics	OE	3	0	3	0	3	40	60	100	3
B19CSO601	E-Commerce Technology and Management	OE	3	3	0	0	3	40	60	100	3
B19ECO601	Geographic Information System	OE	3	3	0	0	3	40	60	100	3
B19EEO601	Fundamentals of Power Electronics	OE	3	3	0	0	3	40	60	100	3
B19MEO601	Entrepreneurship Development	OE	3	0	3	0	3	40	60	100	3

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Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
Semester – VII											
Elective – III											
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AGO701	Production Technology for Agriculture Machinery	OE	3	0	3	0	3	40	60	100	3
B19BMO701	Telemedicine	OE	3	3	0	0	3	40	60	100	3
B19BTO701	Fundamentals of Nanotechnology	OE	3	0	3	0	3	40	60	100	3
B19CSO701	Fundamentals of Cloud Computing	OE	3	3	0	0	3	40	60	100	3
B19ECO701	Introduction to communication systems	OE	3	3	0	0	3	40	60	100	3
B19EEO701	Hybrid ElectricalVehicles	OE	3	3	0	0	3	40	60	100	3
B19MEE503	3D Printing and Tooling	OE	3	0	3	0	3	40	60	100	3

Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
Semester – VIII											
Elective – IV											
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19AGO801	Agriculture Finance, Banking and Cooperative’s	OE	3	3	0	0	3	40	60	100	3
B19BMO801	Hospital Management	OE	3	3	0	0	3	40	60	100	3
B19BTO801	Biological Waste Management	OE	3	0	3	0	3	40	60	100	3
B19CSO801	Fundamentals of IoT	OE	3	3	0	0	3	40	60	100	3
B19ECO801	Wireless Technologies	OE	3	3	0	0	3	40	60	100	3
B19EEO801	Energy Conservation and Management	OE	3	3	0	0	3	40	60	100	3
B19MEO801	Lean Six Sigma	OE	3	0	3	0	3	40	60	100	3

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PROJECT WORK (PW)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19ECP503	Mini Project	PW	4	0	4	0	-	100	-	100	2
B19ECP703	Project work Phase – I	PW	6	0	6	0	3	40	60	100	2
B19ECP801	Project Work Phase - II	PW	16	0	16	0	3	40	60	100	8

CAREER ENHANCEMENT COURSE (CEC)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19CEP201	Soft Skills -I	CEC	2	0	2	0	-	100	-	100	1
B19CEP301	Soft Skills - II	CEC	2	0	2	0	-	100	-	100	1
B19CEP302	Professional Certificate Course-I	CEC	2	0	2	0	-	100	-	100	1
B19CEP401	Career Ability Course - I	CEC	2	0	2	0	-	100	-	100	NC
B19CEP402	In plant Training	CEC	-	-	-	-	-	-	-	-	NC
B19CEP403	Online Certification Courses	CEC	-	-	-	-	-	-	-	-	NC
B19CEP501	Career Ability Course - II	CEC	2	0	2	0	-	100	-	100	NC
B19CEP502	Professional Certificate Course-II	CEC	2	0	2	0	-	100	-	100	1
B19CEP503	Summer Internship	CEC	-	-	-	-	-	-	-	-	1
B19CEP601	Career Ability Course - III	CEC	2	0	2	0	-	100	-	100	NC
B19CEP602	Online Certificate Courses	CEC	-	-	-	-	-	-	-	-	NC

MANDATORY COURSE (MC)											
Course Code	Course Name	Category	Instructional Hours				Assessment				Credit
			Contact Periods	T	P	TU	Hours of Exam. (ESE)	CIA	ESE	Total	
B19MCP101	Life Skills	MC	2	0	2	0	-	100	-	100	NC
B19MCT301	Environmental Sciences	MC	3	3	0	0	-	100	-	100	NC
B19MCT302	Indian Constitution	MC	3	3	0	0	-	100	-	100	NC

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Semester - I

B.E / B.Tech	B19ENT101 - FUNCTIONAL ENGLISH	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To develop the basic reading and writing skills of first year engineering and technology students.
2.	To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
3.	To help learners develop their speaking skills and speak fluently in real contexts.
4.	To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT - I	12
Reading	Short comprehension passages, practice in skimming-scanning
Writing	Instructions, developing hints.
Listening	Listening to peer group
Speaking	Self Introduction, introducing others
Language development	Parts of Speech, Wh-Questions, asking and answering-yes or no questions
Vocabularydevelopment	Prefixes-suffixes, articles.

UNIT - II	12
Reading	Skimming and Scanning - Pre & post reading, comprehension questions, including dialogues and conversations
Writing	Paragraph writing, free writing, day to day events
Listening	Telephonic conversations, conceptual conversations
Speaking	Sharing information of a personal kind, greeting, taking leave
Language development	Regular & Irregular Verbs, tenses
Vocabularydevelopment	Guessing meanings of words in context.

UNIT - III	12
Reading	Short texts and longer passages, note making
Writing	Understanding text structure, use of reference words and discourse markers, jumbled sentences
Listening	Listening to longer texts and filling up the table, product description, narratives from different sources.
Speaking	Short presentation, asking about routine actions and expressing facts and opinions

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Language development	Idioms and Phrases, Degrees of comparison, sentence pattern and types of sentences
Vocabularydevelopment	Single word substitutes

UNIT - IV		**12**
Reading	Intensive and Extensive reading, reading longer texts, reading different types of texts-magazines,	
Writing	Letter writing, informal or personal letters, e-mails	
Listening	Listening to dialogues or conversations and completing exercises based on them	
Speaking	Speaking about one self, speaking about one's friend, conceptual conversations	
Language development	Direct / indirect questions	
Vocabularydevelopment	Synonyms - antonyms, phrasal verbs	

UNIT - V		**12**
Reading	Longer texts-close reading	
Writing	Writing short essays, developing an outline, identifying main and subordinate ideas, dialogue Writing	
Listening	Listening to talks, conversations	
Speaking	Participating in conversations, short group conversations	
Language development	Spelling and Punctuations, modal verbs	
Vocabulary development	Collocations	
	Total Instructional hours : 60	

	Course Outcomes	**K Level**
CO1	Develop basic reading and effective reading skills	K3
CO2	Build their grammatical understanding.	K3
CO3	Explain their opinions efficiently in writing in formal and informal contexts through letters	K2
CO4	Develop their vocabulary skills	K3
CO5	Develop their knowledge through LSRW skills	K3

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Teaching Pedagogy	
1.	Black Board
2.	Blended Learning
3.	Peer Group Learning

Assessment Tools (Direct & Indirect)	
Direct	
1.	Continuous Internal Assessment I, II, III and Mid Semester
2.	Assignment
3.	Presentation
4.	End Semester Examination

Text Books	
1.	Board of Editors. Fluency in English A course book for Engineering and Technology. Orient Blackswan, Hyderabad: 2016.
2.	Sudharshana. N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

Reference Books	
1.	Raman, Meenakshi and Sharma, Sangeetha “Technical Communication Principles and Practice” Oxford University Press: New Delhi, 2014
2.	Kumar, Suresh. E. “Engineering English” Orient Blackswan: Hyderabad, 2015.
3.	Booth L. Diana, Project Work, Oxford University Press, Oxford: 2014.

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B.E / B.Tech	B19MAT101 - MATRICES AND DIFFERENTIAL CALCULUS (Common to all Branches)	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	Matrix algebra is one of the powerful tools to handle practical problems arising in the field of engineering.
2.	The goal of this course is to achieve conceptual understanding and to retain the best traditions of differential calculus.
3.	This is a foundation course which mainly deals with topics such as single variable and multivariable differential calculus and plays an important role in the understanding of science, engineering, medical and business among other disciplines.
4.	The syllabus is designed to provide the basic tools of differential calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.

UNIT - I	MATRICES	12

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley - Hamilton theorem – Quadratic form: Nature, Reduction to canonical form by orthogonal transformation.

UNIT - II	FUNCTIONS OF SEVERAL VARIABLES	12

Partial differentiation – Total derivative – Change of variables – Jacobians – Taylor‘s series expansion for functions of two variables – Maxima and minima of functions of two variables – Lagrange‘s method of undetermined multipliers.

UNIT - III	ORDINARY DIFFERENTIAL EQUATIONS	12

Higher order linear ordinary differential equations with constant coefficients - Higher order linear ordinary differential equations with variable coefficients Cauchy Euler‘s and Cauchy Legendre‘s type - Method of variation of parameters (ordinary differential equations with constant coefficients) - Simultaneous differential equations.

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UNIT - IV	APPLICATIONS OF ORDINARY DIFFERENTIAL EQUATIONS	12
Solution of specified differential equations connected with electric circuits, Bending of beams and simple harmonic motion (Differential equations and associated conditions need to be given).		

UNIT - V	LAPLACE TRANSFORMS	12
Existence conditions - Properties (excluding proofs) - Transform of standard functions - Transforms of derivatives and integrals - Periodic function – Inverse Laplace transform - Applications to solution of linear second order ordinary differential equations with constant coefficients.		
		Total Instructional hours : 60

	Course Outcomes	K Level
CO1	Make use of Eigen values and Eigen vectors to reduce the quadratic form into canonical form and to find the powers of a square matrix	K3
CO2	Determine solution for maxima and minima problems	K3
CO3	To solve differential equations which existing in different engineering disciplines	K3
CO4	Develop the applications of differential equations in various engineering field	K3
CO5	Apply Laplace transform and inverse transform to solve differential equations with constant coefficients	K3

	Teaching Pedagogy
1.	Black Board Method
2.	Peer Group
3.	Blended Learning

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Assessment Tools (Direct & Indirect)	
1.	CIA
2.	Class Test
3.	Assignment

Text Books	
1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media - An imprint of Lakshmi Publications Pvt., Ltd., New Delhi, 7th Edition, 2017.
3.	Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

Reference Books	
1.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2018.
2.	Srimantha Pal and Bhunia, S.C, "Engineering Mathematics", Oxford University Press, 2015.
3.	Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.
4.	Veerarajan T., "Engineering Mathematics for Semester I and II", Tata McGraw Hill Publishing Company, New Delhi, 2015.
5.	Gean Duffy., "Advanced Engineering Mathematics with MATLAB", A CRC Press Company, Boca Raton London , New York Washington, D.C, 2nd edition 2009.

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B.E / B.Tech	B19CHT101 - ENGINEERING CHEMISTRY (Common to all Branches)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
2.	To make the students conversant with basics of polymer chemistry.
3.	To make the students conversant with basic of electrochemical reactions and corrosion.
4.	To make the student acquire sound knowledge of energy devices.
5.	To develop an understanding of the basic concepts of nano materials.

UNIT - I	WATER TECHNOLOGY	9

Hardness of water : Types, Expression of Hardness and their units, boiler troubles Scale and sludge, caustic embrittlement, boiler corrosion, priming and foaming.
Water quality standards : WHO, BIS and CPCB
Treatment of Boiler feed water : Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning).
External treatment : Ion exchange process, Zeolite process.
Desalination of brackish water : Reverse Osmosis - Municipal water treatment, break point chlorination.

UNIT - II	POLYMERS AND COMPOSITES	9

Polymers : Definition, polymerization, types - addition and condensation polymerization - Tacticity - biodegradable and conducting polymers
Plastics : Classification, preparation, properties and uses of PVC, Teflon, Nylon-6,6 and Epoxy resin.
Rubber : Vulcanization of rubber, Synthetic rubbers - Butyl rubber, SBR.
Moulding : Ingredients - compression and Injection.
Composites : Definition, types, polymer matrix composites - FRP.

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UNIT - III	ELECTROCHEMISTRY AND CORROSION	9
Electrochemistry : Redox reaction, Electrode potential - oxidation potential, reduction potential, Nernst equation (derivation) - Measurement and applications - Electrochemical Series and its significance. **Corrosion :** causes- factors- types-chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method.		

UNIT - IV	ENERGY DEVICES	9
Batteries : Types of batteries – Primary battery (dry cell), Secondary battery (lead acid battery, lithium-ion-battery), Fuel Cells- H_2 & O_2 fuel cell. **Super Capacitors :** Principle, Construction, working and applications. **Photo voltaic cell :** Solar cells - Principle, construction, working and applications.		

UNIT - V	NANOCHEMISTRY	9
Basics - distinction between molecules, nanoparticles and bulk materials - Surface area to volume ratio - Quantum confinement (0D,1D,2D,3D) - Synthesis: Top down process (Ball milling) - Bottom up process (Chemical Vapour Deposition and Sol-Gel method) - properties of nano materials - optical, electrical, thermal and mechanical - applications (nano products of today)		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Outline the principle and characterization of water for the treatment of potable and industrial purposes.
CO2	Illustrate and interpret about the basics of Polymer Chemistry.
CO3	Relate the principles of electrochemical reactions and corrosion.
CO4	Understand the concepts of energy devices and its engineering applications.
CO5	Understand the basics of Nano-chemistry and its applications.

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Text Books	
1.	Dara, S S and Umare, S S, “A Textbook of Engineering Chemistry”, Chand S & Company Ltd., New Delhi, 2015.
2.	Jain, P C and Monika Jain, “Engineering Chemistry”, DhanpatRai Publishing Company Pvt. Ltd., New Delhi, 2015
3.	Vairam, S Kalyani, P and Suba Ramesh, “Engineering Chemistry”, Wiley India Pvt. Ltd.,New Delhi, 2013.

Reference Books	
1.	Friedrich Emich, “Engineering Chemistry”, Scientific International Pvt. Ltd., New Delhi, 2014.
2.	Prasanta Rath, “Engineering Chemistry”, Cengage Learning India Pvt. Ltd., Delhi, 2015.
3.	Shikha Agarwal, “Engineering Chemistry - Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.
4.	Charles P. Poole and Frank J. Owens, "Introduction to nanotechnology", John Wiley Sons, New Jersey, 2003.

BoS Chairman

B.E / B.Tech	B19CST102 – PROBLEM SOLVING AND PROGRAMMING USING C (Common to AERO, AGRI, BT & MECH)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the organization of a digital computer, number systems, algorithm and Pseudo code.
2.	To learn the basic of C Programming and control statements.
3.	To understand the concept of Arrays and String operations.
4.	To develop the simple applications using Functions and Pointers.
5.	To understand and develop the applications using structures and unions in C.

UNIT - I	INTRODUCTION	8

Computer : Generation and Classification of Computers, Basic Organization of a Computer.
Number System : Binary, Decimal, Conversion, Problems.
Need for logical analysis and thinking : Algorithm, Pseudo code, Flow Chart.

UNIT - II	C PROGRAMMING BASICS	10

Introduction to "C" programming : Fundamentals, structure of a "C" program, compilation and linking processes.
Basic elements of "C" programming : Constants, Variables, Data Types, Expressions, operators, Managing Input and Output operations.
Control Statements : Decision Making and Branching, Looping statements.
Problem Solving : Solving simple scientific and statistical problems.

UNIT - III	ARRAYS AND STRINGS	9

Arrays : Initialization, Declaration, One dimensional and two-dimensional arrays.
String : String operations, String Arrays.
Simple programs : sorting, searching, matrix operations.

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UNIT - IV	FUNCTIONS AND POINTERS	9
Function : Definition of function, Declaration of function, pass by value, Pass by reference, Recursion. **Pointers :** Definition, Initialization, Pointers arithmetic, Pointers and arrays, Example Problems.		

UNIT - V	STRUCTURES AND UNIONS	9
Introduction : need for structure data type, structure definition, Structure declaration, Structure within a structure. Union, Storage classes, Pre-processor directives, Files handling.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Outline the different problem-solving techniques.
CO2	Make use of various data types and control structures to solve a given problem.
CO3	Develop C programs with different types of arrays and string operations.
CO4	Experiment with the usage of pointers and functions in C.
CO5	Build C Programs data using structures and unions.

Text Books	
1.	Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2016.
2.	Yashavant P. Kanetkar. “Let Us C”, 16^{th} Edition, BPB Publications, 2016.

Reference Books	
1.	Byron S Gottfried, “Programming with C”, Schaum‟s Outlines, Fourth Edition, Tata Mc Graw - Hill, 2018
2.	Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2016.
3.	Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.
4.	Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.
5.	Kernighan, B. and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

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B.E / B.Tech	B19MET101 – ENGINEERING GRAPHICS (Common to All)	T	P	TU	C
		2	4	0	4

Course Objectives	
1.	Understand the basic principles of engineering drawing and construction of curves used in engineering field.
2.	To explain about standard principles of orthographic projection of points, lines and planes.
3.	Enable the students to be familiar with various positions of simple solids and disseminate them into different orthographic views.
4.	Create intricate details of components through sections and develop its surfaces.
5.	To improve visualization skills in developing pictorial and perspective views.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)	2
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.	

UNIT - I	PLANE CURVES AND FREE HANDSKETCHING	14
Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three - Dimensional objects – Layout of views - Free hand sketching of multiple views from pictorial views of objects.		

UNIT - II	PROJECTION OF POINTS, LINES AND PLANE SURFACE	14
Orthographic projection - principles - Principal planes - First angle projection - Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.		

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UNIT - III	PROJECTION OF SOLIDS	14
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.		

UNIT - IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	14
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.		

UNIT - V	ISOMETRIC AND PERSPECTIVE PROJECTIONS	14
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids - prisms, pyramids and cylinders by visual ray method.		

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)	3
Introduction to drafting packages and demonstration of their use.	
Total Instructional hours : 75	

Course Outcomes : Students will be able to	
CO1	Construct the basic engineering curves and freehand sketching of basic geometrical constructions and multiple views of objects.
CO2	Draw problems related to projections of points, straight lines and planes.
CO3	Build the projection of simple solids.
CO4	Apply the knowledge acquired on practical applications of sectioning and development of solids.
CO5	Construct simple solids and its sections in isometric view and projections and to draw its perspective views.

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Text Books	
1.	N.D. Bhattand V.M. Panchal, “Engineering Drawing”, Charotar Publishing House, 53^{rd} Edition, 2014.
2.	K. Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International Publishers, 2017.

Reference Books	
1.	K.R. Gopalakrishna.,“Engineering Drawing” (Vol. I & II combined) Subhas Publications, Bangalore, 2018.
2.	K.V. Natarajan, “A text book of Engineering Graphics”, 28^{th} Edition, Dhana Lakshmi Publishers, Chennai, 2015.
3.	N.S. Parthasarathy and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015.

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B.E / B.Tech	B19CHP101 - CHEMISTRY LABORATORY (Common to all Branches)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To make the students to acquire practical skills in the determination of water quality parameters and estimation of ions through volumetric and instrumental analysis.

List of Experiments

Expt. No.	Description of the Experiments (Any 8 experiments)
1.	Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinityin water sample.
2.	Determination of total, temporary & permanent hardness of water by EDTA method.
3.	Determination of DO content of water sample by Winkler's method.
4.	Determination of chloride content of water sample by Argentometric method.
5.	Estimation of copper in brass.
6.	Determination of strength of given hydrochloric acid using pH meter.
7.	Estimation of iron content of the given solution using potentiometer.
8.	Estimation of iron content of the water sample using spectrophotometer (1,10-Phenanthroline/ thiocyanate method).
9.	Estimation of sodium and potassium present in water using flame photometer.
10.	Conductmetric titration of strong acid vs strong base
11.	Estimation of iodine in common salt.
12.	Estimation of calcium in milk powder.
	Total Instructional hours : 30

Course Outcomes : The students will be able to	
CO1	Relate the acquired knowledge in the quantitative estimation of alkalinity, hardness, DO and chloride ion present in the water samples.
CO2	Understand the nature of water quality parameters to find the pollution level in water.
CO3	Estimate the amount of copper, iodine, calcium in alloys and food products.
CO4	Apply the spectroscopic techniques for the quantitative estimation of sodium, potassium and Ferrous ion.
CO5	Analyze the solutions by electrochemical parameters like conductivity, pH and EMF.

	Text Books
1.	Vogel's Textbook of Quantitative Chemical Analysis, 8^{th} edition, 2014.

BoS Chairman

B.E / B.Tech	B19CSP102 - PROBLEM SOLVING AND PROGRAMMING USING C LABORATORY (Common to AERO, AGRI, BT & MECH)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To develop programs in C using the role of constants, variables, identifiers, operators and other building blocks of C Language.
2.	To create the C programs by using the conditional expressions and looping statements.
3.	To develop the applications in C by using the concept of Array and pointers dealing with memory management.
4.	To develop the applications in C using Structures and unions.
5.	To develop programs using file operations.

List of Experiments

Expt. No.	Description of the Experiments
1.	Develop a C program with I/O Statements.
2.	Develop a C program by using arithmetic operators.
3.	Construct a C program by using the Decision making, branching and looping statements.
4.	Develop a simple calculator which performs basic operations.
5.	Develop a C program to perform sorting of numbers using array.
6.	Develop a C program to perform matrix multiplication using two-dimensional array.
7.	Implementa C program to perform the string operations using build in methods.
8.	Develop a C Program to experiment with call by value and call by reference.
9.	Develop a C program to perform linear search using pointers.
10.	Develop a payroll system of an employee using structures.
11.	Develop a C program to create student details using Unions.
12.	Develop a C program to perform file operations.
	Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply arithmetic operations.
CO2	Build applications using control statements.
CO3	Develop applications using arrays.
CO4	Build applications using functions and pointers.
CO5	Apply structures and unions and file handling concepts to develop applications.

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BoS Chairman

B.E / B.Tech	B19MCP101- LIFE SKILLS (Common to all Branches)	T	P	TU	C
		0	2	0	0

Course Objectives	
1.	To make the students to enhance their attitude, confidence and communication.

UNIT - I	TRANSITION MANAGEMENT	6
Getting started - Getting involved - being responsible - adapting to the new environment.		

UNIT - II	VISION AND GOAL	6
Defining Vision and designing Goals in accordance - Seeing College life as a path towards Lifetime Goals.		

UNIT - III	VALUES VIRTUES	6
Not as preaching but a way of life to succeed in all aspects of life.		

UNIT - IV	FOCUS	6
Focus on basic quality in all activities .Tips to enhance memory and focus skills.		

UNIT - V	LEARNING SKILLS AND PASSIONATE LEARNER	6
Transforming information into knowledge and learning to read people like a book - hedding out inhibitions - Blossoming with talent and leadership abilities.		
		Total Instructional hours : 30

Course Outcomes : Students will be able to		K Level
CO1	Develop the adapting skills to various environment.	K3
CO2	Identify the vision and Goal towards success.	K3
CO3	Build Values and Virtues to succeed in life.	K3
CO4	Show focus in all activities	K3
CO5	Develop knowledge to understand various kinds of people.	K3

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Semester - II

B.E / B.Tech	B19ENT201 - PROFESSIONAL ENGLISH (Common to all Branches)	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	Develop strategies and skills to enhance their ability to read and comprehend engineering and technology texts.
2.	Foster their ability to write convincing job applications and effective reports.
3.	Develop their speaking skills to make technical presentations, participate in group discussions.
4.	Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT - I	12
Listening	Listening to motivational speech
Speaking	Asking for and giving directions
Reading	Reading short technical texts from newspapers and magazines
Writing	Extended definitions, Gerunds & Infinitives, writing checklists, recommendation
Vocabularydevelopment	Technical vocabulary, abbreviations
Language development	Subject verb agreement

UNIT - II	12
Listening	Listening to TED talks
Speaking	Describing a process, narrating a story
Reading	Reading longer technical texts, summarizing
Writing	Interpreting charts, graphs
Vocabularydevelopment	Vocabulary used in formal letters/emails and reports
Language development	British and American spelling, numerical adjectives.

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UNIT - III		12
Listening	Listening to classroom lectures, commentaries and announcements	
Speaking	Oral presentations	
Reading	Longer texts both general and technical, practice in speed reading	
Writing	process writing, use of sequence words, analytical essays and issue based essays	
Vocabularydevelopment	Sequence words, misspelled words.	
Language development	Identifying different types of sentences.	

UNIT - IV		12
Listening	Listening to documentaries, listening to resume preparation and making notes.	
Speaking	Techniques of effective presentations	
Reading	Reading for detailed comprehension	
Writing	Email etiquette, job application- cover letter, résumé preparation, Vocabulary	
Vocabularydevelopment	Finding suitable synonyms, paraphrasing	
Language development	Clauses, if conditionals	

UNIT - V		12
Listening	Listening to talks based on profession	
Speaking	Participating in a group discussion	
Reading	Reading and understanding technical articles	
Writing	Writing reports, minutes of a meeting, writing feasibility, survey and industrial reports	
Vocabularydevelopment	Verbal analogies	
Language development	Reported speech, active and passive voice, impersonal passive	
		Total Instructional hours : 60

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Course Outcomes : Students will be able to		K Level
CO1	Develop their Vocabulary skills	K3
CO2	Develop their grammatical proficiency	K3
CO3	Develop strategies and skills to enhance their ability to read and comprehend	K3
CO4	Interpret graphical representation by comparing and contrasting the information	K2
CO5	Extend their knowledge through LSRW skills	K2

Teaching Pedagogy	
1.	Black Board
2.	Blended Learning
3.	Peer Group Learning

Assessment Tools (Direct & Indirect)	
1.	Continuous Internal Assessment I, II, III and Mid Semester
2.	Assignment
3.	Presentation
4.	End Semester Examination

Text Books	
1.	Board of editors, “Fluency in English A Course Book for Engineering and Technology”, Orient Blackswan, Hyderabad: 2016.
2.	Sudharshana.N.P and Saveetha. C, “English for Technical Communication”, Cambridge University Press: New Delhi, 2016.

Reference Books	
1.	Raman, Meenakshi and Sharma, Sangeetha, “Technical Communication Principles and Practice”, Oxford University Press: New Delhi, 2014.
2.	Kumar, Suresh. E, “Engineering English”, Orient Blackswan: Hyderabad, 2015
3.	Booth L. Diana, “Project Work”, Oxford University Press, Oxford: 2014.

BoS Chairman

B.E / B.TECH	B19MAT201 - INTEGRAL CALCULUS AND COMPLEX ANALYSIS (Common to all Branches)	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.
2.	To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
3.	The various methods of complex analysis can be used for efficiently solving the problems that occur in various branches of engineering disciplines.
4.	To develop an understanding of the standard techniques of complex integration so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.

UNIT - I	DEFINITE AND INDEFINITE INTEGRALS	12

Definite and Indefinite integrals - Substitution rule - Techniques of integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions.

UNIT - II	MULTIPLE INTEGRALS	12

Double integrals: Change of order of integration – Double integrals in polar coordinates - Area enclosed by plane curves – Triple integrals: Evaluation of triple integrals-Volume as triple integral (Simple problems).

UNIT - III	VECTOR CALCULUS	12

Gradient and directional derivative - Divergence and curl - Solenoidal and Irrotational vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Verification of theorem and applications (for cubes and rectangular parallell opipeds).

UNIT - IV	COMPLEX DIFFERENTIATION	12

Analytic functions - Cauchy - Riemann equations (excluding proof) – Properties of analytic function – Harmonic conjugate - Construction of analytic function by Milne Thomson method – Bilinear transformation.

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UNIT - V	COMPLEX INTEGRATION	12
Cauchy‘s integral theorem – Cauchy‘s integral formula – Taylor’s and Laurent’s series - Singularities – Residues – Cauchy‘s Residue theorem – Evaluation of real integrals – use of circular contour and semicircular contour (excluding poles on real axis).		
		Total Instructional hours : 60

Course Outcomes : Students will be able to		K Level
CO1	Develop Fundamental Theorem of Calculus, techniques of Integration such as substitution, partial fractions and integration by parts.	K3
CO2	Make use of integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.	K3
CO3	Apply the line, surface and volume integrals for verification of Green‘s, Gauss and Stokes theorems.	K3
CO4	Construct Analytic function and develop Conformal Mapping.	K3
CO5	Identify infinite series of a complex function within the contour and types of the singularities, finding of complex integrals.	K3

Teaching Pedagogy	
1.	Black Board Method
2.	Peer Group
3.	Blended Learning

Assessment Tools (Direct & Indirect)	
1.	CIA
2.	Class Test
3.	Assignment

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Text Books	
1.	Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2.	Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

Reference Books	
1.	Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media - An imprint of Lakshmi Publications Pvt., Ltd., New Delhi, 7th Edition, 2015.
2.	Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
3.	O'Neil, P.V.,"Advanced Engineering Mathematics", Cengage Learning India Pvt.Ltd, New Delhi, 7th Edition, 2017.
4.	Sastry, S.S, "Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.
5.	Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
6.	Gean Duffy., "Advanced Engineering Mathematics with MATLAB", (A CRC Press Company), Boca Raton London, New York Washington, D.C, 2nd Edition, 2009.

BoS Chairman

B.E / B.Tech	B19PHT101 - ENGINEERING PHYSICS (Common to all Branches)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the students enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT - I	PROPERTIES OF MATTER	9
Elasticity - Modulus, types of modulus, Stress - strain diagram and its uses - factors affecting elastic modulus and tensile strength - Twisting couple, torsion pendulum; theory and experiment. Bending of beams - Bending moment - cantilever; theory and experiment - uniform and non-uniform bending; theory and experiment - I-shaped girders.		

UNIT - II	PHOTONICS AND FIBER OPTICS	9
Lasers; Population of energy levels, Einstein's A and B coefficients derivation- resonant cavity, optical amplification (qualitative) – Types; Nd-YAG Laser, Semiconductor lasers; homojunction and heterojunction, Industrial and Medical Applications. Fibre Optics; Principle, Numerical Aperture and Acceptance Angle - Types of optical fibres (material, refractive index, mode) – Applications; Fibre optic communication system - Block diagram, fibre optic sensors- pressure and displacement sensors – Endoscopy.		

UNIT - III	ULTRASONICS	9
Classification of Sound, Production of ultrasonics - Magnetostriction generators, piezoelectric generators - acoustic grating – cavitation - ultrasonic cleaning. Applications; Non Destructive Testing, pulse echo system through transmission and reflection modes, A, B and C, scan displays- Engineering applications; SONAR,- Medical applications; Sonograms.		

UNIT - IV	QUANTUM PHYSICS	9
Black body radiation; Planck's theory (derivation) - wave particle duality - debroglie wavelength - electron diffraction - Davisson - Germer experiment - concept of wave function and its physical significance. Wave equation; Schroedinger's time independent and time dependent equations, particle in a one - dimensional rigid box - Applications; Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM).		

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UNIT - V	CRYSTAL PHYSICS	9
Crystal Structures; Single crystalline, polycrystalline and amorphous materials - unit cell - crystal systems - Bravais lattices - Miller indices - inter - planar distances - coordination number and packing factor for SC, BCC, FCC and HCP structures - Crystal imperfections; Point and Line defects. Growth of single crystals; Solution and melt growth techniques (Bridgeman & Czhochralski).		
		Total Instructional hours : 45

Course Outcomes : Students will be able to		K Level
CO1	Explain the basics of Properties of matter and its applications.	K2
CO2	Illustrate the basics of Laser, Fiber optics and their applications.	K2
CO3	Infer the concepts of ultrasonics and its applications	K2
CO4	Interpret the basic knowledge of Quantum theory that could be helpful in understanding the wave functions of a particle	K2
CO5	Classify and compare the different types of crystals, their structures and its preparation techniques	K2

Teaching Pedagogy	
1.	Black Board
2.	Blended Learning
3.	Experimental study
4.	Peer Group Learning
5.	Flipped Learning

Assessment Tools	
1.	Continuous Internal Assessment I, II, III and Mid Semester
2.	Assignment

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3.	Presentation
4.	End Semester Examination.

Text Books	
1.	Bhattacharya, D.K. &Poonam, T, “Engineering Physics”, Oxford University Press, 2015.
2.	Gaur, R.K. & Gupta, S.L. “Engineering Physics”, Dhanpat Rai Publishers, 2012.
3.	Pandey, B.K. & Chaturvedi, S. “Engineering Physics”, Cengage Learning India, 2012.
4.	Rajendran V, ‘Engineering Physics”, Tata McGraw Hill, Publishing Company, New Delhi, 2011.

Reference Books	
1.	Halliday, D., Resnick, R. & Walker, J. “Principles of Physics’’, Wiley, 2015.
2.	Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”, Cengage Learning, 2010.
3.	Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics”, W.H. Freeman, 2007.
4.	Avadhanulu M.N, “Engineering Physics”, Volume 1”, S.Chand & Company Ltd., New Delhi, 2010.

BoS Chairman

B.E.	B19EET202 - BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING (Common To AERO & MECH)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To Understand the Electric circuit laws.
2.	To Understand the single and three phase circuits and wiring.
3.	To Understand the Working principles of Electrical Machines.
4.	To Understand the Working principle of various electronic devices.
5.	To Understand the Working principle of measuring instruments.

UNIT - I	ELECTRICAL CIRCUITS	9

Basic circuit components - Ohms Law - Kirchoff's Law - Instantaneous Power - Inductors - Capacitors - Independent and Dependent Sources. Steady state solution of DC circuits - Nodal analysis, Mesh analysis. Theorem's - Thevinin's Theorem, Norton's Theorem, Maximum Power transfer theorem - Superposition Theorem.

UNIT - II	AC CIRCUITS	9

Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three phase balanced circuits – Three phase loads. Housing wiring, industrial wiring, materials of wiring.

UNIT - III	ELECTRICAL MACHINES	9

Principles of operation and characteristics of; DC machines, Transformers (single and three phase). Principles of operation, characteristics and speed control of Synchronous machines, three phase and single phase induction motors. (Qualitative)

UNIT - IV	ELECTRONIC DEVICES & CIRCUITS	9

Types of Materials – Silicon & Germanium - N type and P type materials – PN Junction – Forward and Reverse Bias – Semiconductor Diodes. Bipolar Junction Transistor – Characteristics – Field Effect Transistors – Transistor Biasing. Introduction to operational Amplifier – Inverting Amplifier – Non Inverting Amplifier – DAC – ADC. (Qualitative)

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UNIT - V	MEASUREMENTS & INSTRUMENTATION	9
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric, piezoelectric, photoelectric, Hall effect and Mechanical. Classification of instruments - Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters - three-phase power measurements – instrument transformers (CT and PT). (Qualitative)		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply Ohms law , Kirchhoff's laws and Theorems to analyze the given electrical circuits.
CO2	Interpret waveforms, RMS value, Power and power factor in AC Circuits.
CO3	Outline the basic construction of wiring and materials.
CO4	Explain the construction and operation of dc machines, transformers, Induction motors and synchronous Machines.
CO5	Explain the operation and characteristics of basic semiconductor devices.
CO6	Explain the construction and working principle of various measuring instruments & Indicating instruments.

Text Books	
1.	Leonard S Bobrow, Foundations of Electrical Engineering‖, Oxford University Press, 2013.
2.	Kothari D P and NagarathI.J ,Electrical Machines - Basic Electrical and Electronics Engineering, McGraw Hill Education (India) Private Limited, Third Reprint, 2016.
3.	Sawhney A.K., Dhanpat Rai, 'A Course in Electrical & Electronic Measurements & Instrumentation', 2010.

Reference Books	
1.	N K De, Dipu Sarkar, Basic Electrical Engineering, Universities Press (India) Private Limited 2016.
2.	Vincent Del Toro, Electrical Engineering Fundamentals, Pearson Education, Second Edition New Delhi, 2015.
3.	John Bird, Electrical Circuit Theory and Technology‖, Elsevier, Fifth Edition, 2014.
4.	Murthy D.V.S. 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015.

BoS Chairman

B.E.	B19MET201 - ENGINEERING MECHANICS (Common to AERO, AGRI,BME and MECH)	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To make the students understand the vector and scalar representation of forces and the static equilibrium of particles.
2.	To understand the moment and the equilibrium of rigid bodies in two dimensions and three dimensions.
3.	To make the students understand the properties of surfaces and solidsin relation to moment of inertia.
4.	To understand laws of motion, kinetics of particles and their interrelationship.
5.	To make the students understandeffect of friction on equilibrium and the dynamic forces exerted in rigid bodies.

UNIT - I	STATICS OF PARTICLES	12
Introduction – Units and Dimensions – Laws of Mechanics – Principle of transmissibility – Lami's theorem, Parallelogram and triangular Law of forces – Coplanar Forces – rectangular components – Equivalent systems of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space using vector representation.		

UNIT - II	EQUILIBRIUM OF RIGID BODIES	12
Free body diagram – Types of supports – Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions.		

UNIT - III	PROPERTIES OF SURFACES AND SOLIDS	12
Centroids and centre of mass – Centroids of lines and areas – T section, I section, Angle section and Hollow section by using standard formula –Theorems of Pappus - Area moments of inertia of plane areas – T section, I section, Angle section and Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Mass moment of inertia for cylindrical and spherical solids from first principle.		

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UNIT - IV	DYNAMICS OF PARTICLES	12
Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.		

UNIT - V	FRICTION AND RIGID BODY DYNAMICS	12
Friction force – Laws of sliding friction – Equilibrium analysis of simple systems with sliding friction, wedge friction – General Plane motion of simple rigid bodies such as cylinder and wheel.		
Total Instructional hours : 60		

Course Outcomes : Students will be able to	
CO1	Explain the basics and state of particles and understand the vectorial and scalar representation of forces and moments.
CO2	Interpret static equilibrium of particles and rigid bodies in two and three dimensions.
CO3	Identify the properties of surfaces & solids in relation to moment of inertia.
CO4	Illustrate the laws of motion, kinematics and kinetics of particles and their interrelationship.
CO5	Apply the effect of Friction and dynamics of rigid bodies on general plane motion.

Text Books	
1.	Vela Murali, "Engineering Mechanics", Oxford University Press,2010.
2.	Dr. Bansal, R.K. Sanjay Bansal, "Engineering Mechanics", Lakshmi publication Pvt. Ltd., 2016.

Reference Books	
1.	Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", McGraw- Hill Education (India) Pvt. Ltd. 10th Edition, 2013.
2.	Hibbeller, R.C., Engineering Mechanics: Statics and Dynamics, 13th Edition, Prentice Hall, 2013.
3.	Irving H. Shames, Engineering Mechanics - Statics and Dynamics, Pearson Education Asia Pvt. Ltd., 2011.
4.	Meriam JL and Craige, "Engineering Mechanics: statics and dynamics", John Willey and Sons publication 8th Edition, 2011.

J.P. [signature]

BoS Chairman

B.E. / B.Tech.	B19HST201 - தமிழர் மரபு	T	P	TU	C
		1	0	0	1

அலகு - I	மொழி மற்றும் இலக்கியம்	3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு - II	மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை	3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கள், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு - III	நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்	3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு - IV	தமிழர்களின் திணைக் கோட்பாடுகள்	3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி

அலகு - V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு	3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டில் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப் படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

மொத்தம் - 15 காலங்கள்

Text - Cum - Reference Books

BoS Chairman

1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the Histroyb of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
11.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

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B.E. / B.Tech.	B19HST201 - HERITAGE OF TAMILS (Common to all Branches)	T	P	TU	C
		1	0	0	1

UNIT - I	LANGUAGE AND LITERATURE	3
Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan		

UNIT - II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE	3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils		

UNIT - III	FOLK AND MARTIAL ARTS	3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils		

UNIT - IV	THINAI CONCEPT OF TAMILS	3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas		

UNIT - V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books		
		Total Instructional hours : 15

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Text - Cum - Reference Books	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the Histroy of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
11.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

BoS Chairman

B.E / B.Tech	B19PHP101 - PHYSICS LABORATORY (Common to all Branches)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To introduce different experiments to test basic understanding of physics concepts applied in properties of matter, optics, thermal physics, and liquids.

List of Experiments

Expt. No.	Description of the Experiments (Any 8 experiments)
1.	Determination of rigidity modulus – Torsion pendulum
2.	Determination of Young's modulus by non-uniform bending method
3.	Determination of Young's modulus by uniform bending method
4.	Determination of wavelength of mercury spectrum – spectrometer grating
5.	Determination of Refractive index of a prism – spectrometer
6.	Determination of thickness of a thin wire – Air wedge method
7.	a. Determination of wavelength, and particle size using Laser
	b. Determination of acceptance angle in an optical fiber.
8.	Determination of thermal conductivity of a bad conductor – Lee's Disc method
9.	Determination of band gap of a semiconductor
10.	Determination of specific resistance of the wire using Carey Foster's Bridge
11.	Experiment with Poiseuille's apparatus to determine the viscosity of liquids
12.	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer
	Total Instructional hours : 30

Course Outcomes		K LEVEL
CO1	Classify the elastic properties of the materials by using uniform, non- uniform Bending method and torsional pendulum apparatus.	K2
CO2	Illustrate the Optical properties of light with the help Classify the elastic properties of the materials by using uniform, non- uniform Bending method and torsional pendulum apparatus of LASER, applications, Spectrometer and to determine the thickness of the wire using air wedge.	K2
CO3	Interpret the thermal conductivity of bad conductor using Lee's Disc apparatus.	K2
CO4	Utilize the band gap apparatus to find the band gap a semiconductor and determine the specific resistance of the wire using Carey Foster's Bridge.	K3
CO5	Make use of Poiseuilles's apparatus to determine the viscosity of liquid and to determine the velocity of sound and compressibility of liquid by using ultrasonic Interferometer.	K3

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B.E / B.TECH	B19MEP201 – BASIC WORKSHOP PRACTICE LABORATORY (GROUP - A & B) (Common to all Branches)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical Engineering.
2.	To provide exposure to the students with hands on experience on various basic engineering practices in Electrical Engineering.
3.	To provide exposure to the students with hands on experience on various basic engineering practices in Electronics Engineering.

List of Experiments		
GROUP – A (CIVIL & MECHANICAL)		
I	**Civil Engineering Practices**	**12**
Plumbing and Carpentry Works		
1.	Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings.	
2.	Preparation of wooden joints by sawing, planning and cutting.	
	i. Planning & Polishing operation	
	ii. Half lap joint	
	iii. Cross lap joint	

II	Mechanical Engineering Practices	18
Welding Workshop Study of welding tools and equipment's - Study of various welding methods - Instruction of BI standards and reading of welding drawings.		

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Exercise in arc welding for making	
1.	Lap joint
2.	Butt joint
3.	Demonstration of gas welding and cutting.
Machine Shop	
1.	Drilling and Tapping
2.	Lathe Exercise – Facing operation
3.	Lathe Exercise – Straight turning and Chamfering
Sheet metal	
Making of small parts using sheet metal	
1.	Tray Funnel
2.	Funnel
Machine assembly practice and Demonstration	
1.	Machine assembly practice on
2.	Study of centrifugal pump
3.	Study of air conditioner

GROUP – B (ELECTRICAL & ELECTRONICS)	**30**

Expt. No.	Description of the Experiments
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2.	Fluorescent lamp and Stair case wiring.
3.	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

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4.	Measurement of energy using single phase energy meter.
5.	Measurement of resistance to earth of an electrical equipment.
6.	Study of Electronic components and equipment's – Resistor color coding
7.	Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
8.	Study of logic gates AND, OR, EX-OR and NOT.
9.	Soldering & desoldering practices.
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Explain the pipe connections and identify the various components used in plumbing.
CO2	Develop simple wooden joints using wood working tools and simple components using lathe and drilling machine.
CO3	Construct simple lap, butt and tee joints using arc welding equipment and simple parts using sheet metal.
CO4	Construct Residential house wiring, Fluorescent lamp wiring and Stair case wiring.
CO5	Measure electrical quantities such as voltage, current, power & power factor in RLC Circuit, resistance to earth, AC signal parameter (peak-peak, RMS period, frequency) and ripple factor.
CO6	Examine logic gates (AND, OR, EOR and NOT), Electronic components and equipment's.

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B.E.	B19EEP202 - BASIC ELECTRICAL, ELECTRONICS & INSTRUMENTATION ENGINEERING LABORATORY (Common to AERO and MECH)	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To gain practical experience on electric circuits and verification of Theorems.
2.	To train the students in performing various tests on electrical drives.
3.	To train the students in performing various tests on Transducers & Sensors.

List of Experiments

Expt. No.	Description of the Experiments
1.	Verification of Circuit Laws.
2.	Verification of Circuit Theorems.
3.	Measurement of three phase power.
4.	Diode based application circuits.
5.	Transistor based application circuits.
6.	Calibration of Rotometer.
7.	RTD and Thermistor.
8.	Load test on DC shunt motor.
9.	Speed control of DC shunt motor.
10.	Load test on Single phase Transformer.
11.	Load test on single phase Induction motor.
	Total Instructional hours : 45

Course Outcomes : Students will be able to

CO1	Analyze the Performance characteristics of different electrical machines.
CO2	Analyze the concept of circuit laws and theorems in an electric circuit.
CO3	Use Wattmeters for measuring three phase power.
CO4	Design simple circuits involving diodes and transistors.
CO5	Analyze the characteristics of transducers and sensors.
CO6	Analyze the various electrical parameters of ac signals using Oscilloscope.

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B.E. / B.Tech	B19CEP201 – SOFT SKILLS I	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	Enhance communication and problem solving skills
2.	Develop the inter personal skills
3.	Enhance the Employability and Career Skills of students

UNIT - I	SELF EVALUATION	6
Introducing to soft skills, familiarize yourself, Self-understanding, SWOT analysis, Goal Setting.		
UNIT - II	**INNOVATIVE THINKING**	**6**
Divergent thinking, Encourage curiosity, Write your story, Poster making		
UNIT - III	**COMMUNICATION SKILLS**	**6**
Just a Minute, workplace communication, Role Play, Extempore, Effectiveness of body language.		
UNIT - IV	**EMOTIONAL INTELLIGENCE**	**6**
Personal etiquette and relationship, Stress and Time Management.		
UNIT - V	**PERSONALITY DEVELOPMENT**	**6**
Leadership skills, Managerial skills, corporate etiquette, Team Building Language Development.		
		Total Instructional hours : 30

	Course Outcomes	K Level
CO1	Develop the Interpersonal Skills	K3
CO2	Show the creative skill in different aspects.	K2
CO3	Explain their ideas through conversations.	K2

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CO4	Develop adequate Soft Skills required for the workplace	K3
CO5	Develop leadership qualities	K3

Teaching Pedagogy	
1.	Blended Learning
2.	Peer Group Learning

Assessment Tools (Direct & Indirect)	
1.	Continuous Internal Assessment I, II, III and Mid Semester
2.	Assignment
3.	Presentation

Reference Books	
1.	Butterfield, Jeff, “Soft Skills for Everyone”, Cengage Learning, New Delhi, 2015.
2.	S. Hariharanetal, “Soft Skills”, MJP Publishers: Chennai, 2010.
3.	Peter, Francis, “Soft Skills and Professional Communication”, New Delhi: Tata McGraw Hill, 2012.

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Semester - III

B.E. - AERO, AGRI & EEE	B19MAT303 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To introduce the basic concepts of PDE for solving standard partial differential equations.
2.	To understand Fourier series analysis in representation of Periodic signals.
3.	To develop Fourier series techniques in solving wave and heat flow problems.
4.	To acquaint the student with Fourier transform techniques used in wide variety of situations.
5.	To develop the concept of Z transforms techniques for discrete time systems.

UNIT - I	PARTIAL DIFFERENTIAL EQUATIONS	12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of first order partial differential equations of the forms f(p,q) = 0, z = px + qy + f(p,q), – Lagrange's linear equation – Linear homogeneous partial differential equations of second and higher order with constant coefficients.

UNIT - II	FOURIER SERIES	12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series - Parseval's identity – Harmonic analysis.

UNIT - III	BOUNDARY VALUE PROBLEMS	12

Classification of second order linear PDE – Method of separation of variables – Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction – Fourier series solutions in Cartesian coordinates.

UNIT - IV	FOURIER TRANSFORMS	12

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties (excluding proof) – Transforms of simple functions – Convolution theorem (without proof) – Parseval's identity.

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UNIT - V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS	12
Z - transforms – Elementary properties – Inverse Z - transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem (without proof) – Formation of difference equations – Solution of difference equations using Z – transform.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Solve the partial differential equations with constant coefficients.
CO2	Solve differential equations using Fourier series analysis.
CO3	Apply Fourier series to solve boundary value problems.
CO4	Experiment with Fourier transforms techniques in engineering problems.
CO5	Make use of Z-transforms to solve difference equations.

Text Books	
1.	Grewal B.S., “Higher Engineering Mathematics", 44^{th} Edition, Khanna Publishers, New Delhi, 2020.
2.	Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics" Volume III, S. Chand & Company Ltd., 2016.

Reference Books	
1.	Ramana B.V., “Higher Engineering Mathematics”, McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
2.	Erwin Kreyszig, “Advanced Engineering Mathematics”, 10^{th} Edition, John Wiley, India, 2016.
3.	James G., "Advanced Modern Engineering Mathematics", 3^{rd} Edition, Pearson Education, 2007. Publications Pvt. Ltd, 2014.
4.	Wylie C. Ray and Barrett Louis C., “Advanced Engineering Mathematics” Tata McGraw Hill Education Pvt. Ltd, 6^{th} Edition, New Delhi, 2012.

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B.E.	B19AET301 - FUNDAMENTALS OF AEROSPACE ENGINEERING	T	P	L	C
		3	0	0	3

Course Objectives	
1.	To understand the Historical evaluation of Airplanes.
2.	To study the different component systems and functions.
3.	To understand the basic properties and principles behind the flight.
4.	To study the various types of power plants used in aircrafts.
5.	To study the different structures & construction.

UNIT - I	HISTORY OF FLIGHT	8
Balloon flight – ornithopers - Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.		

UNIT - II	AIRCRAFT CONFIGURATIONS AND ITS CONTROLS	10
Different types of flight vehicles, classifications - Components of an airplane and their functions - Conventional control, powered control - Basic instruments for flying - Typical systems for control actuation.		

UNIT - III	BASICS OF AERODYNAMICS	9
Physical Properties and structures of the Atmosphere - Temperature, pressure and altitude relationships - Newton's Law of Motions applied to Aeronautics - Evolution of lift, drag and moment - Aerofoils, Mach number, Maneuvers.		

UNIT - IV	BASICS OF PROPULSION	9
Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production - Comparative merits, Principle of operation of rocket - types of rocket and typical applications - Exploration into space.		

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UNIT - V	BASICS OF AIRCRAFT STRUCTURES	9
General types of construction - Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure - Metallic and non-metallic materials - Use of Aluminum alloy, titanium, stainless steel and composite materials - Stresses and strains - Hooke's law - stress-strain diagrams - elastic constants - Factor of Safety.		
		Total Instructional hours : 45

Course Outcomes	
At the end of the course, the students will be able to	
CO1	Outline the history of Aircraft and developments over the years. (K2)
CO2	Identify the types and classification of components and control system. (K3)
CO3	Apply the various forces and properties in Aircraft. (K3)
CO4	Categorize the different types of engines and principles of rocket. (K4)
CO5	Identify different type of fuselage and constructions. (K3)

Text Books	
1.	Anderson, J.D., Introduction to Flight, McGraw-Hill; 8th edition, 2015
2.	Stephen.A. Brandt, Introduction to aeronautics: A design perspective, 2nd edition, AIAA Education Series, 2004.

Reference Books	
1.	Kermode, A.C. Flight without Formulae, Pearson Education; Eleven edition, 2011.

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B.E.	B19AET302 - AERO ENGINEERING THERMODYNAMICS	T	P	L	C
		3	0	1	4

Course Objectives	
1.	To study the quantitative analysis of machine and processes for transformation of energy and between work and heat.
2.	To understand the concept and cycles involved with entropy
3.	To develop basic concept of air cycle and its efficiency
4.	To understand the various phases of material with respect to pressure, temperature and velocity
5.	To develop basic concept of gas turbine engines, heat transfer and also to quantify through measurement of related properties, to these energies and their interactions.

UNIT - I	FUNDAMENTAL CONCEPT AND FIRST LAW	12

Concept of continuum, macroscopic approach, thermodynamic systems – closed, open and isolated. Property, state, path and process, quasi-static process, work, internal energy, enthalpy, specific heat capacities and heat transfer, SFEE, application of SFEE to jet engine components, First law of thermodynamics, relation between pressure, volume and temperature for various processes, Zeroth law of thermodynamics.

UNIT - II	SECOND LAW AND ENTROPY	12

Second law of thermodynamics – Kelvin Planck and Clausius statements of second law. Reversibility and Irreversibility, Thermal reservoir, Carnot theorem. Carnot cycle, Reversed Carnot cycle, efficiency, COP, Thermodynamic temperature scale - Clausius inequality, Concept of entropy, Entropy change for various processes. Mixing of fluids.

UNIT - III	AIR STANDARD CYCLES	12

Otto, Diesel, Dual, Ericsson, Atkinson, Stirling and Brayton cycles - air standard efficiency - mean effective pressure.

UNIT - IV	FUNDAMENTALS OF VAPOUR POWER CYCLES	12

Properties of pure substances – solid, liquid and vapour phases, phase rule, p-v, p-T, T-v, T-s, h-s diagrams, p-v-T surfaces, thermodynamic properties of steam - calculations of work done and heat transfer in non-flow and flow processes - standard Rankine cycle, Reheat and Regeneration cycle. Heat rate, Specific steam consumption, Tonne of refrigeration.

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UNIT - V	BASICS OF PROPULSION AND HEAT TRANSFER	12
Classification of jet engines - basic jet propulsion arrangement – Engine station number, thrust equation – Specific thrust, SFC, TSFC, specific impulse, actual cycles, isentropic efficiencies of jet engine components, polytropic efficiency, conduction in parallel, radial and composite wall, basics of convective and radiation heat transfer.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Relate laws of thermodynamics to jet engine components. (K2)
CO2	Apply the law of thermodynamics to find out the efficiency of the system. (K3)
CO3	Identify efficient cycle of Air and jet engine. (K3)
CO4	Construct the condition of working medium. (K3)
CO5	Analyze the heat transfer in complex systems involving several heat transfer mechanics. (K4)

Text Books	
1.	Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2013.
2.	Rathakrishnan E., “Fundamentals of Engineering Thermodynamics”, Prentice-Hall India, 2005.
3.	Yunus A. Cengel and Michael A. Boles, “Thermodynamics: An Engineering Approach” McGraw-Hill Science / Engineering / Math; 7th edition 2010.

Reference Books	
1.	Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
2.	Holman J.P., “Thermodynamics”, 3rd Edition, McGraw-Hill, 2007.
3.	Merala C, Pother, Craig W, Somerton, “Thermodynamics for Engineers”, Schaum Outline Series, Tata McGraw-Hill, New Delhi, 2004.
4.	Ramalingam K.K. “Thermodynamics”, Sci-Tech Publications, 2006.
5.	Venwylen and Sontag, “Classical Thermodynamics”, Wiley Eastern, 1987.

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B.E.	B19AET303 – STRENGTH OF MATERIALS	L	P	TU	C
		2	0	1	3

Course Objectives	
1.	To understand the concepts of stress, strain, principal stresses and principal planes.
2.	To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
3.	To determine stresses and deformation in circular shafts and helical spring due to torsion.
4.	To compute slopes and deflections in determinate beams by various methods.
5.	To study the stresses and deformations induced in thin and thick shells.

UNIT - I	STRESS, STRAIN AND DEFORMATION OF SOLIDS	9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT - II	TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM	9

Beams – types transverse loading on beams – Shear force and bending moment in beams - Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT - III	TORSION	9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT - IV	DEFLECTION OF BEAMS	9

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

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UNIT - V	THIN CYLINDERS, SPHERES AND THICK CYLINDERS	9
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theorem.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the concept of stress and strain in simple compound bars. (K2)
CO2	Illustrate the load transferring mechanism in beams and shear distribution due to shearing force and bending moment. (K2)
CO3	Apply basic equation of simple torsion in designing of shafts, helical spring and columns. (K3)
CO4	Identify the slope and deflection in beams using different methods. (K3)
CO5	Solve the thin and thick shells for the applied internal and external pressures. (K3)

Text Books	
1.	Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2.	Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

Reference Books	
1.	Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2.	Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
3.	Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4.	Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.

BoS Chairman

B.E.	B19AET304 – FLUID MECHANICS AND MACHINERY	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To study the properties of fluids and concept of control volume.
2.	To study applications of the conservation laws to flow through pipes.
3.	To understand the importance of dimensional analysis
4.	To understand the importance of various types of flow in pumps.
5.	To understand the importance of various types of flow in turbines.

UNIT - I	FLUID PROPERTIES AND FLOW CHARACTERISTICS	9

Units and dimensions - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, capillarity and surface tension. Flow characteristics – concept of control volume - application of control volume to continuity equation, energy equation and momentum equation.

UNIT - II	FLOW THROUGH CIRCULAR CONDUITS	9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation – friction factor - Moody diagram - commercial pipes - minor losses – Flow through pipes in series and parallel.

UNIT - III	DIMENSIONAL ANALYSIS	9

Need for dimensional analysis – methods of dimensional analysis – Similitude – types of similitude - Dimensionless parameters - application of dimensionless parameters – Model analysis.

UNIT - IV	PUMPS	9

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies – velocity components at entry and exit of the rotor - velocity triangles - Centrifugal pumps – working principle - work done by the impeller - performance curves - Reciprocating pump - working principle – Rotary pumps – classification.

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UNIT - V	TURBINES	9
Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines - working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Relate the mathematical knowledge to predict the properties and characteristics of fluid. (K2)
CO2	Identify the major and minor losses associated with pipe flow in piping networks. (K3)
CO3	Make use of mathematical prediction to select the nature of physical quantity. (K3)
CO4	Analyze critical performance of pumps. (K4)
CO5	Analyze critical performance of turbines. (K4)

Text Books	
1.	Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.

Reference Books	
1.	Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011.
2.	Kumar K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (p) Ltd., New Delhi, 2016.
3.	Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, “Fluid Mechanics and Machinery”, 2011.
4.	Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010.

BoS Chairman

B.E.	B19MCT302 – INDIAN CONSTITUTION	T	P	TU	C
		3	0	3	0

Course Objectives	
1.	To understand the constitutional organization of India.
2.	To understand the hierarchy of Union Government of India.
3.	To know the hierarchy and systems of state Governments.
4.	To know the power, role of local administration in Government sectors.
5.	To understand role, function of Election Commission of India.

UNIT - I	THE CONSTITUTION - INTRODUCTION	6

- The History of the Making of the Indian Constitution
- Preamble and the Basic Structure, and its interpretation
- Fundamental Rights and Duties and their interpretation
- State Policy Principles

UNIT - II	UNION GOVERNMENT	6

- Structure of the Indian Union
- President – Role and Power
- Prime Minister and Council of Ministers
- Lok Sabha and Rajya Sabha

UNIT - III	STATE GOVERNMENT	6

- Governor – Role and Power
- Chief Minister and Council of Ministers
- State Secretariat

UNIT - IV	LOCAL ADMINISTRATION	6

- District Administration
- Municipal Corporation
- Zila Panchayat

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UNIT - V	ELECTION COMMISSION	6

- Role and Functioning
- Chief Election Commissioner
- State Election Commission

Total Instructional hours : 30

Course Outcomes : Students will be able to	
CO1	Develop the knowledge on organization of Indian constitution. (K3)
CO2	Explain the hierarchy organization of Indian Government. (K2)
CO3	Explain various systems and applications of State Governments. (K2)
CO4	Utilize the power and functional systems of local administration. (K3)
CO5	Apply the role and administration of Indian Election Commission. (K3)

Text Books	
1.	Rajeev Bhargava, "Ethics and Politics of the Indian Constitution", Oxford University Press, New Delhi, 2008.
2.	Fadia, B.L., "The Constitution of India",Sahitya Bhawan; New edition 2017.
3.	Basu, D.D., "Introduction to the Constitution of India", Lexis Nexis; Twenty - Third 2018.

Suggested Software / Learning Websites	
1.	https://www.constitution.org/cons/india/const.html
2.	http://www.legislative.gov.in/constitution-of-india
3.	https://www.sci.gov.in/constitution
4.	https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/

BoS Chairman

B.E. / B.Tech.	B19HST301 - தமிழரும் தொழில்நுட்பமும்	T	P	TU	C
		1	0	0	1

அலகு - I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	3

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு - II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோவில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை

அலகு - III	உற்பத்தித் தொழில் நுட்பம்	3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருவாக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்

அலகு - IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்	3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக் குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்

அலகு - V	அறிவியல் தமிழ் மற்றும் கணித்தமிழ்	3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின் பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்

மொத்தம் - 15 காலங்கள்

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Text - Cum - Reference Books	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL
6.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the Histroy of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
11.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

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B.E. / B.Tech.	B19HST301 - TAMILS AND TECHNOLOGY	T	P	TU	C
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UNIT - I	WEAVING AND CERAMIC TECHNOLOGY	3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries		

UNIT - II	DESIGN AND CONSTRUCTION TECHNOLOGY	3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period		

UNIT - III	MANUFACTURING TECHNOLOGY	3
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel - Copper and goldCoins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram		

UNIT - IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society		

UNIT - V	SCIENTIFIC TAMIL & TAMIL COMPUTING	3
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project		
		Total Instructional hours : 15

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Text - Cum - Reference Books	
1.	தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2.	கணினித் தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
3.	கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5.	Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by : International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils (Dr. S.V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by : International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by : International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10.	Studies in the Histroyb of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by : The Author)
11.	Porunai Civilization (Jointly Published by : Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by : RMRL) - Reference Book.

BoS Chairman

B.E.	B19AEP301 - STRENGTH OF MATERIAL AND FLUID MECHANICS AND MACHINERY LABORATORY	T	P	TU	C
		0	4	0	2

STRENGTH OF MATERIAL LABORATORY

Course Objectives

1.	To study the stress -strain curve and understand its behaviour.
2.	To study the mechanical properties of materials when subjected to different types of loading.
3.	To study the linearly elastic behaviour of mild steel under torsion.
4.	To evaluate the fracture behaviour of materials when subjected to impact loading.
5.	To examine the effect of heat treatment on mechanical properties of materials.

List of Experimentst

Expt. No.	Description of Equipment	
1.	Tension test on a mild steel rod	
2.	Double shear test on Mild steel and Aluminum rods	
3.	Torsion test on mild steel rod	
4.	Impact test on metal specimen	
5.	Hardness test on metals - Brinnell and Rockwell Hardness Number	
6.	Deflection test on beams	
7.	Compression test on helical springs	
8.	Strain Measurement using Rosette strain gauge	
9.	Effect of hardening - Improvement in hardness and impact resistance of steels.	
10.	Tempering- Improvement Mechanical properties Comparison	
	i.	Unhardened specimen
	ii.	Quenched Specimen and
	iii.	Quenched and tempered specimen.

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11.	Microscopic Examination of	
	i.	Hardened samples
	ii.	Hardened and tempered samples
		Total Instructional hours : 30

Course Outcomes : Students will be able	
CO1	Determine the mechanical properties like tensile and compressive strength, shear strength of materials. (K5)
CO2	Identify the materials for best practices based on mechanical properties like hardness and toughness.(K3)
CO3	Analyze the deformation behavior of materials for different loading conditions.(K4)
CO4	Utilize the strain gauges for measurement of loaded beams. (K3)
CO5	Analyze the different hardened samples using various hardness machines.(K4)

List of Equipment for Batch of 30 Students

Sl. No.	**Name of the Equipment**	**Quantity**
1.	Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
2.	Torsion Testing Machine (60 NM Capacity)	1
3.	Impact Testing Machine (300 J Capacity)	1
4.	Brinell Hardness Testing Machine	1
5.	Rockwell Hardness Testing Machine	1
6.	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7.	Metallurgical Microscopes	3
8.	Muffle Furnace (800 °C)	1

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FLUID MECHANICS AND MACHINES LABORATORY

Course Objectives

1.	To study the coefficient of discharge for various flow meters.
2.	To calculate rate of flow for the liquids.
3.	To determine friction factor for a pipes.
4.	To verify the performance of the pumps.
5.	To verify the performance of the turbines.

List of Experiments

Expt. No.	Description of the Experiments
1.	Determination of the Coefficient of discharge of given Orifice meter.
2.	Determination of the Coefficient of discharge of given Venturi meter.
3.	Calculation of the rate of flow using Rota meter.
4.	Determination of friction factor for a given set of pipes.
5.	Conducting experiments and drawing the characteristic curves of centrifugal pump / submergible pump
6.	Conducting experiments and drawing the characteristic curves of reciprocating pump.
7.	Conducting experiments and drawing the characteristic curves of Gear pump.
8.	Conducting experiments and drawing the characteristic curves of Pelton wheel.
9.	Conducting experiments and drawing the characteristics curves of Francis turbine.
10.	Conducting experiments and drawing the characteristic curves of Kaplan turbine.
	Total Instructional hours : 30

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Course Outcomes : Students will be able	
CO1	Analyze the various flow meters for measuring coefficient of discharge. (K4)
CO2	Examine the operation of the variation in friction factor for the given set of pipes. (K4)
CO3	Analyze the discharge coefficients of flow meters for calibration of centrifugal and reciprocating pumps.(K4)
CO4	Examine the performance of Pelton wheel and gear pump. (K4)
CO5	Evaluate the characteristics curves of the operation of fluid machineries. (K5)

List of Equipment for a Batch of 30 Students

Sl. No.	Name of the Equipment	Quantity
1.	Orifice meter setup	1
2.	Venturi meter setup	1
3.	Rotameter setup	1
4.	Pipe Flow analysis setup	1
5.	Centrifugal pump/submergible pump setup	1
6.	Reciprocating pump setup	1
7.	Gear pump setup	1
8.	Pelton wheel setup	1
9.	Francis turbine setup	1
10.	Kaplan turbine setup	1

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B.E.	B19AEP302 - THERMODYNAMICS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To understand the Operating Principle, components Performance of the four stroke Engine and to calculate the overall efficiency of the Engine.
2.	To calculate and understand the Heat flux of the specimen, thermal conductivity. overall heat, transfer co-efficient for the composite wall
3.	To understand the Carnot Cycle used in the refrigeration system and compressor component and to calculate the Coefficient of the performance to measure the refrigeration effects and psychometric properties of air.
4.	To calculate the Specific heat of the specimen and thermal conductivity.
5.	To understand the different types of water flows in the Heat Exchanger and to analyze and calculate Mass and specific heat and Overall Heat transfer Coefficient of the Flows.

List of Experiments

Expt. No.	Description of the Experiments
1.	Performance test on a 4-stroke engine
2.	Valve timing of a 4 – stroke engine and port timing of a 2 stroke engine
3.	Determination of heating value of a fuel
4.	Determination of thermal resistance of a composite wall.
5.	COP test on a vapour compression refrigeration test rig
6.	COP test on a vapour compression air-conditioning test rig
7.	Determination of specific heat of solid
8.	Determination of thermal conductivity of solid.
9.	Determination of effectiveness of a parallel flow heat exchanger
10.	Determination of effectiveness of a counter flow heat exchanger
	Total Instructional hours : 60

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Course Outcomes : Students will able to	
CO1	Experiment with the diesel/petrol engine for its performance characteristics. (K3)
CO2	Determine the properties of the fuels. (K5)
CO3	Evaluate the performance of vapor compression refrigeration systems. (K5)
CO4	Determine the properties of the solids. (K5)
CO5	Analyze the effectiveness of different types of water flow in the heat exchanger. (K4)

List of Equipment for a Batch of 30 Students

Sl. No.	Details of Equipment	Qty Req.	Experiment No.
1.	4 stroke twin cylinder diesel engine	1	1
2.	Cut section model of 4 stroke diesel engine and cut section model of 2 stroke petrol engine	1	2
3.	Parallel and counter flow heat exchanger test rig	1	3, 4
4.	Bomb Calorimeter	1	5
5.	Vapour compression refrigeration test rig	1	9
6.	Vapour compression air-conditioning test rig	1	10
7.	Conductive heat transfer set up	1	7
8.	Composite wall	1	8

BoS Chairman

B.E. / B.TECH	B19CEP301 – SOFT SKILLS - II (Common to all Branches)	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To enhance communication skills through LSRW skills.
2.	To enrich interpersonal skills through integrated activities.
3.	To develop social and professional etiquette.
4.	To identify and apply employability skills for professional success.

UNIT - I	COMMUNICATION SKILLS	6

Define Listening - Types of Listening - Listening and Filling Information - Basis of Phonetics - Strategies of Effective Reading - Reading & Responding to Business Communications - E-mail.

UNIT - II	INTERPERSONAL SKILLS	6

Interpersonal Skills - Need & Components – Understanding Inter cultural Competence – Team Work - Problem Solving Skills – Workplace Conflict Management & Resolutions.

UNIT - III	EMOTIONAL INTELLIGENCE	6

Key Elements of Emotional Intelligence - Self Awareness – Self Performance - Psychometric Analysis - Relationship Management - Critical Thinking & Reasoning.

UNIT - IV	BUSINESS ETIQUETTE	6

Define Etiquette – Types & Importance of Workplace Etiquette – Basic Corporate Etiquette - Telephone Etiquette - Meeting & E-mail Etiquette - Customer Service Etiquette.

UNIT - V	CORPORATE SKILLS	6

Work Ethics - Adaptability - Analytical Reasoning - Lateral Thinking - Stress & Time Management - Professionalism in Today's Workforce.

Total Instructional hours : 30

BoS Chairman

Course Outcomes : At the end of the course the student will be able to	
CO1	Develop professional communication through LSRW skills.
CO2	Apply systematic approach in problem solving skills.
CO3	Utilize leadership skills with ability to work in a team.
CO4	Demonstrate employability skills.
CO5	Analyze & adapt workplace etiquette.

Reference Books	
1.	R1 - Meenakshi Raman, Shalini Upadhyay, 'Soft Skills', Cengage Learning India Pvt. Ltd, Delhi, 2018.
2.	R2 - M.S.Rao,'Soft Skills Enhancing Employability', I. K. International Publishing House Pvt. Ltd, New Delhi, 2010.
3.	R3 - Sabina Pillai, Agna Fernandez, 'Soft Skills and Employability Skills', Cambridge University Press, 2018.
4.	R4 - John Peter.A, 'Self – Development and Professional Excellence', Cengage Learning India Pvt. Ltd, Delhi, 2019.

BoS Chairman

B.E.	B19CEP302 - UAV SYSTEMS & ITS APPLICATIONS	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To understand the basic concepts of UAV systems design.
2.	To introduce the basics of Airframe and Hardware for UAV.
3.	To study the preliminary design requirements for an UAV system.
4.	To understand the basic Avionics system required for UAV design.
5.	To identify the various applications of the UAV systems.

UNIT - I	INTRODUCTION TO UAV	6
History of UAV – Classification – Basic terminology – Introduction to UAS – Recent trends in Mini UAV and MAV – Models and Prototypes – UAV Pilot Training.		

UNIT - II	BASICS OF AIRFRAME & HARDWARE	6
Airframe – Dynamics – Structures – Aerodynamics – Control surfaces –Specifications – Autopilot – Sensors – Sensor calibration		

UNIT - III	PAYLOADS, CONTROLS & PATH PLANNING	6
Payloads – Ground controls software – Displays – Parameter settings – Simulation – System ground test – Waypoint navigation – GCS operation training.		

UNIT - IV	REMOTE SENSING, GIS & IT USES	6
Aerial remote sensing – DGPS – Software – Photogrammetry – Concepts of GIS –Applications of RS and GIS – Servers & nodes – Computing – Memory Capacity.		

UNIT - V	UAV APPLICATIONS & WEB GIS	6
Military – Agriculture – Forestry – Disaster – Mining – Construction – Transport – Water Resource Management – Urban Studies – Utilities etc. – Importance of Web GIS.		
		Total Instructional hours : 30

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Outline fundamentals of UAV systems. (K2)
CO2	Outline basic Airframe and Hardware systems used in the UAV. (K2)
CO3	Identify primary requirements for the designing of an UAV systems. (K3)
CO4	Relate Avionics systems required for UAV design. (K2)
CO5	Summarize the various applications of the UAV systems. (K2)

Text Books	
1.	Reg Austin “unmanned aircraft systems UAV design, development and deployment”, Wiley, 2010
2.	Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc,1998
3.	Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy”, Springer, 2007

References Books	
1.	P.J.Swatton - Ground studies for pilots’ flight planning, Sixth edition, 2002.
2.	Ian Heywood., “An Introduction to GIS”, Pearson Education, New Delhi, 2001.
3.	Patel A.N & Surendra Singh, “Remote sensing principles & applications”, Scientific Publishers, Jodhpur 1992
4.	Lillesand, T. M., and Kiefer, R.W., Remote Sensing and Image Interpretation, John Wiley and Sons, New York, 2000.
5.	Unmanned Aerial Vehicle (UAV) application for societal applications (https://www.cbinsights.com/research/drone-impact-society-uav/).

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Semester - IV

B.E.	B19MAT402 – NUMERICAL METHODS (Common to EEE & AERONAUTICAL)	T	P	TU	C
		3	0	1	4

Course Objectives : The aim of this course is to	
❍	Provide the basic concepts of solving algebraic and transcendental equations.
❍	Introduce the numerical techniques of interpolation in real life situation.
❍	Acquaint the student with understanding of numerical techniques of differentiation and Integration and apply in engineering and technology disciplines.
❍	Enrich the knowledge insolving ordinary differential equations.
❍	Gain practice in solving various types of partial differential equations.

UNIT - I	ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEMS	12

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton Raphson method – Solution of linear system of equations – Gauss elimination method – Pivoting – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT - II	INTERPOLATION AND APPROXIMATION	12

Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation – Difference operators and relations – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT - III	NUMERICAL DIFFERENTIATION AND INTEGRATION	10

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Cubic Spline – Romberg's Method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT - IV	INITIAL VALUE PROBLEMS (ODE)	12

Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method for solving first order equations – Multi step methods – Milne's and Adams – Bash forth predictor corrector methods for solving first order equations.

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UNIT - V	BOUNDARY VALUE PROBLEMS	14
Finite difference methods for solving second order two – point linear boundary value problems – Finite difference techniques for the solution oftwo dimensional heat equations – Laplace’s and Poison’s equations (Cartesian co-ordinates only) – One dimensional heat equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Interpret the basic concepts and techniques of solving algebraic and Transcendental equations.
CO2	Apply the numerical techniques of interpolation and error approximations in various intervals.
CO3	Make use of various numerical techniques of differentiation and integration for Engineering problems.
CO4	Relate the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5	Solve the partial and ordinary differential equations with boundary conditions related to engineering problems.

Text Books	
1.	Burden R.L and Faires J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Grewal B.S., and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th edition, New Delhi, 2015.

Reference Books	
1.	Sankara Rao K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2017.
2.	Kandasamy P.,Thilagavathy K., and Gunavathi K., “Numerical Methods”, 2nd Edition, S. Chand and Co, Reprint 2012
3.	Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, 44th Edition, 2017.

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B.E.	B19AET401 – LOW SPEED AERODYNAMICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the concepts of mass, momentum and energy conservation relating to aerodynamics.
2.	To make the student understand the concept of vorticity, irrotationality and real flow over the 2D objects.
3.	To understand the Theory of Aero foil And Wing Sections
4.	To introduce the basics of viscous flow.
5.	To introduce the conceptual boundary layer thickness.

UNIT - I	INTRODUCTION TO LOW-SPEED FLOW	9

Euler equation, Incompressible Bernoulli's Equation. Circulation and Vorticity, Green's lemma and Stoke's Theorem, Barotropic flow, Kelvin's Theorem, Streamline, Stream function, Irrotational flow, Potential function, Equipotential lines, Elementary flows and their combinations.

UNIT - II	TWO-DIMENSIONAL INVISCID INCOMPRESSIBLE FLOW	9

Ideal Flow over a circular cylinder, D'Alembert's Paradox, Magnus Effect, Kutta Joukowski's Theorem, Starting vortex, Kutta condition, Real flow over smooth and rough cylinder.

UNIT - III	AIRFOIL THEORY	9

Cauchy - Riemann relations, complex potential, Methodology of conformal Transformation, kutta - Joukowski's Transformation and its applications, Thin Airfoil Theory and its Applications.

UNIT - IV	SUBSONIC WING THEORY	9

Vortex filament, Biot and Savart law, bound vortex and Trailing vortex, horse shoe vortex, Lifting line Theory and its Limitations.

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UNIT - V	INTRODUCTION TO BOUNDARY LAYER THEORY	9
Boundary layer and Boundary layer Thickness, Displacement Thickness, Momentum Thickness, Energy Thickness, Shape Parameter, Boundary layer equations for a steady, two-dimensional incompressible flow, boundary layer growth over a flat plate, critical Reynolds number, Blasius solution, basics of turbulent flow.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Identify the characteristics of low-speed flow. (K3)
CO2	Examine the characteristics of wing performance in in viscid compressible flow. (K4)
CO3	Apply the airfoil theory to predict airfoil performance. (K3)
CO4	Interpret the concept of subsonic wing theory and vortex formations. (K5)
CO5	Categorize the characteristics of boundary layer formation. (K4)

Text Books	
1.	Anderson, J.D., "Fundamentals of Aerodynamics", McGraw Hill Book Co., 2010.

Reference Books	
1.	Clancy, L J.," Aerodynamics", Pitman, 1986.
2.	John J Bertin., "Aerodynamics for Engineers", Pearson Education Inc, 2002.
3.	Kuethe, A.M and Chow, C.Y, "Foundations of Aerodynamics", Fifth Edition, John Wiley & Sons, 2000.
4.	Milne Thomson, L.H., "Theoretical Aerodynamics", Macmillan, 1985.

BoS Chairman

B.E.	B19AET402 – AIRCRAFT STRUCTURES - I	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To provide the students an understanding on the linear static analysis of determinate and indeterminate aircraft structural components.
2.	To calculate the deflection of beams, frames and trusses by different energy methods.
3.	To calculate the buckling load and stresses in beam columns.
4.	To provide the design process using different failure theories.
5.	To understand the impacts of induced stresses.

UNIT - I	STATICALLY DETERMINATE & INDETERMINATE STRUCTURES	10
Plane truss analysis – Method of joints – Method of sections – Method of shear – 3-D Trusses – principle of super position, Clapeyron's 3 Moment equation.		

UNIT - II	ENERGY METHODS	10
Strain Energy in axial, bending, Torsion and shear loadings. Castigliano's theorems and their applications. Energy theorems – Dummy load & unit load methods – Energy methods applied to Statically determinate and Indeterminate beams, Frames, Rings & Trusses.		

UNIT - III	COLUMNS	10
Euler's column curve – Inelastic buckling – Effect of initial curvature – South well plot – Columns with eccentricity – use of energy methods – theory of beam columns – beam columns with different end conditions – Stresses in beam columns.		

UNIT - IV	FAILURE THEORIES	8
Ductile and Brittle materials – Maximum principal stress theory - Maximum principal strain theory - Maximum shear stress theory - Distortion energy theory – Octahedral shear stress theory.		

UNIT - V	INDUCED STRESSES	7
Thermal stresses – Impact loading – Fatigue – Creep - Stress Relaxation, Introduction to elasticity approach.		
Total Instructional hours : 45		

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Course Outcomes : Students will be able to	
CO1	Identify the determinate and indeterminate aircraft structural components based on linear static analysis. (K3)
CO2	Apply the reactions of structures using strain energy concept. (K3)
CO3	Identify the stresses in beam columns with different end conditions. (K3)
CO4	Examine the structural failures using different theories of failures. (K4)
CO5	Identify response of statically indeterminate structures under various loading conditions. (K3)

Text Books	
1.	James M. Gere & Barry J Goodno.,"Mechanics of Materials", cengage Learning Custom Publishing; 8th edition, 2012.
2.	Megson T M G.," Aircraft Structures for Engineering students", Butterworth-Heinemann publisher, 5th edition, 2012.
3.	N.C. Pandya, C.S. Shah.," Elements of Machine Design",Charotar Publishing House, 15th edition, 2009.

Reference Books	
1.	Bruhn E F., "Analysis and Design of Flight Vehicle Structures", Tri-State Off-set Company, USA, 1985.
2.	Donaldson, B.K., "Analysis of Aircraft Structures", - An Introduction' Cambridge University Press publishers, 2nd edition, 2008.
3.	Peery, D.J., and Azar, J.J.," Aircraft Structures", 2nd edition, McGraw – Hill, N.Y., 1999.

BoS Chairman

B.E.	B19AET403 – AIR BREATHING PROPULSION	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To establish fundamental approach and application of jet engine components and estimate the thrust developed by jet engine.
2.	To understand the working principle of inlets & its types, nozzle & its types.
3.	To gain knowledge about the different types of combustion chambers and its mechanism.
4.	To understand the working principle of axial compressor and centrifugal compressor.
5.	To gain knowledge about the working of turbines and its matching with other components.

UNIT - I	PRINCIPLES OF AIR BREATHING ENGINES	9

Operating principles of piston engines – Classification of piston engines - Illustration of working of gas turbine engines – Factors affecting thrust – Methods of thrust augmentation – Performance parameters of jet engines – Study on recent advancement in air breathing engine.

UNIT - II	JET ENGINE INTAKES AND EXHAUST NOZZLES	9

Ram effect, Internal flow and Stall in subsonic inlets - Modes of operation - Supersonic inlets – Starting problem on supersonic inlets – Shock swallowing by area variation – Real flow through nozzles and nozzle efficiency – losses in nozzles – Ejector and variable area nozzles - Interaction of nozzle flow with adjacent surfaces – Thrust reversal.

UNIT - III	JET ENGINE COMBUSTION CHAMBERS	9

Chemistry of combustion, Combustion equations, Combustion process, Classification of combustion chambers – Combustion chamber performance – Effect of operating variables on performance – Flame stabilization.

UNIT - IV	JET ENGINE COMPRESSORS	9

Euler's turbo machinery equation, Principle operation of centrifugal compressor, Principle operation of axial flow compressor– Work done and pressure rise – velocity diagrams – degree of reaction – Free vortex and constant reaction designs of axial flow compressor – Performance parameters axial flow compressors– Stage efficiency.

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UNIT - V	JET ENGINE TURBINES	9
Principle of operation of axial flow turbines – limitations of radial flow turbines - Work done and pressure rise – Velocity diagrams – Degree of reaction – Constant nozzle angle designs – Performance parameters of axial flow turbine– Turbine blade cooling methods – Stage efficiency calculations – Basic blade profile design considerations – Matching of compressor and turbine.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Interpret control volume and momentum equation to estimate the forces produced by aircraft propulsion systems. (K2)
CO2	Illustrate the principal design parameters and constraints that set the performance of gas turbine engines. (K2)
CO3	Analyze the gas turbine engine to relate thrust and fuel burn to component performance parameter. (K4)
CO4	Identify the working of multistage compressor to use velocity triangles for the performance of compressor. (K3)
CO5	Make use of velocity triangles and turbine blade cooling methods to choose the turbine performance parameters. (K3)

Text Books	
1.	Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Pearson education (2009)

Reference Books	
1.	Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. “Gas Turbine Theory”, Pearson Education Canada; 6th edition, 2008.
2.	Mathur, M.L. and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers & Distributors, Delhi, 2nd edition 2014.
3.	Oates, G.C., “Aero thermodynamics of Aircraft Engine Components”, AIAA Education Series, New York, 1985.
4.	“Rolls Royce Jet Engine”, Rolls Royce; 4th revised edition, 1986.

BoS Chairman

B.E.	B19AET404 – AIRCRAFT SYSTEMS AND INSTRUMENTS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart knowledge of the hydraulic and pneumatic systems components.
2.	To impart the modern control system and auto pilot system in aircraft
3.	To understand the different types of fuel system in jet engine and piston engine.
4.	To Apply the air cycle system, vapors cycle system and cabin pressurization system.
5.	To get the knowledge about the accelerometer, air speed indicator and gyroscopic

UNIT - I	AIRCRAFT SYSTEMS	9

Hydraulic systems – Study of typical systems – Components – Hydraulic systems controllers – Modes of operation – Pneumatic systems – Working principles – Typical Pneumatic Power system – Brake system – Components, Landing Gear Systems – Classification – Shock absorbers – Retractive mechanism.

UNIT - II	AIRPLANE CONTROL SYSTEMS	10

Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system – Operating principles – Modern control systems – Digital fly by wire systems – Auto pilot system, Active Control Technology.

UNIT - III	ENGINE SYSTEMS	9

Piston and Jet Engines- Fuel systems – Components - Multi-engine fuel systems, lubricating systems – Starting and Ignition systems.

UNIT - IV	AIRCONDITIONING AND PRESSURIZING SYSTEM	8

Basic Air Cycle systems – Vapour Cycle Systems, Boot-strap air cycle system – Evaporative vapour cycle systems – Evaporation air cycle systems – Oxygen systems – Fire extinguishing system and Smoke detection system, Deicing and anti-icing system.

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UNIT - V	AIRCRAFT INSTRUMENTS	9
Flight Instruments and Navigation Instruments – Accelerometers, Air speed Indicators – Mach Meters – Altimeters – Gyroscopic Instruments– Principles and operation – Study of various types of engine instruments – Tachometers – Temperature and Pressure gauges.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the principles and working of different Aircraft systems. (K2)
CO2	Compare the features of various flight control system. (K4)
CO3	Identify the performance of various aircraft engine systems. (K3)
CO4	Experiment with the data from various aircraft system cycle. (K3)
CO5	Identify the principles and operation of various cockpit control systems. (K3)

Text Books	
1.	Mekinley, J.L. and R.D. Bent , " Aircraft Power Plants", McGraw Hill 1993.
2.	Pallet, E.H.J, "Aircraft Instruments & Principles, " Pitman & Co 1993.

Reference Books	
1.	Handbooks of "Airframe and Power plant Mechanics", US dept. of Transportation, Federal, Aviation Administration, the English Book Store, New Delhi, 1995.
2.	McKinley, J.L. and Bent R.D., " Aircraft Maintenance & Repair", McGraw Hill, 1993.
3.	Teager, S, "Aircraft Gas Turbine technology", McGraw Hill 1997.

BoS Chairman

B.E. / B.Tech	B19MCT301 – ENVIRONMENTAL SCIENCES	T	P	TU	C
		3	0	0	3

Course Objectives	
❍	To study the nature and facts about environment.
❍	To find and implement scientific, technological, economic and political solutions to environmental problems.
❍	To study the interrelationship between living organism and environment.
❍	To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
❍	To study the dynamic processes and understand the features of the earth's interior and surface.

UNIT - I	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	9

Definition, scope and importance of environment – need for public awareness - concept of anecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecologicalpyramids – Introduction, types, characteristic features, structure and function of the (a) forestecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams,lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species andecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use,productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and locallevels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitatloss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of commonplants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT - II	ENVIRONMENTAL POLLUTION	9

Definition – causes, effects and control measures of : (a) Air pollution (b) Water pollution (c) Soilpollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid wastemanagement: causes, effects and control measures of municipal solid wastes – role of an individual inprevention of pollution – pollution case studies – disaster management: floods, earthquake, cycloneand landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

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UNIT - III	NATURAL RESOURCES	9
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining,dams and their effects on forests and tribal people – Water resources: Use and over- utilization ofsurface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineralresources: Use and exploitation, environmental effects of extracting and using mineral resources,case studies – Food resources: World food problems, changes caused by agriculture andovergrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, casestudies – Energy resources: Growing energy needs, renewable and non renewable energy sources,use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation,man induced landslides, soil erosion and desertification – role of an individual in conservation ofnatural resources – Equitable use of resources for sustainable lifestyles. Field study of local area todocument environmental assets – river / forest / grassland / hill / mountain.		

UNIT - IV	SOCIAL ISSUES AND THE ENVIRONMENT	9
From unsustainable to sustainable development – urban problems related to energy – waterconservation, rain water harvesting, watershed management – resettlement and rehabilitation ofpeople; its problems and concerns, case studies – role of non-governmental organization environmental ethics: Issues and possible solutions – climate change, global warming, acid rain,ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation –consumerism and waste products – environment production act – Air (Prevention and Control ofPollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forestconservation act – enforcement machinery involved in environmental legislation- central and statepollution control boards - Public awareness.		

UNIT - V	HUMAN POPULATION AND THE ENVIRONMENT	9
Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and childwelfare – role of information technology in environment and human health – Case studies.		
		Total Instructional hours : 45

Course Outcomes	
At the end of the course the student will be able to understand the	
CO1	Basic concepts of environment, ecosystem and biodiversity
CO2	Different types of pollution and their control measures.

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CO3	Various natural resources.
CO4	Development and improvement in the standard of living that has lead to serious environmental disasters.
CO5	Causes of population and role of Information technology in environment.

Text Books	
1.	Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2.	Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.

Reference Books	
1.	Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
2.	Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) PVT, LTD, Hydrabad, 2015.
3.	Rajagopalan, R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2005.
4.	G.Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt, Ltd, Delhi, 2014

BoS Chairman

B.E.	B19AEP401 – AERODYNAMICS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To understand the fundamental and geometrical properties related to external flows
2.	To make the students to calculate Aerodynamic forces and moments on wings and bluffed bodies.
3.	To understand the Pressure Distribution over different Airfoil and Circular Cylinder.
4.	To use the wind tunnel to measure flow velocity, lift and drag over a flat plate.
5.	To visualize the low speed flows over the airfoil and its effects of AOA

List of Experiments

Expt. No.	Description of the Experiments
1.	Calibration of a subsonic Wind tunnel.
2.	Determination of lift for the given airfoil section.
3.	Pressure distribution over a smooth circular cylinder.
4.	Pressure distribution over a rough circular cylinder.
5.	Pressure distribution over a symmetric aero foil.
6.	Pressure distribution over a cambered aero foil.
7.	Force measurement using wind tunnel balancing set up.
8.	Flow over a flat plate at different angles of incidence.
9.	Flow visualization studies in low speed flows over cylinders.
10.	Flow visualization studies in low speed flows over airfoil with different angle of incidence.
	Total Instructional hours : 30

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Course Outcomes : Students will be able to	
CO1	Identify the fundamental aerodynamics and geometric properties related to external flow over airfoil, wing and bluff bodies. (K3)
CO2	Determine the aerodynamics forces and moment experience by airfoil, wing and bluff bodies. (K5)
CO3	Evaluate the performance of different type of airfoil by thin airfoil theory. (K5)
CO4	Inspect the flow and pressure distribution over 2D and 3D bodies by flow visualization methods. (K4)
CO5	Examine the flow pattern over the aerodynamics model with different angle of incidence. (K4)

List of Equipment

Sl. No.	Name of the Equipment	Quantity	Experiment No.
1.	Subsonic Wind tunnel	1	1, 2, 4, 5, 6, 7, 8, 9, 10
2.	Models (aerofoil, rough and smooth cylinder, flat plate)	2	5, 6, 7, 8, 9, 10
3.	Angle of incidence changing mechanism	1 No.	8,10
4.	Multi tube Manometer	1 No.	2, 3, 4, 5, 6
5.	Pitot-Static Tubes	1 No.	1
6.	Cylinder models (Rough and Smooth)	2 Nos.	3, 4
7.	Wind Tunnel balances (3 or 6 components)	1 No.	7
8.	Smoke Generator	1 No.	8, 9, 10
9.	Water flow channel	1 No.	8, 9, 10

BoS Chairman

B.E.	B19AEP402 – AIRCRAFT COMPONENT DRAWING LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To make the students understand and interpret drawings of machine components
2.	To prepare assembly drawings both manually and using standard CAD packages
3.	To familiarize the students with Indian Standards on drawing practices and standard components
4.	To gain practical experience in handling 2D drafting and 3D modeling software systems.
5.	To understand the load impacts for various mechanical components

List of Experiments

Expt. No.	Description of the Experiments
1.	Basics of engineering drawing code of practice, BIS Symbols and other Standard Components
2.	Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & tolerancing.
3.	Introduction to 2 D Drawing (Solid Works) basics tools
4.	Introduction to 3D Modelling Software (Solid Works)
5.	3D Assembly of Flange Coupling
6.	3D Assembly of Universal Coupling
7.	3D Assembly of Oldham's Coupling
8.	3D Assembly of Knuckle Joints
9.	3D Assembly of Gib and cotter joints
10.	3D Assembly of sleeve and cotter joints

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11.	Design and drafting control components bell crank
12.	3D Modelling of Swept Wing from Airfoil Coordinates
13.	3D Modelling of Tapered Wing with blended winglet
14.	3D Modelling of Aircraft fuselage
	Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Identify the drawing standard used in design. (K3)
CO2	Plan the fits and tolerances limits used in design. (K3)
CO3	Design the part drawings as per standard. (K6)
CO4	Design the sectional view of drawings as per standard. (K6)
CO5	Design the assembly drawings as per standard. (K6)

Text Books	
1.	Gopalakrishna K.R., “Machine Drawing”, 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013.

Reference Books	
1.	Junnarkar, N.D., “Machine Drawing”, 1st Edition, Pearson Education, 2004.
2.	N.D. Bhatt and V.M. Panchal, “Machine Drawing”, 48th Edition, Charotar Publishers,2013.
3.	N. Siddeshwar, P. Kanniah, V.V.S. Sastri, ”Machine Drawing”, published by Tata McGraw Hill, 2006.
4.	S. Trymbaka Murthy, “A Text Book of Computer Aided Machine Drawing”, CBS Publishers, New Delhi, 2007.

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B.E / B. Tech	B19CEP401 – CAREER ABILITY COURSE - I	T	P	TU	C
		0	2	0	NC

Sl. No.	Topics	Hours
1.	**NUMBER SYSTEM** Numbers, HCF and LCM of Numbers, Decimal Fractions, Square Roots & Cube Roots, Problems on Numbers, Surds and Indices	6
2.	**SIMPLIFICATION** Addition, Subtraction, Multiplication, Division, Decimal Fractions BODMAS Rule.	6
3.	**ARITHMETIC ABILITY – I** Average, Problems on Ages, percentage, Profit & Loss, Ratio and Proportion, Partnership.	6
4.	**ARITHMETIC ABILITY – II** Chain Rule, Time and Work, Pipes and cisterns, Time and Distance.	6
5.	**ARITHMETIC ABILITY – III** Problems on trains, Boats and Streams, Allegation or Mixture, Simple interest, Compound Interest.	6
		Total Instructional Hours : 30

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Semester - V

B.E.	B19AET501 – AIRCRAFT PERFORMANCE	T	P	TU	C
		3	0	1	4

Course Objectives	
1.	To study the performance of airplanes under various operating conditions
2.	To introduce the various engine parameters affecting the performance
3.	To understand the climbing, glidingperformance and load factor of airplanes
4.	To understand the turning performance of airplanes
5.	To introduce the takeoff, landing performance and also the distance estimation of these performance.

UNIT - I	CRUISING FLIGHT PERFORMANCE	12

Forces and moments acting on a flight vehicle – Flight stability and response system - Equation of motion of a rigid flight vehicle - Different types of drag – estimation of parasite drag co-efficient by proper area method- Drag polar of vehicles from low speed to high speeds.

UNIT - II	INFLUENCES OF ENGINE FEATURES IN PERFORMANCE	12

Introduction - Performance - Variation of thrust, power with velocity and altitudes for air breathing engines. Performance of airplane in level flight - Power available and power required curves. Maximum speed in level flight - Conditions for minimum drag and power required.

UNIT - III	MANEUVERING FLIGHT PERFORMANCE	12

Range and endurance - Climbing and gliding flight - Maximum rate of climb - steepest angle of climb, Minimum rate of sink - shallowest angle of glide – Hodograph – Absolute Ceiling and Service Ceiling.

UNIT - IV	TURNING PERFORMANCE	12

Introduction - Turning performance (Turning rate turn radius) - Level Turn - Minimum Turn Radius Maximum Turn Rate - Instantaneous turn - Pull up and Pull down manoeuvers - Cobra Maneuver - Bank angle and load factor - V-n diagram and load factor.

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UNIT - V	TAKEOFF AND LANDING PERFORMANCE	12
Introduction to Take-off, Estimation of take-off distance - ground roll, obstacle clearing distance and height, Take off assist devices – Spoilers andlanding distance – approach distance and flare distance.		
		Total Instructional hours : 60

Course Outcomes : Students will be able to	
CO1	Classify the forces and moments acting on an aircraft and flight performance in steady level flight. (K2)
CO2	Analyze the performance characteristics of jet and propeller engines. (K4)
CO3	Identify the maneuvering flight performance in steady level flight. (K3)
CO4	Examine the performance during turning manoeuvers of aircraft. (K4)
CO5	Make use of landing and taking characteristics to recognize the ground effects of the aircraft. (K3)

Text Books	
1.	Mc Cornick. W., “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley, NY, 1979.
2.	Nelson, R.C. “Flight Stability and Automatic Control”, McGraw-Hill Book Co., 2004.
3.	Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son, Inc, NY, 1988.

Reference Books	
1.	Babister, A.W., “Aircraft Dynamic Stability and Response”, Pergamon Press, Oxford, 1980.
2.	Dommasch, D.O., Sherby, S.S., and Connolly, T.F., “Aeroplane Aero dynamics”, Third Edition, Issac Pitman, London, 1981.
3.	Etkin, B., “Dynamics of Flight Stability and Control”,Edn. 2, John Wiley, NY, 1982.
4.	Mc Cornick B. W, “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley, NY, 1995

BoS Chairman

B.E.	B19AET502 – AIRCRAFT STRUCTURES - II	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To provide the behavior of loads experience of aircraft indigenous components.
2.	To understand the shear flow of symmetrical, unsymmetrical and thin-walled structures.
3.	To provide conception design of major aircraft structural components.
4.	To provide the better understate the low weight structures.
5.	To provide the students adopt with various methods for analysis of aircraft wings and fuselage

UNIT - I	UNSYMMETRICAL BENDING	9

Bending of symmetric beams subject to skew loads - Bending stresses in beams of unsymmetrical sections – Generalized k-method, Neutral axis method, Principal axis method, Advantages and Disadvantages of three methods.

UNIT - II	SHEAR FLOW IN OPEN SECTIONS	9

Thin-walled beams – Concept of shear flow – The shear center and its determination – Shear flow distribution in symmetrical and unsymmetrical thin-Walled sections – Structural idealization – Shear flow variation in idealized sections - Applications of shear flow calculations.

UNIT - III	SHEAR FLOW IN CLOSED SECTIONS	9

Bredt - Batho theory – Single-cell and multi-cell tubes subject to torsion – Shear flow distribution in thin-walled single & Multi-cell structures subject to combined bending and torsion – With walls effective and ineffective in bending - Importance of shear flow & shear center determination.

UNIT - IV	BUCKLING OF PLATES	9

Bending of thin plates - local buckling stress of thin walled sections – Crippling strength estimation - Thin skin stringer panel - Effective skin width – Inter rivet buckling - Skin stringer panel - Integrally stiffened panels - cutouts - Lightly loaded beams.

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UNIT - V	STRESS ANALYSIS OF WING AND FUSELAGE	9
Aircraft loads - classification – The V-n diagram – Shear force and bending moment distribution over the aircraft wing and fuselage – Shear flow in thin-webbed beams with parallel and non-parallel flanges – Complete tension field beams – Semi-tension field beam theory.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Analyze the loads acting on aircraft. (K4)
CO2	Identify and resolve the structural design & the limitations. (K3)
CO3	Identify the distribution of loads on aircraft member. (K3)
CO4	Categorize the design of low weight to high strength panel member. (K4)
CO5	Analyze the aircraft real structures components such as wings and fuselages. (K4)

Text Books	
1.	Bruhn E.H., “Analysis and Design of Flight Vehicles Structures”, Tri-state off-set Company, USA, 1985.
2.	Megson T M G, “Aircraft Structures for Engineering Students”, Elsevier Ltd, 2012
3.	Michael Chun-Yung Niu, “Airframe structural Design”, Conmilit Press Ltd, 1998

Reference Books	
1.	Howard D Curtis, "Fundamentals of Aircraft Structural Analysis", WCB-McGraw Hill, 1997.
2.	Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw Hill, 1993.
3.	Peery, D.J., and Azar, J.J., "Aircraft Structures", 2^{nd} edition, McGraw Hill, N.Y., 1999.

BoS Chairman

B.E.	B19AET503 – HIGH SPEED AERODYNAMICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the concepts of compressibility and performance of the pressure
2.	To make the student understand the theory behind the formation of shocks and strength of the shock
3.	To make the student understand the theory behind the formation expansion fans in Supersonic flows and shock behavior of interaction
4.	To introduce the methodology of measurements in Supersonic flows
5.	To understand characteristics of Aircraft wing structure to transonic flow over the wing and conceptual understanding of the hypersonic aerodynamics

UNIT - I	ONE DIMENSIONAL COMPRESSIBLE FLOW	10

Energy, Momentum, and Continuity equations, Velocity of sound, Adiabatic steady state flow equations, Flow through convergent - divergent passage, Performance under various back pressures.

UNIT - II	NORMAL AND OBLIQUE SHOCKS	10

Prandtl equation and Rankine – Hugoniot relation, Pitot static tube, Oblique shocks and corresponding equations, Pressure turning angle, Shock polar, Flow past wedges and concave corners, Strong, Weak and Detached shocks.

UNIT - III	EXPANSION WAVES AND METHOD OF CHARACTERISTICS	9

Flow past convex corners, Expansion hodograph, Reflection and interaction of shocks and expansion, waves. Two-dimensional supersonic nozzle contours. Rayleigh and Fanno Flows.

UNIT - IV	DIFFERENTIAL EQUATIONS OF MOTION FOR STEADY COMPRESSIBLE FLOWS	8

Small perturbation potential theory, Solutions for supersonic flows, Mach waves and Mach angles, Prandtl-Glauert rule - Affine transformation relations for subsonic flows, Linearized two-dimensional supersonic flow theory - Lift, Drag, Pitching moment and center of pressure of supersonic profiles.

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UNIT - V	HIGH SPEED FLOW OVER WING	8
Lower and upper critical Mach numbers, Drag divergence, shock induced separation, Characteristics of swept wings, Effects of thickness, camber and aspect ratio of wings, Transonic area rule. Introduction to Hypersonic Aerodynamics.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the characteristics fluid flows. (K2)
CO2	Identify the properties across normal and oblique shocks. (K3)
CO3	Make use of two-dimensional theory to analyze compressible flow problems. (K3)
CO4	Analyze fluid flow characteristics over wing airfoils and airplanes. (K4)
CO5	Distinguish the characteristics of wing and examine flow behaviors over the wing. (K4)

Text Books	
1.	Anderson Jr., D, "Modern compressible flows", McGraw-Hill Book Co., New York, 1999.
2.	L.J. Clancy, "Aerodynamics" Sterling Book House, 2006.

Reference Books	
1.	Rathakrishnan, E., "Gas Dynamics", 6^{th} Edition, Prentice Hall of India, 2017.
2.	Shapiro, A.H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronald Press, 1982.
3.	Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.

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B.E.	B19AET504 - ROCKET AND SPACECRAFT PROPULSION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart make students understand theory in non-air-breathing and hypersonic propulsion methods.
2.	To gain knowledge about the basic principle of chemical rocket propulsion.
3.	To understand about the working principle of solid propellant rocket motors and its features.
4.	To understand the working principle of liquid propellant rocket engine and hybrid propulsion.
5.	To gain knowledge about the advance propulsion systems.

UNIT - I	RAMJET AND SCRAMJET PROPULSION	8

Operating principle of Ramjet engine – Combustion in Ramjet engine- Ramjet performance and sample ramjet design calculations - Introduction to hypersonic air breathing propulsion - Need for supersonic combustion for hypersonic propulsion – Salient features of scramjet engine and its applications for hypersonic vehicles – Problems associated with supersonic combustion – Engine/airframe integration aspects of hypersonic vehicles – Fuel injection schemes in scramjet combustors – Recent revolutionary advancement in rocket and spacecraft propulsion.

UNIT - II	CHEMICAL ROCKET PROPULSION	9

Operating principle – Specific impulse of a rocket – Internal ballistics – performance Characteristics of rockets – Simple rocket design problems – Types of igniters - Rocket nozzle classification - preliminary concepts in nozzle-less propulsion – Air augmented rockets – Pulse rocket motors – Static testing of rockets & instrumentation – Safety considerations.

UNIT - III	SOLID ROCKET PROPULSION	10

Salient features of solid propellant rockets – Selection criteria of solid propellants – Estimation of solid propellant adiabatic flame temperature - Propellant grain design considerations – Erosive burning in solid propellant rockets – Combustion instability – Strand burner and T-burner – Applications and advantages of solid propellant rockets.

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UNIT - IV	LIQUID AND HYBRID ROCKET PROPULSION	10
Salient features of liquid propellant rockets – Selection of liquid propellants – Various feed systems and injectors for liquid propellant rockets -Thrust control and cooling in liquid propellant rockets and the associated heat transfer problems – Combustion instability in liquid propellant rockets – Cryogenic liquids in Rocket launching - Zero gravity problems associated with cryogenic propellants - Introduction to hybrid rocket propulsion – Standard and reverse hybrid systems - combustion mechanism in hybrid propellant rockets – Applications and limitations.		

UNIT - V	ADVANCED PROPULSION SYSTEMS	8
Electric rocket propulsion – Types of electric propulsion techniques - Ion propulsion – Nuclear rocket – Comparison of performance of these propulsion systems with chemical rocket propulsion systems – Future applications of electric propulsion systems - Solar sail – Current scenario of advanced propulsion projects worldwide.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the hypersonic air breathing propulsion system. (K2)
CO2	Identify the chemical rocket propulsion systems. (K3)
CO3	Organize the solid rocket propulsion rocket system. (K3)
CO4	Distinguish the principles of liquid and hybrid propulsion system. (K4)
CO5	Compare the different types of advanced propulsion systems. (K4)

Text Books	
1.	Mathur, M.L., and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers and Distributors, Delhi, 2014.
2.	Sutton, G.P., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 8^{th} Edition, 2010.

Reference Books	
1.	Robert G. Jahn, “Physics of Electric Propulsion”, Dover Publications, 2006.

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B.E.	B19AEP501 - AIRCRAFT STRUCTURES LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To enable the students, understand the behavior of aircraft structural components under different loading conditions.
2.	To make the students to verify the Superposition and Maxwell's reciprocal theorem.
3.	To provide the principle involved in photo elasticity and its applications in stress analysis for composite laminates
4.	To calculate the free, forced and vibrations of cantilever beams.
5.	To calculate the tensile and flexural test of composite beams.

List of Experiments

Expt. No.	Description of the Experiments
1.	Deflection of Beams
2.	Verification of superposition theorem and Maxwell's reciprocal theorem
3.	Buckling load estimation of slender eccentric columns
4.	Determination of flexural rigidity of composite beams
5.	Unsymmetrical Bending of a Cantilever Beam
6.	Combined bending and Torsion of a Hollow Circular Tube
7.	Material Fringe Constant of a Photo elastic Models
8.	Free Vibration of a Cantilever Beam
9.	Forced Vibration of a cantilever Beam
10.	Fabrication of a Composite Laminate.
11.	Tension field beam
12.	Determination of elastic constant for a composite tensile and flexural specimen
	Total Instructional hours : 60

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Course Outcomes : Students will be able to	
CO1	Identify the different types of beams. (K3)
CO2	Examine the super position and Maxwell's reciprocal theorem for different types of beams. (K4)
CO3	Estimate the buckling load for different end conditions of columns. (K5)
CO4	Evaluate the fringe patterns to detect the flaws in the specimen by photo elasticity. (K5)
CO5	Examine the fringe patterns in photo elastic technique and there by analysis the stress formation due to flaws in the specimen. (K4)

List of Equipment

Sl. No.	Name of the Equipment	Quantity	Experiment No.
1.	100 kN Universal Testing Machine	1	12
2.	Beams with weight hangers and dial gauges	6	1, 2
3.	Column set up with dial gauges	2	3
4.	Photo elasticity set up	1	7
5.	Vibration set up with accessories	1	8, 9
6.	Wagner beam	1	11
7.	Unsymmetrical bending set up	1	5
8.	Set up for combined bending and torsion	1	6

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B.E.	B19AEP502 – PROPULSION LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To explore practically components of aircraft piston and gas turbine engines and their working principles.
2.	To impart practical knowledge of flow phenomenon of subsonic and supersonic jets.
3.	To determine practically thrust developed by rocket propellants.
4.	To calculate wall pressure measurement high speed jets and supersonic nozzle.
5.	To understand the flow visualization by using schileren and shadowgraph techniques.

List of Experiments

Expt. No.	Description of the Experiments
1.	Study of aircraft piston and gas turbine engines
2.	Velocity profiles of free jets.
3.	Velocity profiles of wall jets.
4.	Wall pressure measurements of a subsonic diffusers and ramjet ducts.
5.	Flame stabilization studies using conical and hemispherical flame holders.
6.	Cascade testing of compressor blades.
7.	Velocity and pressure measurements high speed jets.
8.	Wall Pressure measurements of supersonic nozzle.
9.	Flow visualization of supersonic flow.
10.	Study experiments.
	Total Instructional hours : 30

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Course Outcomes : Students will be able to	
CO1	Identify the components and information of piston and gas turbine engine. (K3)
CO2	Analyze the behavior of flow through ducts and jet engine components. (K4)
CO3	Examine the flow phenomenon in supersonic flow. (K4)
CO4	Identify the performance parameters of rocket propellants. (K3)
CO5	Distinguish the subsonic and supersonic flow characteristics of propeller efficiency. (K4)

List of Equipment

Sl. No.	Name of the Equipment	Quantity	Experiment No.
1.	Jet Engine	1	1
2.	Piston engine	1	1
3.	Jet facility with compressor and storage tank	1	2, 3, 8, 9, 10
4.	Multitube manometer	3	2, 3, 4, 6, 8, 9
5.	Wind tunnel	1	6
6.	0-5 bar pressure transducer with pressure indicator OR DSA pressure scanner	8	8, 9
7.	Ramjet facility	1	4
8.	Conical flame holder model	1	5
9.	Hemispherical flame holder model	1	5
10.	Water flow channel	1	5
11.	Compressor blade set	1	6
12.	Schlieren or Shadowgraph set up	1	10
13.	Convergent nozzle	1	8
14.	Convergent divergent nozzle	1	7, 8, 9, 10
15.	Thruster with load cells	1	1

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B.E.	B19AEP503 – MINI PROJECT	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To develop their own innovative prototype of ideas.
2.	To train the students in preparing mini project reports and examination.

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

Total periods: 60

Course Outcomes : Students will be able to	
CO1	On Completion of the mini project work students will be in a position to take up their final year project work and find solution by formulating proper methodology.

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B.E. / B. Tech	B19CEP501 - CAREER ABILITY COURSE- II	T	P	TU	C
		0	2	0	NC

Sl. No.	Topics	Hours
1.	**GENERAL MENTAL ABILITY - I** Analogy, Classification, Series Completion, Coding and Decoding, Blood Relations.	6
2.	**GENERAL MENTAL ABILITY - II** Direction Sense Test, Logical Venn Diagram, Data Sufficiency, Assertion and Reason.	6
3.	**NON VERBAL REASONING – I** Mirror Images, Water Images, Embedded Figures, Paper folding and paper cutting, Cubes and Dice.	6
4.	**NON VERBAL REASONING – II** Completion of incomplete pattern, Dot Situation, Construction of Squares and Triangles.	6
5.	**DATA INTERPRETATION** Tabulation, Bar Graphs, Pie Chart, Line Graphs	6
		Total Instructional Hours : 30

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B.E.	B19CEP502 – SURFACE MODELLING AND ASSEMBLY	T	P	TU	C
		0	2	0	1

Course Objectives	
1.	To understand and learn the software tools.
2.	To make the different types of parametric and feature based modeling.
3.	To gain the knowledge about assembly
4.	To create the 2D modeling for various component.
5.	To create the 3D modeling for different shapes.

UNIT - I	COMPLEX 2D SKETCH/PROFILE CREATION	4

Operation Toolbar - Re-limitations (Corner, Chamfer, Trim, Break, Quick Trim, Close arc, Complement), Transformation (Mirror, Symmetry, Translate, Rotate, Scale, Offset). Constraint - Important of Dimensional Constraints, Geometrical Constrains and its.

UNIT - II	PART CREATION & MODIFICATION	6

Introduction to Part Design, Introduction to Parametric and Feature Based Modeling. Sketch-Based Features - Pads, Pockets, Shaft, Groove, Hole, Rib, Slot, Solid combine Stiffener, Multi-section Solid, and Multi-Section Remove. Dress-Up Features - Fillets, Chamfer, Drafts, Shell, Thickness, Thread/ Tap, Remove & Replace face. Transformation Features - Translation, Rotation, Symmetry, Axis to Axis, Rectangular, Circular & User - defined Pattern, Scale, and Affinity. Reference Elements - Point, Lines, Planes.

UNIT - III	BUILD, CONTROL AND ANALYZE ASSEMBLIES	7

Introduction to Assembly Design, Types of Approaches – Top down & Bottom-up Assembly. Product Structure Tools, Constraints - Coincidence, Contact, Offset, Angle, Fix Component, Fix Together, Change constraint, Reus.

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UNIT - IV	CREATING MANUFACTURING READY 2D DRAWINGS	7
Inserting New Sheet, Views, etc., Views - Projections (Front View, Unfolded View, View from 3D, Projection View, Auxiliary view, Isometric view, Advanced front view), Sections, Details view, Clipping view, Broken view, Breakout view, 3D clipping, View creation wizard. Dimensioning, Annotations.		

UNIT - V	CREATING COMPLEX COMPONENTS	6
Introduction to Wireframe & Surface Design, Wireframe - Point, Line, Plane, Projection, Intersection, Circle, Corner, Connect Curve, Spline, Helix. Surfaces - Extrude, Revolve, Sphere, Cylinder, Offset, Sweep, Fill, Multi-Section Surface, Blend. Operations - Join, Healing, Disassemble, Split, Tri.		
		Total Instructional hours : 30

Course Outcomes : Students will be able to	
CO1	Summarize with the Engineering graphics fundamentals, Industrial Standards. (K2)
CO2	Apply the special features for part creation. (K3)
CO3	Create complex 2D models of engineering components. (K6)
CO4	Create complex 3D models of engineering components. (K6)
CO5	Create complex Mechanical & Aeronautical Components. (K6)

Text Books	
1.	Gopalakrishna K.R., “Machine Drawing”, 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013.
2.	Sham Tickoo, “CATIA V5-6R2015 for Engineers and Designers”, 13th Edition, 2016

BoS Chairman

Professional Elective - I

B.E.	B19AEE501 – MECHANICS OF MACHINES	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To understand the principles in the formation of mechanisms and their kinematics.
2.	To know the different types of gears and their nomenclature
3.	To understand the effect of friction in different machine elements.
4.	To get the knowledge about the various governors and it's important.
5.	To understand the importance of balancing and vibration.

UNIT - I	KINEMATICS OF MACHINES	9

Mechanisms – Terminology and definitions – Kinematics inversions of 4 bar and slide crank chain – Kinematics analysis in simple mechanisms – Velocity and acceleration polygons – Cam and followers – Classifications – Displacement diagrams - Layout of plate cam profiles – Derivatives of followers motion

UNIT - II	GEARS AND GEAR TRAINS	9

Spur gear – Law of toothed gearing – Involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – Nonstandard teeth – Gear trains – Parallel axis gears trains – Epicyclic gear trains.

UNIT - III	FRICTION	9

Types of friction – Friction Drives -Friction in screw threads – Bearings – Friction clutches – Belt drives.

UNIT - IV	BALANCING AND MECHANISM FOR CONTROL	9

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines - Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines - Governors and Gyroscopic effects.

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UNIT - V	VIBRATION	9
Free, Forced and Damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration Isolation – Vibration absorption – Torsional vibration of shafts – Single and Multi-rotor systems – Geared shafts – Critical speed of shafts.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply the kinematic mechanisms to layout the velocity polygons and cam profiles. (K3)
CO2	Apply the law of gearing for gears and gear trains. (K3)
CO3	Analyze the forces and torques acting in the machine members. (K4)
CO4	Apply the friction principles in belt, clutches and brakes. (K3)
CO5	Analyze the natural frequency of the vibrating system. (K4)

Text Books	
1.	Ambekar A.G., Mechanism and Machine Theory", Prentice Hall of India, New Delhi, 2007.
2.	Shigley J.E., Pennock G.R and Uicker J.J., – Theory of Machines and Mechanisms", Oxford University Press, 2003.

Reference Books	
1.	Ghosh A, and A.K. Mallick., "Theory and Machine", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
2.	Ramamurthi. V., "Mechanisms of Machine", Narosa Publishing House, 2005.
3.	Rao J.S. and Dukkipatti R.V., "Mechanisms and Machines", Wiley-Eastern Ltd., New Delhi, 1998.
4.	Robert L. Norton, "Design of Machinery", McGraw-Hill, 2012.
5.	Thomas Bevan., "Theory of Machines", CBS Publishers and Distributors, 2010.

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B.E.	B19AEE502 - PRINCIPLES OF INDUSTRIAL MANAGEMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To enable the students to study the evaluation of management, Organization, Culture, types and its environment.
2.	To learn about the nature and purpose types of planning and decision-making ideas.
3.	To learn the application of the principle of organizing an organization and departmentalization, Career management.
4.	To the gain the knowledge about leadership communication and motivational techniques.
5.	To understand the controlling process budgetary techniques and productivity management.

UNIT - I	INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS	9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers - managerial roles and skills – Evolution of Management – Scientific, Human relations, System and contingency approaches – Types of Business organization - Sole proprietorship, Partnership, company - Public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

UNIT - II	PLANNING	9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT - III	ORGANIZING	9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – Delegation of authority – Centralization and Decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, Selection, Training and Development, Performance Management , Career planning and management.

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UNIT - IV	DIRECTING	9
Foundations of individual and group behavior – Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – leadership – Types and theories of leadership – communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.		

UNIT - V	CONTROLLING	9
System and process of controlling – Budgetary and Non-budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Classify the types of manager and managerial roles. (K2)
CO2	Apply the various planning and Strategic management. (K3)
CO3	Explain the Line authority staff authority and departmentalization. (K2)
CO4	Apply the individual, group behaviors and leadership qualities. (K3)
CO5	Apply the budgetary and non-budgetary control techniques. (K3)

Text Books	
1.	JAF Stoner, Freeman R.E and Daniel R Gilbert "Management", 6th Edition, Pearson Education, 2004.
2.	Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.

Reference Books	
1.	Harold Koontz & Heinz Weihrich, "Essentials of Management", Tata McGraw Hill, 1998.
2.	Robert Kreitner & Mamata Mohapatra, "Management", Biztantra, 2008.
3.	Stephen A. Robbins & David A. Decenzo & Mary Coulter, "Fundamentals of Management", 7th Edition, Pearson Education, 2011.
4.	Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

BoS Chairman

B.E.	B19AEE503 – CONTROL ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the control system types and its mathematical modeling of systems.
2.	To introduce the mathematical modeling of systems, open loop and closed loop systems and analyses in time domain and frequency domain.
3.	To understand the analyses process in time domain and frequency domain.
4.	To impart the knowledge on the concept of stability and various methods to analyze stability in both time and frequency domain.
5.	To introduce sampled data control system.

UNIT - I	INTRODUCTION	9

Historical review, Simple pneumatic, hydraulic and thermal systems, Series and parallel system, Analogies, mechanical and electrical components, Development of flight control systems.

UNIT - II	OPEN AND CLOSED LOOP SYSTEMS	9

Feedback control systems – Control system components - Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs, Output to input ratios.

UNIT - III	CHARACTERISTIC EQUATION AND FUNCTIONS	9

Laplace transformation, Response of systems to different inputs viz., Step impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

UNIT - IV	CONCEPT OF STABILITY	9

Necessary and sufficient conditions, Routh-Hurwitz criteria of stability, Root locus and Bode techniques, Concept and construction, frequency response.

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UNIT - V	SAMPLED DATA SYSTEMS	9
Z - Transforms Introduction to digital control system, Digital Controllers and Digital PID controllers.		
		Total Instructional Hours : 45

Course Outcomes : Students will be able to	
CO1	Apply mathematical knowledge for Mechanical, Electrical component analogies-based problems. (K3)
CO2	Solve the block diagram representation of control systems, reduction of block diagram signal flow graph-based problems. (K3)
CO3	Analyze the stability of time and frequency. (K4)
CO4	Choose different graphical method for calculating frequency. (K3)
CO5	Classify the different control system, digital controllers and digital PID controllers. (K4)

Text Books	
1.	Azzo, J.J.D. and C.H. Houpis. "Feedback control system analysis and synthesis", McGraw-Hill International 3rd Edition, 1998.
2.	OGATO,. "Modern Control Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.

Reference Books	
1.	Houpis, C.H. and Lamont, G.B. "Digital control Systems", McGraw Hill Book Co., New York, U.S.A. 1995.
2.	Kuo, B.C. "Automatic control systems", Prentice-Hall of India Pvt. Ltd., New Delhi, 1998.
3.	Naresh K Sinha, "Control Systems", New Age International Publishers, New Delhi, 1998.

BoS Chairman

B.E.	B19AEE504 – HEAT TRANSFER	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To introduce the governing equations of the with and without governing equations.
2.	To understand the convection mode of heat transfer and overall heat transfer coefficient
3.	To get the knowledge about the radiation heat transfer of white body, gray body and block body.
4.	To learn the knowledge about the different types of fin and pin.
5.	To understand the gas turbine engine heat transfer.

UNIT - I	CONDUCTION	8

Governing Equation in Cartesian, Cylindrical and Spherical coordinates. 1-D steady state heat conduction with and without heat generation. Composite wall - Electrical analogy – Critical thickness of insulation – Heat transfer from extended surface – Effect of temperature on conductivity - 1-D Transient analysis.

UNIT - II	CONVECTION	12

Review of basic Equations of fluid flow – Dimensional analysis - Forced convection – Laminar flow over flat plate and flow through pipes - Flow across tube banks. Turbulent flow over flat plate and flow through pipes – Free convection – Heat transfer from vertical plate using integral method – Empirical relations - Types of heat exchangers – Overall heat transfer coefficient – LMTD and NTU methods of analysis.

UNIT - III	RADIATION	9

Basic definitions – Concept of black body - Laws of black body radiation-Radiation between black surfaces – Radiation heat exchange between grey surfaces – Radiation shielding – Shape factor-Electrical network analogy in thermal radiation systems.

UNIT - IV	NUMERICAL METHODS IN HEAT TRANSFER	9

1-D and 2-D Steady and unsteady state heat conduction – Composite walls - heat generation - Variable thermal conductivity - Extended surfaces analysis using finite difference method - Convective heat transfer - Stream function - Vorticity method - Creeping flow analysis - Convection - diffusion 1-D, 2-D Analysis using finite difference approximation. Numerical methods applicable to radiation heat transfer.

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UNIT - V	HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING	4
Heat transfer problems in gas turbines, Rocket thrust chambers- Aerodynamic heating – Ablative heat transfer.		
		Total Instructional Hours : 45

Course Outcomes : Students will be able to	
CO1	Classify the difference between various modes of Heat Transfer and the Resistance Concept used in Heat Conduction. (K2)
CO2	Make use of the basic methods in Conduction andunderstand the concept of Lump Parameter analysis and when it is applicable and earn the concepts of boundary layer. (K3)
CO3	Apply various correlation used in Convective Heat Transfer and Understand the concepts of Black Body, Grey Body, View factor, Radiation shielding. (K3)
CO4	Construct the design/size Heat Exchanger and understand the concept of Mass transfer, its types & laws associated with it. (K3)
CO5	Apply various technique used for high-speed flow heat transfer. (K3)

Text Books	
1.	Holman, J.P., "Heat Transfer", McGraw Hill Book Co., Inc., New York, Sixth Edition, 1991.
2.	Sachdeva, S.C., "Fundamentals of Engineering Heat and Mass Transfer", Wiley Eastern Ltd., New Delhi,1981.
3.	Yunus,A.Cengel, "Heat Transfet-A Practical Approach", Tata McGraw Hill, Second edition, 2003.

Reference Books	
1.	Lienhard, J.H , "A Heat Transfer Text Book", Prentice Hall Inc., 1981.
2.	Mathur, M. and Sharma, R.P, "Gas Turbine and Jet and Rocket Propulsion", Standard Publishers, New Delhi, 1988.
3.	Sutton, G.P, "Rocket Propulsion Elements", John Wiley and Sons, Fifth Edition, 1986

BoS Chairman

B.E.	B19AEE505 – EXPERIMENTAL STRESS ANALYSIS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To study the various experimental techniques in extensometer types and displacement sensor.
2.	To understand about the types and operation of strain gauge.
3.	To learn the concept of light, photo elastic effect and various functional process.
4.	To understand the strain analysis, brittle coating and moiré techniques.
5.	To study the fundamental of non-destructive testing and their types.

UNIT - I	EXTENSOMETERS AND DISPLACEMENT SENSORS	8

Principles of measurements, Accuracy, Sensitivity and range of measurements, Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages, Capacitance gauges, Laser displacement sensors.

UNIT - II	ELECTRICAL RESISTANCE STRAIN GAUGES	12

Principle of operation and requirements, Types and their uses, Materials for strain gauges, Calibration and temperature compensation, Cross sensitivity, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, Strain indicators, Rosette analysis, Stress gauges, load cells, Data acquisition, Six component balance.

UNIT - III	PHOTO ELASTICITY	11

Two dimensional photo Elasticity, Photo elastic materials, Concept of light - Photoelastic effects, stress optic law, Transmission photoelasticity, Jones calculus, plane and circular polariscopes, Interpretation of fringe pattern, Calibration of photoelastic materials, Compensation and separation techniques, Introduction to three dimensional photo elasticity.

UNIT - IV	BRITTLE COATING AND MOIRE TECHNIQUES	7

Relation between stresses in coating and specimen, Use of failure theories in brittle coating, Moire method of strain analysis.

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UNIT - V	NON – DESTRUCTIVE TESTING	7
Fundamentals of NDT, Acoustic Emission Technique, Radiography, Thermography, Ultrasonics, Eddy Current testing, Fluorescent Penetrant Testing.		
		Total Instructional Hours : 45

Course Outcomes : Students will be able to	
CO1	Classify the stress and strain measurements in various extensometers. (K2)
CO2	Analyze the strain at various loading conditions for rosette gauges. (K4)
CO3	Evaluate photo elastic materials by compensation and separation techniques. (K5)
CO4	Make use of brittle coating and Moire techniques for stress and strain analysis. (K3)
CO5	Evaluate the location and size of defect in aircraft materials by non-destructive testing methods. (K5)

Text Books	
1.	Dally, J.W., and Riley, W.F., "Experimental Stress Analysis", McGraw Hill Inc., New York 1998.
2.	Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., "Experimental Stress Analysis", Tata McGraw Hill, New Delhi, 1984.
3.	Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 1996.

Reference Books	
1.	Durelli. A.J., "Applied Stress Analysis", Prentice Hall of India Pvt Ltd., New Delhi, 1970
2.	Hetenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.
3.	Max Mark Frocht, "Photo Elasticity", John Wiley and Sons Inc., New York, 1968
4.	Pollock A.A., "Acoustic Emission in Acoustics and Vibration Progress", Ed. Stephens R.W.B., Chapman and Hall,1993.
5.	Ramesh, K., “Digital Photoelasticity", Springer, New York, 2000.

BoS Chairman

Open Elective - I

B.E. / B.TECH	B19AG0501 - ENVIRONMENT AND AGRICULTURE (Common to all Except AGRI)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the importance of land, water and social structure in agriculture.
2.	To remember the impacts of mechanization, irrigation and urbanization in agriculture.
3.	To know the ecological issues, climate change, environmental policies and sustainable agriculture.
4.	To learn about the Ecological diversity in agricultural applications.
5.	To understand the emerging issues in environment and agriculture.

UNIT - I	ENVIRONMENTAL CONCERNS	9

Environmental basis for agriculture and food – Land use and landscape changes – Water quality issues – Changing social structure and economic focus – Globalization and its impacts – Agro ecosystems.

UNIT - II	ENVIRONMENTAL IMPACTS	9

Irrigation development and watersheds – mechanized agriculture and soil cover impacts – Erosion and problems of deposition in irrigation systems – Agricultural drainage and downstream impacts – Agriculture versus urban impacts.

UNIT - III	CLIMATE CHANGE	9

Global warming and changing environment – Ecosystem changes – Changing blue-green - grey water cycles – Water scarcity and water shortages – Desertification.

UNIT - IV	ECOLOGICAL DIVERSITY AND AGRICULTURE	9

Ecological diversity, wild life and agriculture – GM crops and their impacts on the environment – Insets and agriculture – Pollination crisis – Ecological farming principles – Forest fragmentation and agriculture – Agricultural biotechnology concerns.

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UNIT - V	EMERGING ISSUES	9
Global environmental governance – alternate culture systems – Mega farms and vertical farms – Virtual water trade and its impacts on local environment – Agricultural Biodiversity. Agricultural environment policies and its impacts – Sustainable agriculture.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the environmental concerns and impacts in agriculture
CO2	Outline about the interventions like mechanization, watershed development and irrigation in agriculture
CO3	Summarize about the climate change and its issue in agriculture
CO4	Illustrate a capacity building on the focus areas for ecological farming and agriculture biotechnology issues
CO5	Explain the agriculture environmental policies for sustainable agriculture

Text Books	
1.	M.Lakshmi Narasaiah, — Environment and Agriculture, Discovery Pub. House, 2006.
2.	Arvind Kumar, — Environment and Agriculture, ABH Publications, New Delhi, 2005.

Reference Books	
1.	T.C. Byerly, — Environment and Agriculture, United States. Dept. of Agriculture. Economic Research Service, 2006.
2.	Robert D. Havener, Steven A. Breth, — Environment and agriculture: rethinking development issues for the 21st century: proceedings of a symposium, Winrock International Institute for Agricultural Development, 1994.
3.	Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium‖, Bangkok, Thailand. 1989.
4.	https://nptel.ac.in/courses/126/105/126105014/

BoS Chairman

B.E. / B.TECH	B19BMO501 – INTRODUCTION TO MEDICAL PHYSICS (Common to all Except BME)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To outline the effects of non ionizing radiation and its application.
2.	To summarize the principles of radioactive nuclides.
3.	To explain the interaction of radiation with matter.
4.	To illustrate the radiation detectors.
5.	To explain the radiation quantities.

UNIT - I	NON IONIZING RADIATION AND ITS MEDICAL APPLICATION	9

Overview of non-ionizing radiation effects - Low Frequency Effects - Higher frequency effects. Thermography – Application. Ultrasound Transducer - Interaction of Ultrasound with matter; Cavitations, Conditions for reflection, Transmission - Scanning systems – Artefacts - Ultrasound Doppler - Double Doppler shift Clinical Applications.

UNIT - II	PRINCIPLES OF RADIOACTIVE NUCLIDES	9

Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology ,Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, radionuclide Generator-Milking process (Technetiumgenerator).

UNIT - III	INTERACTION OF RADIATION WITH MATTER	9

Interaction of charged particles with matter – Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter - Photoelectric effect, Compton Scattering, Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance.

UNIT - IV	PRINCIPLES OF RADIATION DETECTION AND DOSIMETERS	9

Principles of radiation detection, Properties of dosimeters, Theory of gas filled detectors, Ionization Chamber, Proportional chamber, G.M. Counter, Film dosimetry, luminescence dosimetry, scintillation detectors, Radiation detection instruments, Area survey meters, Personal Radiation monitoring device, Film badge, TLD, OSLD.

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UNIT - V	BASIC RADIATION QUANTITIES	9
Introduction - exposure - Inverse square law - KERMA - Kerma and absorbed dose - stopping power - relationship between the dosimetric quantities - Bremsstrahlung radiation, Bragg"s curve - concept of LD 50 - Stochastic and Non-stochastic effects, Different radiation Unit, Roentgen, gray, Sievert.		
	Total Instructional hours : 45	

Course Outcomes : Students will be able to	
CO1	Recall the effect of non ionising radiation in human body and applications in the field of medicine
CO2	Interpret radioactive decay and production of radio nuclides
CO3	Discuss the interaction of radiation with matter
CO4	Illustrate the measurement of ionizing radiation
CO5	Summarize about the radiation quantities

Text Books	
1.	John. R Cameron, James G Skofronick, “Medical Physics”, John-Wiley & Sons, 1978.
2.	Muhammad Maqbool, “An Introduction to Medical Physics”, Springer International Publishing AG 2017.

Reference Books	
1.	P.Uma Devi, A.Nagarathnam, BS Satish Rao, “Introduction to Radiation Biology”, B.I Chur Chill Livingstone Pvt. Ltd, 2000.
2.	By B.H Brown, R.H Smallwood, D.C. Barber, P.V Lawford, D.R Hose J.P.Woodcock, “Medical Physics and Biomedical Engineering”, CRC Press,1998.
3.	Hylton B.Meire and Pat Farrant, “Basic Ultrasound”, John Wiley & Sons, 1995.

BoS Chairman

B.E. / B.TECH	B19BTO501 - FOOD PROCESSING AND PRESERVATION (Common to all Except BT)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the students acquire the basics of food processing.
2.	To able to understand the food preservation techniques.
3.	To be able to understand the significance of food processing.
4.	To familiarize with the recent methods of processing of foods
5.	To understand the principles of food preservation.

UNIT - I	FOOD PROCESSING	9

Principles, importance, food processing methods: pasteurization (definition, time-temperature combination and equipments) sterilization (definition, time-temperature combination and equipments), blanching (definition, time-temperature combination and equipments, adequacy in blanching), canning (definition, time-temperature combination and equipments), packaging (Introduction, Metal Containers, Glass Containers, Rigid Plastic Containers, Retortable Pouches).

UNIT - II	FOOD FREEZING AND DRYING	9

Freezing : Introduction, freezing point and freezing rate, freezing methods: Air freezing, plate freezing, liquid immersion freezing and cryogenic freezing, Freezer selection, Advantages and disadvantages of freezing.

Drying : Definition, free and bound moisture, concept of water activity, factors affecting drying, Drying methods and equipments: sun/solar drying, Cabinet drying, tunnel dryer, spray dryer, freeze dryer, fluidized bed dryer, Nutritional, physico-chemical changes during drying.

UNIT - III	PROCESSING OF FOOD PRODUCTS	9

Evaporation - Definition, types of evaporator (single effect, double effect and multiple effect evaporator); Freeze concentration - General principles and applications, basic elements, ice crystal nucleation, growth and crystallization, separation techniques (filtration and wash column).

UNIT - IV	MEMBRANE TECHNOLOGIES IN FOOD PROCESSING	9

General principles and advantages, dead end and cross flow, Classification of membrane system: Reverse Osmosis, Nanofiltration, Ultra Filtration, Micro Filtration, Electodialysis and Pervaporation; Membrane technology comparison chart, Membrane application in the food industries and industrial effluent treatments; Membrane performance, and Limitation of membrane processes.

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UNIT - V	FOOD PRESERVATION	9
Introduction and principles. Traditional methods of preservation; Types of food based on its perishability; Importance of food preservation, Wastage of processed foods; Shelf life of food products. Advantages of food preservation		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the different methods applied in the processing of foods
CO2	Understand the significance of food processing and the role of food and beverage industries in the supply of foods
CO3	Acquire knowledge on the changes occurring in the food during processing and storage
CO4	Explain the food preservation and various food processing techniques
CO5	Understand effective food preservation techniques

Text Books	
1.	Ramaswamy H. and Marcotte M, “Food Processing: Principles and Applications”, by Taylor & Francis, 2005.
2.	Norman N Potter and Joseph H. Hotchkiss, “Food Science”, 5th Edition, CBS Publishers and Distributors, 1996.
3.	Barbosa-Canovas.,“Novel Food Processing Technologies”, Tapia & Cano CRC Press, 2004.
4.	Gould GW, “New Methods of Food Preservation”, Springer Science & Business Media. 2012.
5.	Rahman MS, “Food Preservation”, In: Handbook of Food Preservation, 2nd Edition, (pp. 14-29), CRC press, 1999.
6.	Subbulakshmi G. and A.S. Udipi, “Food Processing and Preservation”, New Age Publications, 2006.

Reference Books	
1.	Manay S. and M.S. Swamy, “Foods: Facts and Principles”, 4th Ed. New Age Publishers, 2004.
2.	Deman J.M., “Principles of Food Chemistry”, 2nd Ed., Van Nostrand Reinhold, NY., 1990.

BoS Chairman

B.E. / B.TECH	B19CSO501 – FUNDAMENTALS OF DATABASE MANAGEMENT SYSTEM (Common to all Except CSE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts of database management systems.
2.	To acquire basic knowledge about database models and its design.
3.	To reveal the role and functionalities of database in business community.
4.	To learn about the Structured Query Language (SQL)
5.	To learn the client / server relation.

UNIT - I	INTRODUCTION	9
Database Types and Systems – An Overview – Meaning, Definition – Components – Objectives – Advantages and Disadvantages – Evolution.		

UNIT - II	MODELS	9
DBMS Architecture – Associations – Relationship – Generalization – Classifications – Conceptual Data Modeling – File Organization.		

UNIT - III	DATABASE DESIGN	9
Relational Data Model – ER Diagram – Data Dictionary – Normalization – Boyce Code Normal Form - Integrity – Relational Database Languages – Database Administration.		

UNIT - IV	UNDERSTANDING SQL	9
SQL Data Definition and Data Types - SQL - Specifying Constraints - Key and Referential Integrity Constraints - Basic Retrieval Queries in SQL - Joins – Sub queries – Nested subquery.		

UNIT - V	OPERATIONS AND MANAGEMENT	9
Client/Server and Databases – Data Warehousing – Query Processing – Heterogeneous and Homogeneous – Controls.		
Total Instructional hours : 45		

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Course Outcomes : Students will be able to	
CO1	Understand the basics of database management systems.
CO2	Acquire basic knowledge about database and its design with models.
CO3	Translate ER model to Relational model to perform database design effectively.
CO4	Understand the SQL for DB creation and updation.
CO5	Design client / server relation.

Text Books	
1.	Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017.

Reference Books	
1.	Abraham Silberschatz, Henry F Korth and Sudarshan S, “Database System Concepts”, Sixth Edition, McGraw-Hill, 2011.
2.	Martin Gruber,” Understanding SQL”, Sybex Inc,1990 (4^{th} unit 50%)
3.	C.J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
4.	Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, McGraw-Hill College Publications, 2015.

BoS Chairman

B.E. / B.TECH	B19ECO501 - LOGIC AND DISTRIBUTED CONTROL SYSTEMS (Common to all Except ECE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To give an introductory knowledge on Programmable Logic Controller (PLC) and their programming languages
2.	To give adequate knowledge about applications of PLC
3.	To give basic knowledge about Computer Controlled Systems
4.	To give basic knowledge on the architecture and local control unit of Distributed Control System (DCS)
5.	To give adequate information with respect to interfaces used in DCS

UNIT - I	PROGRAMMABLE LOGIC CONTROLLER	9
Evolution of PLCs – Components of PLC – Architecture of PLC – Discrete and analog I/O modules – Programming languages - Ladder diagram – Function block diagram (FBD) - Programming timers and counters.		

UNIT - II	APPLICATIONS OF PLC	9
Instructions in PLC – Program control instructions, math instructions, data manipulation Instructions, sequencer and shift register instructions – Case studies in PLC.		

UNIT - III	COMPUTER CONTROLLED SYSTEMS	9
Basic building blocks of computer controlled systems – Data acquisition system – Supervisory control – Direct digital control- SCADA - Hardware and software, Remote terminal units, Master Station and Communication architectures.		

UNIT - IV	DISTRIBUTED CONTROL SYSTEM	9
DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities.		

UNIT - V	INTERFACES IN DCS	9
Operator interfaces - Low level and high level operator interfaces – Displays - Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS – Case studies in DCS.		
		Total Instructional hours : 45

R. Gowri

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Course Outcomes : Students will be able to	
CO1	Infer the PLC
CO2	Apply PLC in various applications
CO3	Infer the concepts of Computer Controlled Systems
CO4	Construct knowledge about various architectures of DCS
CO5	Analyze the various interfaces in DCS

Text Books	
1.	F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010.
2.	Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986.
3.	D. Popovic and V.P.Bhatkar, “Distributed computer control for industrial Automation” Marcel Dekker, Inc., Newyork ,1990.

Reference Books	
1.	T.A. Hughes, “Programmable Controllers”, Fourth edition, ISA press, 2005.
2.	Krishna Kant, “Computer Based Industrial Control”, Second edition, Prentice Hall of India, New Delhi, 2010.
3.	John W. Webb and Ronald A. Reis, “Programmable Logic Controllers”, Fifth edition, Prentice Hall of India, New Delhi, 2010.
4.	John R. Hackworth and Frederick D. Hackworth Jr, Programmable Logic Controllers, Pearson, New Delhi, 2004.
5.	Clarke, G., Reynders, D. and Wright, E., “Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems”, Newnes, 1st Edition, 2004.
6.	E.A.Parr, Programmable Controllers, An Engineer‟s Guide, Elsevier, 2013.

R. Gowri

BoS Chairman

B.E. / B.TECH	B19EEO501 - ROTATING MACHINES AND TRANSFORMERS (Common to all Except EEE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impact knowledge on magnetic-circuit analysis and introduce magnetic materials.
2.	To understand the Working principles of DC Generator.
3.	To understand the Working principles of DC Motor.
4.	To understand the Working principles of Induction and synchronous machines.
5.	To understand the Working principles of Transformer.

UNIT - I	MAGNETIC CIRCUITS AND MAGNETIC MATERIALS	9

Magnetic circuits –Laws governing magnetic circuits - Flux linkage, Inductance and energy – Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets- Transformer as a magnetically coupled circuit (Qualitative Only).

UNIT - II	DC GENERATORS	9

Construction and components of DC Machine – Principle of operation - Lap and wave windings-EMF equations– circuit model – armature reaction –methods of excitation commutation – inter poles compensating winding –characteristics of DC generators (Qualitative Only).

UNIT - III	DC MOTORS	9

Principle and operations - types of DC Motors – Speed Torque Characteristics of DC Motors starting and speed control of DC motors –Plugging, dynamic and regenerative braking testing and efficiency – Permanent Magnet DC (PMDC) motors-applications of DC Motor (Qualitative Only).

UNIT - IV	INDUCTION AND SYNCHRONOUS MACHINES	9

Single phase motor - Double revolving field theory - starting methods - no load and block rotor test - equivalent circuit - types of single phase motor - 3 Phase induction motor – Construction – types - principle of operation - speed control of 3 phase motor - starting methods for 3 phase induction motor. Synchronous Machine Alternator, Construction and Basic principle - Synchronous motor - Basic principle, methods of starting, applications (Qualitative Only).

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UNIT - V	TRANSFORMERS	9
Transformers - Construction and types - Operation of single phase transformers - EMF equation - Voltage regulation - Losses and Efficiency - All day efficiency - Parallel operation Testing: Open circuit and Short circuit tests - 3 Phase transformers: (Construction & connections) - Autotransformers (Qualitative Only).		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the magnetic-circuits and materials.
CO2	Explain the construction and operation of DC Generator.
CO3	Explain the construction and operation of DC Motor.
CO4	Explain the construction and operation of induction and Synchronous machines.
CO5	Explain the construction, working principle of transformer and Autotransformer.

Text Books	
1.	Nagrath, I.J. and Kothari D.P., "Electrical Machines", Tata McGraw Hill Publishing Company Ltd., 4th Edition, 3rd Reprint, New Delhi, 2011.
2.	P.C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons; 3rd Edition 2013.

Reference Books	
1.	S.K. Bhattacharya, "Electrical Machines", McGraw-Hill Education, New Delhi, 3rd Edition, 2009.
2.	B.R. Gupta, "Fundamental of Electric Machines", New age International Publishers, 3rd Edition, Reprint 2015.
3.	Vincent Del Toro, "Basic Electric Machines", Pearson India Education, 2016.
4.	Surinder Pal Bali, "Electrical Technology Machines & Measurements", Vol.II, Pearson, 2013.

BoS Chairman

B.E. / B.TECH	B19MEO501 – ROBOTICS (Common to all Except MECH)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the concepts of the basic components of a robot.
2.	To apply the distinct drive systems and end effectors to control the robot actuation.
3.	To study the role and application of various types of sensors and machine vision system.
4.	To make use of the knowledge in the robot kinematics and to write Robot Programs.
5.	To identify the social and economic challenges while implementing the robot systems.

UNIT - I	FUNDAMENTALS OF ROBOT	9

Robot - Definition - Robot Anatomy Coordinate Systems, Work Envelope Types and Classification - Specifications Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load - Robot Parts and their Functions - Different Applications A view on Global and Indian manufacturers of Robots Need for Robots in Indian environment.

UNIT - II	ROBOT DRIVE SYSTEMS AND END EFFECTORS	9

Drives hydraulic, pneumatic, mechanical, electrical, Servo motors, Stepper motors - salient features, application; End effectors – types; Grippers- mechanical, pneumatic, hydraulic, magnetic, vacuum limitations, Multiple grippers.

UNIT - III	SENSORS AND MACHINE VI	9

Requirements of sensors, principles, types and applications of Proximity (Inductive, Hall effect, Capacitive, Ultrasonic and Optical); – Range (Triangulation, Structured light approach); Speed, Position (resolvers, optical encoders); – Force – Torque – Touch sensors (binary, analog sensor). Introduction to Machine Vision; applications, functions; image processing and analysis; training the vision system.

UNIT - IV	ROBOT KINEMATICS AND ROBOT PROGRAMMING	9

Forward kinematics and Reverse kinematics of manipulators; two, three degrees of freedom, homogeneous transformation matrix; introduction to manipulator dynamics, trajectory generator, manipulator mechanism, Degeneracy and Dexterity; Lead through programming, Robot programming languages; VAL programming, motion commands, sensor commands, end effecter commands, simple programs (for loading, unloading and palletizing operations), introduction to advances in Robot Programming.

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UNIT - V	APPLICATION, IMPLEMENTATION AND ROBOT ECONOMICS	9
Robot cell design; types, application of robots in processing, assembly, inspection, material handling in automobile, medical, Nuclear Industries, RGV, AGV; Implementation of Robots in Industries; S afety considerations for robot operations, safety codes, Economic analysis of robots.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the concepts of industrial robots, classification, specifications and coordinatesystems
CO2	Illustrate the different types of robot drive systems as well as robot end effectors
CO3	Apply the different sensors and image processing techniques in robotics to Improve the ability of robots
CO4	Develop robotic programs for different operations and familiarize with the kinematicsmotions of robot
CO5	Examine the implementation of robots in various industrial sectors and interpolate theeconomic analysis of robots

Text Books	
1.	Groover M.P., — Industrial Robotics -Technology Programming and Applications, McGraw Hill, 2012.
2.	Deb S R and Deb S, — Robotics Technology and Flexible Automation‖, Tata McGraw Hill Education Pvt. Ltd, 2010.
3.	Saha S K, —Introduction to Robotics‖, Tata McGraw Hill Education Pvt. Ltd, 2010, 2nd Ed, 2014.

Reference Books	
1.	Craig J.J., — Introduction to Robotics Mechanics and Control‖, Pearson Education, Global Edition, 3rd Edition, 2014.
2.	Deb S.R., — Robotics Technology and Flexible Automation, Tata McGraw Hill Book Co., 2013.
3.	Ashitava Ghoshal, — Robotics - Fundamental Concepts and Analysis, OxfordUniversity Press, Sixth impression, 2010.

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Semester - VI

B.E.	B19AET601 – FINITE ELEMENT METHODS	T	P	TU	C
		2	0	1	3

Course Objectives	
1.	To understand various approximate methods and weighted residual approach to solve the structural problems
2.	To impart local and natural coordinates for bar, truss, beam and frame elements for various loading and boundary conditions.
3.	To give exposure on various plane stress, strain and axis symmetry problems
4.	To know about shape function and stiffness matrix by using numerical integration method.
5.	To realize the steady flow and heat transfer problem solving methods and to know about the software packages.

UNIT - I	INTRODUCTION	8

Review of various approximate methods – variational approach and weighted residual approach - application to structural mechanics problems. Finite difference methods - governing equation and convergence criteria of finite element method.

UNIT - II	DISCRETE ELEMENTS	10

Bar elements, uniform section, mechanical and thermal loading, varying section, 2D and 3D truss element. Beam element - problems for various loadings and boundary conditions – 2D and 3D Frame elements - longitudinal and lateral vibration. Use of local and natural coordinates.

UNIT - III	CONTINUUM ELEMENTS	8

Plane stress, plane strain and axisymmetric problems. Derivation of element matrices for constant and linear strain triangular elements and axisymmetric element.

UNIT - IV	ISOPARAMETRIC ELEMENTS	9

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, stiffness matrix and consistent load vector, evaluation of element matrices using numerical integration.

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UNIT - V	FIELD PROBLEM AND METHODS OF SOLUTIONS	9
Heat transfer problems, steady state fin problems, derivation of element matrices for two dimensional problems, torsion problems. bandwidth - elimination method and method of factorization for solving simultaneous algebraic equations – Features and application of software packages.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply different mathematical techniques to find deflection and bending moment. (K3)
CO2	Solve stiffness matrix for bar, beam and frame problems with different loading conditions. (K3)
CO3	Identify plane stress and plane strain for triangular and axisymmetric elements. (K3)
CO4	Evaluate the shape function and stiffness matrix using numerical integration for isoparametric elements. (K5)
CO5	Apply the concepts of finite element methods to solve fluid flow and heat transfer problems. (K3)

Text Books	
1.	Reddy J.N., "An Introduction to Finite Element Method", McGraw-Hill Education; 4th edition 2018.
2.	Tirupathi.R. Chandrapatha and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall India, Fourth edition, 2012.

Reference Books	
1.	Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
2.	Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw Hill, 2000.
3.	Rao. S.S., "Finite Element Methods in Engineering," Butterworth and Heinemann, 2001.

BoS Chairman

B.E.	B19AET602 - COMPOSITE MATERIALS AND STRUCTURES	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the classification and application of composite materials.
2.	To understand the micromechanics of composite material.
3.	To realize the failure of laminates composite under various loading conditions.
4.	To expose on various fabrication process and repair techniques in composites.
5.	To gain knowledge in the design concepts, materials and failure modes of sandwich construction.

UNIT - I	MICROMECHANICS	9

Introduction - advantages and application of composite materials – types of reinforcements and matrices - micro mechanics – mechanics of materials approach, elasticity approach - bounding techniques – fiber volume ratio – mass fraction – density of composites effect of voids in composites

UNIT - II	MACROMECHANICS	12

Generalized Hooke's Law - elastic constants for anisotropic, orthotropic and isotropic materials - macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis – determination of in plane strengths of a lamina - experimental characterization of lamina. failure theories of a lamina. hygrothermal effects on lamina.

UNIT - III	LAMINATED PLATE THEORY	12

Governing differential equation for a laminate. Stress – strain relations for a laminate. different types of laminates. in plane and flexural constants of a laminate. hydrothermal stresses and strains in a laminate. failure analysis of a laminate. Impact resistance and interlaminar stresses. netting analysis.

UNIT - IV	FABRICATION PROCESS AND REPAIR METHODS	6

Various open and closed mould processes, manufacture of fibers, importance of repair and different types of repair techniques in composites – autoclave and non-autoclave methods.

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UNIT - V	SANDWICH CONSTRUCTIONS	9
Basic design concepts of sandwich construction - materials used for sandwich construction - failure modes of sandwich panels – effect of vibration in composites - bending stress and shear flow in composite beams.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the mechanics of composite materials. (K2)
CO2	Identify the elastic constants of macro mechanic materials. (K3)
CO3	Analyze the laminated composites for various loading conditions. (K4)
CO4	Examine different types of fabrication process and repair methods. (K4)
CO5	Choose different material used for sandwich construction. (K5)

Text Books	
1.	Autar K Kaw, 'Mechanics of Composite Materials', CRC Press, 2nd edition, 2005.
2.	Isaac M. Daniel & Ori Ishai, "Mechanics of Composite Materials," OUP USA publishers, 2nd edition, 2005.
3.	Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures, University Press, 2004

Reference Books	
1.	Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites," John Wiley & Sons, 3rd edition, July 2006.
2.	Allen Baker, Composite Materials for Aircraft Structures, AIAA Series, 2nd Edition, 2004.
3.	Calcote, L R. "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Company, New York 1998.
4.	Lubing, Handbook on Advanced Plastics and Fibre Glass, Von Nostran Reinhold Co., New York, 1989.
5.	Michael F. Ashley, "Material Selection in Mechanical Design", 5th edition, Butterworth-Heiner, 2016.

BoS Chairman

B.E.	B19AET603 – AIRCRAFT STABILITY AND CONTROL	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know about the static longitudinal stability, power and Influence of CG location
2.	To introduce the concept of stick controls of Aircraft and Aerodynamic balancing.
3.	To acquire knowledge about lateral and directional stability of airplanes during different maneuvering conditions
4.	To impart knowledge about various Aerobatics Manoeuvres
5.	To understand the dynamic modes of stability in longitudinal, lateral and directional stability conditions.

UNIT - I	STATIC LONGITUDINAL STABILITY	9

Degree of freedom of rigid bodies in space - Static and dynamic stability - Purpose of controls in airplanes. Wing and tail contribution - Effects of Fuselage and nacelles - Power effects - Jet driven airplane and Propeller driven airplane - Influence of CG location.

UNIT - II	STICK FIXED AND FREE LONGITUDINAL STABILITY	9

Basic equations of motion Elevator hinge moment, Estimation of hinge moment parameters - Stick fixed neutral point - Stick free neutral points - Symmetric manoeuvres - Stick force gradients - Stick force per ‘g’ - Aerodynamic balancing.

UNIT - III	LATERAL AND DIRECTIONAL STABILITY	9

Dihedral effect - Lateral control - Coupling between rolling and yawing moments - Adverse yaw effects - Aileron reversal - Static directional stability - Weather cocking effect - Rudder requirements - One engine inoperative condition - Rudder lock.

UNIT - IV	BASIC AEROBATICS MANOEUVRES	9

Introduction – Wing over (chandelle / lazy eight) – Loop – Aileron roll – Stall Turn- Barrel Roll – Slow roll – Roll of the top – Half reverse – Cuban – Loss of controls in the verticals- Wing drop stalls.

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UNIT - V	DYNAMIC STABILITY	9
Introduction to dynamic longitudinal stability : Modes of stability, Characteristics modes of oscillation in stick fixed and stick free longitudinal dynamics - Dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin – Introduction to flight simulation software.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Summarize the degree of freedom, static stability and the requirement of control force and power effect of aircraft system (K2)
CO2	Utilize the knowledge about degrees of stability, stick fixed, stick free stability and aerodynamic balancing. (K3)
CO3	Categorize the lateral control, rolling and yawing moments, rudder and aileron control requirements & rudder lock. (K4)
CO4	Identify the different manoeuvres performed by the aircraft. (K3)
CO5	Classify the dynamic longitudinal stability and stability derivatives. (K4)

Text Books	
1.	Nelson, R.C. “Flight Stability and Automatic Control”, McGraw-Hill Book Co., 2004.
2.	Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son: Inc, NY, 1988.
3.	Aerobatics Manual- C152 A Master – 7th Edition

Reference Books	
1.	Babister, A.W., “Aircraft Dynamic Stability and Response”, Pergamon Press, Oxford, 1980.
2.	Dommasch, D.O., Sherby, S.S., and Connolly, T.F., “Aeroplane Aero dynamics”, Third Edition, Issac Pitman, London, 1981.
3.	Etkin, B., “Dynamics of Flight Stability and Control”, Edn. 2, John Wiley, NY, 1982.
4.	Mc Cornick B.W, “Aerodynamics, Aeronautics and Flight Mechanics”, John Wiley, NY, 1995

BoS Chairman

B.E.	B19AEP601 - AERO ENGINE AND AIRFRAME STRUCTURAL LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To impart knowledge on assembling and reassembling of an aircraft piston engine and its operating principle.
2.	To attain knowledge lubrication and auxiliary system in aircraft.
3.	To understand various joining methods in airframe.
4.	To expose patch repairing procedure and tube bending methods.
5.	To attain hands on experience on glass epoxy laminate and sheet metal forming.

List of Experiments

Expt. No.	Description of the Experiments
1.	Dismantling and reassembling of an aircraft piston engine.
2.	Study of Camshaft operation, firing order and magneto, valve timing
3.	Study of lubrication and cooling system
4.	Study of auxiliary systems, pumps and carburetor
5.	Aircraft wood gluing-single & double scarf joints
6.	Welded single & double V-joints.
7.	Fabric & Riveted Patch repairs
8.	Tube bending and flaring
9.	Sheet metal forming
	Total Practical Hours : 60

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Experiment with the Aircraft to perform the Dismantling and Reassembling of an Aircraft piston Engine, there by the cam shaft operation and valve timings arestudied. (K3)
CO2	Identify the Lubrication and Auxiliary systems incorporated with the Aircraft. (K3)
CO3	Examine the wood gluing and welding techniques that is used to join the given work pieces. (K4)
CO4	Inspect the structural damage to perform repair works by means of Fabric Patch work and Flaring methods. (K4)
CO5	Construct the channel section by sheet metal forming and Glass epoxy composite Laminates. (K6)

List of Equipment for a Batch of 30 Students

Sl. No.	Description of the Equipment	Quantity
1.	Aircraft Piston engines	1
2.	Set of basic tools for dismantling and assembly	1 set
3.	NDT equipment	1 set
4.	Micrometers, depth gauges, vernier calipers	2 sets
5.	Valve timing disc	1
6.	Shear cutter pedestal type	1
7.	Drilling Machine	1
8.	Bench Vices	1
9.	Radius Bend bars	1
10.	Pipe Flaring Tools	1
11.	Welding machine	1
12.	Glass fibre, epoxy resin	1
13.	Strain gauges and strain indicator	1

BoS Chairman

B.E.	B19AEP602 - COMPUTER AIDED SIMULATION LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To attain knowledge about grid independence and flow simulation over backward facing step.
2.	To impart knowledge on flow simulation on cylinder, subsonic and supersonic flows.
3.	To understand the internal flow of a CD nozzle and structural analysis of Two-Dimensional Element.
4.	To explore the structural behavior of tapered wing and fuselage structure.
5.	To introduce the composite laminate behavioral and thermal analysis

List of Experiments

Expt. No.	Description of the Experiments
1.	Grid independence study and convergence test using any simple case like pipe flow, diffuser flow, flow over a cylinder, aero foil etc.
2.	Simulation of flow over backward facing step.
3.	Simulation of Karman vortex trail (vortex shedding) using circular cylinder.
4.	External flow simulation of subsonic and supersonic aero foils.
5.	Internal flow simulation of subsonic, sonic and supersonic flow through a CD nozzle.
6.	Structural analysis of bar, beam and truss.
7.	Structural analysis of tapered wing.
8.	Structural analysis of fuselage structure.
9.	Analysis of composite laminate structures.
10.	Thermal analysis of composite structures.
	Total Practical Hours : 60

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Course Outcomes : Students will be able to	
CO1	Relate the grid independence and convergence test using simple cases. (K2)
CO2	Analyze the flow behavior of backward facing step and circular cylinder. (K4)
CO3	Analyze the flow behavior of CD nozzle and airfoil. (K4)
CO4	Estimate the structural analysis of wing, fuselage and solid structure. (K5)
CO5	Estimate the composite laminate structure and landing gear for the aircraft. (K6)

List of Equipment for a Batch of 30 Students

Sl. No.	Description of the Equipment	Quantity
1.	Internal server (or) Work station	1
2.	Computers	30
3.	Standard Modelling and analysis packages	30 licenses
4.	UPS	1
5.	Printer	1

BoS Chairman

B.E.	B19AEP603 - AIRCRAFT DESIGN LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To study the different types of airplanes and their specifications.
2.	To know the performance details, associate with their own aircraft.
3.	To understand the preliminary design concept of aircraft.
4.	To acquire knowledge on performance calculations and estimation of drag.
5.	To gain exposure on V-n diagram through stability analysis.

To make the student work in groups and understand the Concepts involved in aircraft structure, aerodynamics and powerplant selection. The following are the assignments are to be carried out.	
1.	The preliminary weight estimation, Selection of design parameters, power plant selection, aero foil selection, control surfaces, landing gear selection and stability aspects of different types of airplanes.
2.	Preliminary design of an aircraft wing – Shrenck's curve, structural load distribution, shear force, bending moment
3.	Detailed design of an aircraft wing – Design of spars and stringers.
4.	Preliminary design of an aircraft fuselage – load distribution on an aircraft fuselage
5.	Detailed design of an aircraft fuselage – design of bulkheads and longerons – bending stress and shear flow calculations.
6.	Design of control surfaces - balancing and maneuvering loads on the tail plane and aileron, rudder loads
	Total Practical Hours : 30

Course Outcomes : Students will be able to	
At the end of this course, the student will be able to:	
CO1	Develop the structural design of an aircraft wing. (K3)
CO2	Build the spars and stringer for the aircraft wing with bending stress and shear flow analysis (K3)
CO3	Analyze the load, buckling and bending stress distribution on an aircraft fuselage.(K4)
CO4	Explain the maneuvering loads acts on the control surfaces. (K5)
CO5	Design the landing gear, wing root attachment. (K6)

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B.E.	B19CEP601 – CAREER ABILITY COURSE- III	T	P	TU	C
		0	2	0	0

Sl. No.	Topics	Hours
1.	**FUNDAMENTALS OF ELECTRIC CIRCUITS** Design and Analysis of Multiple Sources and Multiple Elements in Electrical Networks.	6
2.	**ELECTROMAGNETIC FIELDS** Computational behaviour of Electromagnetic Fields and Wave Theory.	6
3.	**FUNDAMENTALS OF ANALOG AND DIGITAL ELECTRONICS** Introduction of Electronic devices and components - Linear Circuits - Digital circuits - Applications.	6
4.	**POWER ELECTRONICS AND APPLICATIONS** Introduction to Power Semiconductor devices - Characteristics - Applications.	6
5.	**ELECTRICAL MACHINES** Generalized theory of Electric Machines (AC & DC) - Types - Characteristics - Applications.	6
		Total Instructional Hours : 30

BoS Chairman

Professional Elective - II

B.E.	B19AEE601 – SPACE MECHANICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the eccentricities of space environment and its effect towards materials, and life in space.
2.	To know the basics concept of solar system, universal laws of gravitation and general N body problem.
3.	To gain knowledge on satellite injection, satellite perturbation and various method of variation of orbital elements.
4.	To expose several interplanetary trajectories and launch of interplanetary spacecraft.
5.	To introduce ballistic missile trajectories and various phases of flight.

UNIT - I	SPACE ENVIRONMENT	8

Peculiarities of space environment and its description – effect of space environment on materials of spacecraft structure and astronauts - manned space missions – effect on satellite life time.

UNIT - II	BASIC CONCEPTS AND THE GENERAL N- BODY PROBLEM	10

The solar system – reference frames and coordinate systems – terminology related to the celestial sphere and its associated concepts – Kepler's laws of planetary motion and proof of the laws – Newton's universal law of gravitation - the many body problem - Lagrange - Jacobi identity – the circular restricted three body problem – libration points – the general N-body problem – two body problem – relations between position and time.

UNIT - III	SATELLITE INJECTION AND SATELLITE PERTURBATIONS	10

General aspects of satellite injection – satellite orbit transfer – various cases – orbit deviations due to injection errors – special and general perturbations – Cowell's method and Encke's method – method of variations of orbital elements – general perturbations approach.

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UNIT - IV	INTERPLANE TARY TRAJECTORIES	8
Two-dimensional interplanetary trajectories – fast interplanetary trajectories – three dimensional interplanetary trajectories – launch of interplanetary spacecraft – trajectory estimation about the target planet – concept of sphere of influence – Lambert's theorem.		

UNIT - V	BALLISTIC MISSILE TRAJECTORIES	9
Introduction to ballistic missile trajectories – boost phase – the ballistic phase – trajectory geometry – optimal flights – time of flight – re-entry phase – the position of impact point – influence coefficients.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the structures of spacecraft, astronauts and satellite lifetime on space environment. (K2)
CO2	Apply Kepler's law , Newton universal law for Two and many Body problem.(K3)
CO3	Relate the delta-v required for transferring a spacecraft from one orbit to another. (K2)
CO4	Estimate the trajectory/orbit of a space vehicle or a satellite in a suitable coordinate system. (K5)
CO5	Apply orbital mechanics to control ballistic missile. (K3)

Text Books	
1.	Cornelisse, J.W., "Rocket Propulsion and Space Dynamics", J.W. Freeman &Co.,Ltd, London, 1982
2.	Parker, E.R., "Materials for Missiles and Spacecraft", Mc.Graw Hill Book Co. Inc., 1982

Reference Books	
1.	Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1993.

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B.E.	B19AEE602 – PATENT FILING AND GRANTS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To gain knowledge about several intellectual properties and other technological innovations.
2.	To understand the registration procedures of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets
3.	To acquire exposure on national and international IPR agreements and legislations act.
4.	To identify the meaning and relationship between unfair competition and IP Laws
5.	To enforce the measures, emerging issues involved in the IPR and relate it with case studies.

UNIT - I	INTRODUCTION	9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT - II	REGISTRATION OF IPRs	9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT - III	AGREEMENTS AND LEGISLATIONS	9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT - IV	DIGITAL PRODUCTS AND LAW	9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

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UNIT - V	ENFORCEMENT OF IPRs	9
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Summarize the concept and need for IPR globally. (K2)
CO2	Utilize the registration benefits of IPR and recognize the practical aspects of it. (K3)
CO3	List the various legislation act and agreement on International Treaties. (K4)
CO4	Make use of various laws to protect assets and digital content. (K3)
CO5	Examine the infringement, enforcement and emerging issues of IPR through case studies. (K4)

Text Books	
1.	S.V. Satakar, Intellectual Property Rights and Copy Rights, EssEss Publications, New Delhi, 2002.
2.	V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.

Reference Books	
1.	Deborah E. Bouchoux, “Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets”, Cengage Learning, Third Edition, 2012.
2.	Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.
3.	Prabuddha Ganguli,” Intellectual Property Rights: Unleashing the Knowledge Economy”, McGraw Hill Education, 2011.

BoS Chairman

B.E.	B19AEE603 – FUNDAMENTALS OF NANO SCIENCES IN AIRCRAFT APPLICATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To gain knowledge about the basic concepts of nanomaterials and science behind it.
2.	To understand several preparation methods of nanoparticles.
3.	To gain exposure in the carbon-based nanomaterials and their synthesis process.
4.	To impart knowledge characterization techniques for morphological behavior, chemical analysis and surface analysis.
5.	To understand the benefits of application of nano materials in wide range spectrum.

UNIT - I	INTRODUCTION	9

Nanoscale Science and Technology - Implications for Physics, Chemistry, Biology and Engineering - Classifications of nano structured materials - nano particles- quantum dots, nanowires - ultra-thin films- multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT - II	GENERAL METHODS OF PREPARATION	9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapor phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT - III	NANO MATERIALS	9

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT) - methods of synthesis (arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications - Nanometal oxides - ZnO, TiO_2, MgO, ZrO_2, NiO, nano alumina, CaO, $AgTiO_2$, Ferrites, Nano clays - functionalization and applications - Quantum wires, Quantum dots-preparation, properties and applications.

UNIT - IV	CHARACTERIZATION TECHNIQUES	9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques - AFM, SPM, STM, SNOM, ESCA, SIMS - Nano indentation.

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UNIT - V	APPLICATIONS	9
Nano Info Tech: Information storage - nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) - Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Summarize about the science of nanomaterials and its technologies (K2).
CO2	Demonstrate the preparation of nanomaterials (K2).
CO3	Develop knowledge in characteristic nanomaterial (K3).
CO4	Examine the nanomaterials using characterization techniques. (K4)
CO5	Analyse the application of nanomaterials in biomedical, mechanical and electrical application (K4).

Text Books	
1.	A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2.	N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2^{nd} edition, Weinheim Cambridge, Wiley-VCH, 2000.

Reference Books	
1.	Akhlesh Lakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007. G Timp, "Nanotechnology", AIP press / Springer, 1999.

BoS Chairman

B.E.	B19AEE604 – CRYOGENICS ENGINEERING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamentals of cryogenic and refrigeration system.
2.	To understand the importance of cryostat design and their jointing techniques.
3.	To make the students understand the composition of Natural Gas, LNG and its safety aspects in storing procedure.
4.	To understand the application of cryogenic in various fields like electronic, food and nuclear industry.
5.	To familiarize about cryogenic insulation and regulation regarding the explosive hazards.

UNIT - I	CRYOGENIC ENGINEERING	9
Introduction to Cryogenic Systems - liquefaction systems - Lnde Hampton, precooled Linde Hampson, linde dual pressure, cascade, Claude, Kapitza-liquefaction systems for neon, hydrogen & helium - Refrigerators - Magnetic cooling, magnetic refrigeration systems, nuclear demagnetization, valves.		

UNIT - II	CRYOGENIC PLANTS	9
Design of cryostat - Various types of cryostats - construction - their salient features - Fabrications and jointing techniques - flanged and bolted joints - joining of dissimilar metals - welding of stainless steel and alloy steels.		

UNIT - III	CRYOFUEL SYSTEMS	9
Natural Gas - composition, source and pretreatment. Liquefaction of natural gas – simple cascade, mixed refrigerant and turbine expansion cycles. Storage of LNG - Application of NG and LNG and safety aspects.		

UNIT - IV	CRYOGENIC APPLICATIONS	9
Electronic Applications - MASER, LASER, infrared detectors, photomultipliers. Superconductive devices: Superconducting bearings, magnets, motors gyroscope and switches, cryotrons, MRI. Nuclear Application - Bubble chambers, radioactive waste disposal. Metal fabrication applications - cold stretching, cryo forming, metal stress reliving. Food handling applications: food freezing, food shipment and handling.		

BoS Chairman

UNIT - V	INSULATION AND HAZARDS	9
Cryogenic Insulation - various types such as gas filled & fibrous insulation, vacuum insulation, evacuated powder & fibrous insulation, opacified powder insulation, multi-layer insulation. Hazards - Physical hazards, Chemical hazards, Physiological hazards, combustion hazards, oxygen hazards. Safety in handling of cryogens, care for storage of gaseous cylinders, familiarization with regulations of department of explosives.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Identify the Various Cryogenic Systems. (K3)
CO2	Explain the Construction Techniques of Various Cryostats. (K2)
CO3	Illustrate the Pretreatment, Storage and Safety aspects of NG and LNG. (K2)
CO4	Determine the Electronic and Nuclear Applications of Cryogenics. (K5)
CO5	Explain the Various Hazards, Its Safety and Insulating Methods Handling of Cryogenics. (K5)

Text Books	
1.	Mamata Mukhopadhyay, "Fundamentals of Cryogenic Engineering", PHI Learning Pvt limited, 2013

Reference Books	
1.	Barron, R. F., "Cryogenic Systems", Oxford University, 2006.
2.	Timmerhaus, Flynn, "Cryogenics Process Engineering", Plenum Press, New York, 2007.
3.	G.M Walker. "Cryocooler Part - 1 Fundamental", Plenum Press, New York and London, 2001.
4.	G.M Walker. "Cryocooler Part - 2", Plenum Press, New York and London, 2005.

BoS Chairman

B.E.	B19AEE605 – AIRCRAFT GENERAL ENGINEERING AND MAINTENANCE PRACTICES	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart knowledge in various ground support system for aircraft operations.
2.	To carry out ground servicing of critical aircraft systems.
3.	To understand the specifications standards of aircraft hardware systems.
4.	To understand the ground handling procedures and types of equipment's with special maintenance.
5.	To make student understand do shop safety, Environment cleanliness in an aircraft materials shop.

UNIT - I	AIRCRAFT GROUND HANDLING AND SUPPORT EQUIPMENT	9

Mooring, jacking, leveling and towing operations – Preparation – Equipment – precautions – Engine starting procedures – Piston engine, turboprops and turbojets – Engine fire extinguishing – Ground power unit.

UNIT - II	GROUND SERVICING OF VARIOUS SUB SYSTEMS	9

Air conditioning and pressurization – Oxygen and oil systems – Ground units and their maintenance.

UNIT - III	MAINTENANCE OF SAFETY AND AIRCRAFT SYSTEM PROCESSES	9

Shop safety – Environmental cleanliness – Precautions - Hand tools – Precision instruments – Special tools and equipment's in an airplane maintenance shop – Identification terminology.

UNIT - IV	INSPECTION	9

Process – Purpose – Types – Inspection intervals – Techniques – Checklist – Special inspection – Publications, bulletins, various manuals – FAR Air worthiness directives – Type certificate Data sheets – ATA Specifications.

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UNIT - V	AIRCRAFT HARDWARE, MATERIALS, SYSTEM PROCESSES	9
Specification and correct use of various aircraft hardware (i.e. nuts, bolts, rivets, screws) – American and British systems of specifications – Threads, gears, bearings, – Drills, tapes and reamers – Identification of all types of fluid line fittings. Materials, metallic and non-metallic Plumbing connectors – Cables – Swaging procedures, tests, Advantages of swaging over splicing.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply the procedure and precaution for ground handling and its equipment. (K3)
CO2	Apply the ground servicing techniques for aircraft subsystems. (K3)
CO3	Utilize special tools and equipment's in airplane maintenance shop. (K3)
CO4	Summarize the airworthiness directives and various manuals for inspection of an aircraft. (K2)
CO5	Identify the specialization standards of aircraft hardware systems. (K3)

Text Books	
1.	Kroes Watkins Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1993.

Reference Books	
1.	A & P Mechanics, "Aircraft Hand Book", F A A Himalayan Book House, New Delhi, 1996.
2.	A & P Mechanics, "General Hand Book", F A A Himalayan Bok House, New Delhi, 1996.

BoS Chairman

Professional Elective - III

B.E.	B19AEE606 – VIBRATION AND ELEMENTS OF AERO ELASTICITY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To Gain basic understanding of single and multi-degree vibrating systems
2.	To use numerical techniques for vibration problems
3.	To understand types of vibrations according to dampness and particle motion.
4.	To impart knowledge on Rayleigh and Holzer method to find natural frequency of an object.
5.	Knowledge acquired in aero elasticity and fluttering and to understand the formation of Aileron reversal, flutter and wing divergence.

UNIT - I	SINGLE DEGREE OF FREEDOM SYSTEMS	9

Introduction to simple harmonic motion, D'Alembert's principle, free vibrations – damped vibrations – forced vibrations, with and without damping – support excitation – transmissibility - vibration measuring instruments.

UNIT - II	MULTI DEGREE OF FREEDOM SYSTEMS	9

Two degrees of freedom systems - static and dynamic couplings - vibration absorber - Multi degree of freedom systems - principal co-ordinates - principal modes and orthogonal conditions - Eigen value problems - Hamilton's principle - Lagrangean equations and application.

UNIT - III	CONTINUOUS SYSTEMS	9

Vibration of elastic bodies - vibration of strings – longitudinal, lateral and torsional vibrations.

UNIT - IV	APPROXIMATE METHODS	9

Approximate methods - Rayleigh's method - Dunkerley's method – Rayleigh - Ritz method, matrix iteration method.

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UNIT - V	ELEMENTS OF AEROELASTICITY	9
Vibration due to coupling of bending and torsion - aeroelastic problems - Collar’s triangle - wing divergence - aileron control reversal – flutter – buffeting. – elements of servo elasticity.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Summarize the knowledge of single degree of freedom systems. (K2)
CO2	Apply the numerical techniques for multi degree of freedom systems. (K3)
CO3	Distinguish different types of vibrations according to dampness and particle motion. (K4)
CO4	Analyze the natural frequency of an object by approximate methods. (K4)
CO5	Analyze the various aero elastic problems induced by vibrations. (K4)

Text Books	
1.	Grover. G.K., “Mechanical Vibrations”, 7th Edition, Nem Chand Brothers, Roorkee, India, 2003
2.	Thomson W T, ‘Theory of Vibration with Application’ - CBS Publishers, 1990.

Reference Books	
1.	Bisplinghoff R.L., Ashely H and Hogman R.L., "Aeroelasticity", Addision Wesley Publication, New Tork, 1983.
2.	Den Hartog, "Mechanical Vibrations" Crastre Press, 2008.
3.	TSE. F.S., Morse, I.F., Hinkle, R.T., "Mechanical Vibrations" – Prentice Hall, New York, 1984.
4.	William W Seto, "Mechanical Vibrations" – McGraw Hill, Schaum Series.
5.	William Weaver, Stephen P. Timoshenko, Donovan H. Yound, Donovan H. Young. ‘Vibration Problems in Engineering’ – John Wiley and Sons, New York, 2001

BoS Chairman

B.E.	B19AEE607 – AIRLINE AND AIRPORT MANAGEMENT	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the operational flow of airlines and air transportation maintenance.
2.	To understand the structure and management levels of aviation sectors.
3.	To attribute the financial influences those are structuring the airlines and airport operations.
4.	To impart knowledge on scheduling and flight plan.
5.	To expose the fleet planning, evaluation and

UNIT - I	INTRODUCTION	9

Historical Development of Aviation and Air Transportation - Global Air Transport Authority: Overview - Roles of International Air Transport Association and International Civil Aviation Organization - Airline Management System - Organization Levels and functions.

UNIT - II	AIRLINE ECONOMICS	9

Airline Economics - Forecasting - general factors considered for Airlines economic Analysis - Margin Growth - Forecasting Approach of Indian Airline Economics - Airline Revenue and Gross Domestic Product - Operating cost of Airlines - Load Factor - Passenger fare and tariffs - influence of geographical, economic & political factors on routes and route selection.

UNIT - III	AIRPORT OPERATIONAL STRUCTURE	9

Airport structures and sectors - Divisional responsibilities - Organizational Levels of Airport of Airport management system - Airport Authority of India: Organizational Structure - Functional policies and Objectives - Overview of DGCA.

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UNIT - IV	PRINCIPLES OF AIRLINES SCHEDULING	9
Flight operations and crew scheduling - ground operations and facility - limitations, Equipment Maintenance scheduling - Principles of Airlines Scheduling - Types of Airline scheduling - Point to Point Scheduling - Hub and Spoke Scheduling - Preparation of Flight Plan.		

UNIT - V	FLEET PLANNING AND DESIGN	9
Introduction: Airline Fleet - Fleet Planning and Aircraft evaluation Process - Factors considered for Fleet planning - Fleet size - Fleet structure - Fleet Rationalism - Fleet commonality - Fleet cost planning - capital acquisition - valuation & depreciation - budgeting - Air crew Evalution.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Interpret the roles and functions of Airlines and Airport Industry. (K2)
CO2	Explain the economic flow in functioning Airline Sectors. (K2)
CO3	Apply the principles of management theories for Airport operations. (K3)
CO4	Analyze the scheduling methods to control the flight plan process of airlines. (K4)
CO5	Analyze the factors influencing the design of fleet. (K4)

Text Books	
1.	Fedric J.H., "Airport Management", 2000.
2.	C.H. Friend, "Aircraft Maintenance Management", 2000.

Reference Books	
1.	Alexander T Wells, "Air Transportation", Wadsworth Publishing Company, California, 1993.
2.	"Indian Aircraft manual" - DGCA Publications.

BoS Chairman

B.E.	B19AEE608 – UAV & MAV SYSTEMS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know about the basic terminology and design stages of UAV and MAV.
2.	To understand the aerodynamics, airframe configurations and structures.
3.	To impart knowledge about the avionics system used in UAV and MAV
4.	To understand the communication and control systems for suitable payloads.
5.	To expose the navigation system and future challenges in mini-UAV.

UNIT - I	INTRODUCTION TO UAV AND MAV	9

Historical Background of UAVs and MAVs - classifications based on range and Endurance - basic terminology-models and prototypes - Preliminary, Conceptual and Detailed design stages.

UNIT - II	THE DESIGN OF AIRFRAME STRUCTURE	9

Introduction to Design and Selection of the System - Aerodynamics and Airframe Configurations - Airfoil selection - Propeller Selection - Empennage design - Design for Stealth - control surfaces - specifications.

UNIT - III	AVIONICS HARDWARE	9

Autopilot – AGL - Selection of motors and Battery - UAV and MAV airframe weight calculations, pressure sensors – servos - accelerometer – gyros-actuators - power supply processor, installation, and testing.

UNIT - IV	COMMUNICATION PAYLOADS AND CONTROLS	9

Payloads – Telemetry – tracking - Aerial photography – controls - PID feedback - radio control frequency range – modems - memory system – simulation - ground test - Fully Autonomous takeoff and Landing system analysis - trouble shooting.

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UNIT - V	THE DEVELOPMENT OF UAV SYSTEMS	9
Way points navigation - ground control software - System Ground Testing - System In-flight Testing - Future Prospects and Challenges - Case Studies – Mini and Micro UAVs.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the basic terminologies to develop the UAV systems. (K2)
CO2	Identify the integration methods and subsystems to construct the UAVs and MAV. (K3)
CO3	Choose the Motors, Battery and Calculate Weight for Installation and Testing of UAV and MAV. (K3)
CO4	Analyze the Flight Simulation and Trouble shoot the Takeoff and Landing System. (K4)
CO5	Develop the Mini and Micro UAVs. (K6)

Text Books	
1.	Reg Austin, "Unmanned Air Systems: UAV Design, Development and Deployment "First Edition, Wiley Publishers, 2015.

Reference Books	
1.	Mirosaw Adamski, "Power units and power supply systems in UAV", New Edition, Taylor and Francis Group publishers, 2014
2.	Skafidas, "Microcontroller Systems for a UAV", KTH, TRITA-FYS 2002:51 ISSN 0280-316 X. 34, 2002.
3.	Drone pep, "Unmanned Aircraft Systems Logbook for Drone Pilots & Operators", Create Space Independent Publishing Platform, Latest Edition, 2015.

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B.E.	B19AEE609 – AIRCRAFT MATERIALS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the structure of aerospace materials and its requirement.
2.	To impart knowledge in usage of composite materials in aircraft component design.
3.	To understand the role of corrosion and heat treatment processes of aircraft materials.
4.	To provide introduction to powder metallurgy and material fabrication process.
5.	To gain exposure to high temperature materials for space applications.

UNIT - I	ELEMENTS OF AEROSPACE MATERIALS	9

Structure of solid materials – Atomic structure of materials – crystal structure – miller indices – density – packing factor – space lattices – x-ray diffraction – imperfection in crystals – physical metallurgy - general requirements of materials for aerospace applications

UNIT - II	MECHANICAL BEHAVIOUR OF MATERIAL	9

Linear and non linear elastic properties – Yielding, strain hardening, fracture, Bauchinger's effect – Notch effect testing and flaw detection of materials and components – creep and fatigue - comparative study of metals, ceramics plastics and composites.

UNIT - III	CORROSION & HEAT TREATMENT OF METALS AND ALLOYS	9

Types of corrosion – effect of corrosion on mechanical properties – stress corrosion cracking – corrosion resistance materials used for space vehicles heat treatment of carbon steels – aluminium alloys, magnesium alloys and titanium alloys – effect of alloying treatment, heat resistance alloys – tool and die steels, magnetic alloys.

UNIT - IV	CERAMICS AND COMPOSITES	9

Introduction – powder metallurgy - modern ceramic materials – cermets - cutting tools – glass ceramic – production of semi fabricated forms - plastics and rubber – carbon/carbon composites, fabrication processes involved in metal matrix composites - shape memory alloys – applications in aerospace vehicle design, open and close mould processes.

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UNIT - V	HIGH TEMPERATURE MATERIALS CHARACTERIZATION	9
Classification, production and characteristics – methods and testing – determination of mechanical and thermal properties of materials at elevated temperatures – application of these materials in thermal protection systems of aerospace vehicles – super alloys – high temperature material characterization.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply the knowledge of atomic structures of materials for aerospace applications. (K3)
CO2	Analyze the mechanical behavior of material. (K4)
CO3	Demonstrate the role of corrosion and heat treatment process of aircraft materials. (K2)
CO4	Identify the different types of ceramic and composite materials for aerospace vehicle design. (K3)
CO5	Determine the characteristics of high temperature materials. (K5)

Text Books	
1.	Titterton.G., ”Aircraft Materials and Processes", V Edition, Pitman Publishing Co., 1995.

Reference Books	
1.	Martin, J.W., "Engineering Materials, Their properties and Applications", Wykedham Publications (London) Ltd., 1987.
2.	Raghavan.V., "Materials Science and Engineering", Prentice Hall of India, New Delhi, 1993.
3.	Van Vlack.L.H., "Materials Science for Engineers", Addison Wesley, 1985.

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B.E.	B19AEE610 – EXPERIMENTAL AERODYNAMICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart knowledge on measurement techniques in aerodynamic flow.
2.	To acquire basics concepts of wind tunnel measurement systems.
3.	To understand the specific instruments for flow parameter measurement like pressure, velocity.
4.	To expose the several measurement techniques involved in aerodynamic testing.
5.	To study the model measurements, lift and drag measurements through various techniques and testing of different models.

UNIT - I	BASIC MEASUREMENTS IN FLUID MECHANICS	9

Objective of experimental studies – Fluid mechanics measurements – Properties of fluids – Measuring instruments – Performance terms associated with measurement systems – Direct measurements - Analogue methods – Flow visualization – Components of measuring systems – Importance of model studies.

UNIT - II	WIND TUNNEL MEASUREMENTS	9

Characteristic features, operation and performance of low speed, transonic, supersonic and special tunnels - Power losses in a wind tunnel – Instrumentation and calibration of wind tunnels – Turbulence - Wind tunnel balance – Wire balance – Strut-type – Platform-type – Yoke-type – Pyramid type – Strain gauge balance – Balance calibration.

UNIT - III	FLOW VISUALIZATION AND ANALOGUE METHODS	9

Visualization techniques – Smoke tunnel – Hele - Shaw apparatus - Interferometer – Fringe - Displacement method – Schlieren system – Shadowgraph - Hydraulic analogy – Hydraulic jumps – Electrolytic tank.

UNIT - IV	INTRUSIVE AND NON-INTRUSIVE TECHNIQUES	9

Intrusive techniques – Pitot - static tube characteristics – Directional probes – Hot wire turbulence measurements - Non-intrusive techniques – Particle image velocimetry – Laser Doppler techniques – molecular tagging velocimetry – infrared thermography - image processing and data deduction.

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UNIT - V	SPECIAL FLOWS AND UNCERTAINTY ANALYSIS	9
Experiments on Taylor - Proudman theorem and Ekman layer – Measurements in boundary layers - Data acquisition and processing – Signal conditioning – Uncertainty analysis – Estimation of measurement errors – External estimate of the error – Internal estimate of the error – Uncertainty calculation - Uses of uncertainty analysis.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Identify components and its performance terms associated with the measuring system. (K3)
CO2	Analyze the performance of wind tunnel to calibrate power loss. (K4)
CO3	Analyze the principles of flow visualization by the various analogue methods. (K4)
CO4	Measure pressure, velocity and temperature in low & high-speed flows. (K5)
CO5	Estimate the internal and external measurement errors in the special flows. (K5)

Text Books	
1.	Rathakrishnan, E., “Instrumentation, Measurements, and Experiments in Fluids,” CRC Press – Taylor & Francis, 2007.
2.	Robert B Northrop, “Introduction to Instrumentation and Measurements”, Second Edition, CRC Press, Taylor & Francis, 2006.

Reference Books	
1.	Bradsaw "Experimental Fluid Mechanics", Elsevier, 2nd edition, 1970.
2.	Pope, A., and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985.

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Open Elective - II

B.E. / B.TECH	B19AGO601- INTEGRATED WATER RESOURCES MANAGEMENT (Common to all Except AGRI)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the key elements of IWRM.
2.	To know about the water economics and policies related to IWRM.
3.	To understand the water supply with reference to human health.
4.	To learn the concept of water security for agriculture practices.
5.	To know the water regulation acts and international water scenarios.

UNIT - I	CONTEXT FOR IWRM	9
Water as a global issue: key challenges and needs – Definition of IWRM within the broader context of development – Complexity of the IWRM process – Examining the key elements of IWRM process.		

UNIT - II	WATER ECONOMICS	9
Economic view of water issues: economic characteristics of water good and services – Non-market monetary valuation methods – Water economic instruments, policy options for water conservation and sustainable use – Private sector involvement in water resources management - PPP experiences through case studies.		

UNIT - III	WATER SUPPLY AND HEALTH WITHIN THE IWRM CONSIDERATION	9
Links between water and human health: options to include water management interventions for health – Health protection and promotion in the context of IWRM – Health impact assessment of water resources development.		

UNIT - IV	AGRICULTURE IN THE CONCEPT OF IWRM	9
Water for food production: blue‟ versus “green‟ water debate – Conjunctive use of surface and groundwater - Virtual water trade for achieving global water security –- Irrigation efficiencies, irrigation methods and current water pricing.		

UNIT - V	WATER LEGAL AND REGULATORY SETTINGS	9
Basic notion of law and governance: principles of international and national law in the area of water management. Understanding UN law on non-navigable uses of international water courses – Development of IWRM in line with legal and regulatory framework.		
		Total Instructional hours : 45

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Explain the concepts of IWRM.
CO2	Build an economic conservation of water under PPP and IWRM.
CO3	Identify the linkages between human health and water
CO4	Summarize the water use effectiveness in agriculture.
CO5	Make use of knowledge on regulatory acts and policies of water

Reference Books	
1.	Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
2.	Technical Advisory Committee, Poverty Reduction and IWRM, Technical Advisory Committee Background paper no: 8. Global water partnership, Stockholm, Sweden, 2003.
3.	Technical Advisory Committee, Regulation and Private Participation in Water and Sanitation section, Technical Advisory Committee Background paper No:1. Global water partnership, Stockholm, Sweden, 1998.
4.	Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
5.	Technical Advisory Committee, Water as social and economic good: How to put the principles to practice". Technical Advisory Committee Background paper No: 2. Global water partnership, Stockholm, Sweden, 1998.
6.	Technical Advisory Committee, Effective Water Governance".Technical Advisory Committee Background paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
7.	Cech Thomas V., "Principles of water resources: history, development, management and policy", John Wiley and Sons Inc., New York. 2003.
8.	Mollinga .P. etal, "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
9.	Iyer R. Ramaswamy, "Towards Water Wisdom: Limits, Justice, Harmony", Sage Publications, New Delhi, 2007.
10.	https://nptel.ac.in/courses/105/105/105105110/

BoS Chairman

B.E. / B.TECH	B19BMO601 - INTRODUCTION TO BIOMEDICAL ENGINEERING (Common to all Except BME)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of biomedical engineering technology
2.	To learn the working principles of diagnostic devices
3.	To study the principles of therapeutic devices
4.	To know the concepts of medical imaging techniques present in biomedical field.
5.	To learn various prevention and safety tools

UNIT - I	INTRODUCTION TO BIOMEDICAL ENGINEERING	9
Introduction – History of medical devices – Characteristics of human anatomy and physiology that relate to medical devices – Electrical signals and conductivity – Physiological monitoring systems.		

UNIT - II	DIAGNOSTIC DEVICES AND MEASUREMENTS	9
ECG Machine – Blood pressure measurements – Temperature measurements – Pulse oximeters – Biochemical analysers – Blood flow detectors – Respiration monitor.		

UNIT - III	THERAPEUTIC DEVICES AND MEASUREMENTS	9
Introduction – Defibrillators- Pacemakers – Ventilators – Heart lung machine – CPAP/BPAP – Humidifiers.		

UNIT - IV	DIAGNOSTIC IMAGING	9
Basic Principles of X-ray- CT -MRI – PET – SPECT		

UNIT - V	PREVENTION AND PATIENT SAFETY TOOLS	9
Electrical Safety – testing methods – other safety considerations – Troubleshooting techniques – general test equipment – Specialized biomedical test equipment – tools.		
		Total Instructional hours : 45

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Outline the basics of biomedical Engineering
CO2	Discuss about the diagnostic devices and measurements
CO3	Summarize about the therapeutic devices and measurements
CO4	Explain about diagnostic imaging
CO5	Describe about prevention and patient safety tools

Reference Books	
1.	Laurence J. Street, “Introduction to Biomedical Engineering Technology”, 3rd Edition, CRC Press, 2017.
2.	John Enderle, “Introduction to Biomedical Engineering”, 3rd Edition, Academic Press, 2011.
3.	Germin Nisha. M, John Robert Prince. M, Sivagama Sundari Meenakshi Sundaram, “Bio-Medical Instrumentation: Medical Applications”, Lambert Academic Publishing, 2020
4.	Shakti Chatterjee, Aubert Miller, “Biomedical Instrumentation Systems”, Thomson Press (India) Ltd, 2012

BoS Chairman

B.E. / B.TECH	B19BTO601 – BASIC BIOINFORMATICS (Common to all Except BT)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the units of various physical parameters, conversion factors.
2.	To understand about the various material balances and difference between steam and heat and their balances.
3.	To explain about the application of energy balance in bioprocesses.
4.	To explain about the fluid flow in packed columns and their flow patterns.
5.	To understand about the process of agitation and various agitator vessels.

UNIT - I	BIOLOGICAL DATABASES	9
Biological databases – types of databases – DNA database: GenBank, EMBL – DNA database: ESTs, STS, HTGS- NCBI, Pubmed, Entrez, BLAST, OMIM – Protein databases: SWISSPORT, PIR – DNA and protein sequences: ExPASy, Locus link, Unigene, Entrez, EBI, IMGT.		

UNIT - II	SEQUENCE ALIGNMENT	9
Multiple sequence alignment – models of sequence alighment- databases of sequence alignments: SMART, Pfam – Conserved domains in biomolecules – databases of conserved domains: PRINTS, BLOCKS – integrated multiple sequence alighment – ClustalW, ClustalX, Interpro, MetaFam, PopSet resources of sequence mining.		

UNIT - III	DATABASE SEARCH	9
Sequence homology – similarity, identity and sequence gaps – Pairwise alignment, detection, significance and limitations: Needleman Wunsch, Smith Waterman Algorithm – BLAST: List, scan, extent, E value and P value, alignment, search strategies – principles of BLAST search – types of BLAST.		

UNIT - IV	STRUCTURE PREDICTION TOOLS	9
Analysis of 3D protein structure data – protein data bank (PDB) – SCOB – CATH – Dali Domain directory – FSSP – Protein structure modeling – comparative modeling – Abinitio prediction – Threading – Protein folding.		

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UNIT - V	EVOLUTION ANALYSIS	9
Phylogenetic analysis and molecular evolution – nomenclature of phylogenetic trees – interpretation of phylogenetic data – phenotypic and gene trees – molecular visualization – tools of visualization: Swiss PDB viewer, RasMol, QMol – applications of phylogeny and molecular visualization.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Recall the basics of about Bioinformatics tools
CO2	Outline the numerous algorithms for sequence alignments
CO3	Explain about a brief knowledge on similarity analysis
CO4	Illustrate about the structural genomics of ancestry
CO5	Make use of brief understanding of evolution study

Text Books	
1.	David W M, "Bioinformatics: Sequence and Genome Analysis", CBS publishers, New York, 2004.

Reference Books	
1.	Attwood TK and DJP Smith, "Introduction to Bioinformatics", Addison Wesley Longman Limited, 1999.
2.	Mount DW, "Bioinformatics Sequence and Genome Analysis", Cold Spring Harbour Laboratory Press, 2001.
3.	Pevsner J, "Bioinformatics and Functional Genomics", John Wiley, 2003.
4.	Rastogi SC, Mendiratta N, Rastogi P, "Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery", 3rd Edition, Prentice Hall Inc. 2005.

BoS Chairman

B.E.	B19CSO601 - E-COMMERCE TECHNOLOGY AND MANAGEMENT (Common to all Except CSE, AI&DS, CSBS)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To learn the E-Commerce Platform and its concepts.
2.	To understand the Technology, infrastructure and Business in E-Commerce.
3.	To understand the Security and Challenges in E-Commerce.
4.	To build an own E-Commerce using Open Source Frameworks.
5.	To apply the security and learn the payment systems.

UNIT - I	INTRODUCTION	9

Infrastructure : Working of Web – Web Browsers - Traditional commerce and E commerce – Internet and WWW – role of WWW – value chains – strategic business and Industry value chains – role of E commerce.

UNIT - II	BUILDING E-COMMERCE SITES AND APPS	9

Systematic approach to build an E-Commerce - Planning - System Analysis - System Design - Building the system - Testing the system - Implementation and Maintenance, Optimize Web Performance – Choosing hardware and software – Other E-Commerce Site tools – Developing a Mobile Website and Mobile App.

UNIT - III	E-COMMERCE SECURITY AND PAYMENT SYSTEMS	9

E-Commerce Security Environment – Security threats in E-Commerce – Technology Solutions: Encryption - Securing Channels of Communication - Protecting Networks - Protecting Servers and Clients – Management Policies - Business Procedure and Public Laws - Payment Systems.

UNIT - IV	BUSINESS CONCEPTS IN E-COMMERCE	9

Digital Commerce Marketing and Advertising strategies and tools – Internet Marketing Technologies – Social Marketing – Mobile Marketing – Location based Marketing – Ethical- Social - Political Issues in E-Commerce

BoS Chairman

UNIT - V	TOOLS FOR E-COM	9
Web server – performance evaluation - web server software feature sets – web server software and tools – web protocol – search engines – intelligent agents – EC software – web hosting – cost analysis - Mini Project: Develop E-Commerce project in any one of Platforms like Woo-Commerce, Magento or Opencart.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Build Website using HTML CSS and JS.
CO2	Develop Responsive Sites.
CO3	Infer Manage, Maintain and Support Web Applications.
CO4	Choose the marketing and advertising strategies and tools for marketing.
CO5	Identify the security technique and learn the payment systems.

Text Books	
1.	Kenneth C.Laudon, Carol Guercio Traver "E-Commerce", Pearson, 10th Edition, 2016.
2.	Harvey M. Deitel, Paul J.Deitel, Kate Steinbuhler, e-business and e-commerce for managers, Pearson, 2011.

Reference Books	
1.	Robbert Ravensbergen, "Building E-Commerce Solutions with Woo Commerce", PACKT, 2nd Edition
2.	Parag Kulkarni, Sunita Jahirabad kao, "Pradeep Chande, e-business", Oxford University Press, 2012.
3.	Kala kota et al, "Frontiers of Electronic Commerce", Addison Wesley, 2004.
4.	Micheal Papaloelon and Peter Robert, "E-business", Wiley India, 2006.
5.	Efraim Turban, Jae K.Lee, avid King, Ting Peng Liang, Deborrah Turban, "Electronic Commerce – A managerial perspective", Pearson Education Asia, 2010.

BoS Chairman

B.E. / B.TECH	B19ECO601 – GEOGRAPHIC INFORMATION SYSTEM (Common to all Except ECE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the fundamentals and components of Geographic Information System.
2.	To provide details of spatial data models.
3.	To understand the input topology.
4.	To study the data analysis tools.
5.	To introduce the marketing and business applications.

UNIT - I	FUNDAMENTALS OF GIS	9
Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales / levels of measurements.		

UNIT - II	SPATIAL DATA MODELS	9
Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models - TIN and GRID data models - OGC standards - Data Quality.		

UNIT - III	DATA INPUT AND TOPOLOGY	9
Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input – Digitiser – Topology - Adjacency, connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping.		

UNIT - IV	DATA ANALYSIS	9
Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation.		

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UNIT - V	APPLICATIONS	9
GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the basic idea about the fundamentals of GIS
CO2	Summarize the types of data models
CO3	Analyse about data input and topology
CO4	Analyse about tools and models used for data analysis
CO5	Interpret the data management functions and data output

Text Books	
1.	Kang - Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.
2.	Ian Heywood, Sarah Cornelius, Steve Carver, SrinivasaRaju, "An Introduction Geographical Information Systems", Pearson Education, 2nd Edition, 2007.

Reference Books	
1.	Lo.C.P, Albert K.W. Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice - Hall India Publishers, 2006.

BoS Chairman

B.E. / B.TECH	B19EEO601 - FUNDAMENTALS OF POWER ELECTRONICS (Common to all Except EEE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To get an overview of different types of power semiconductor devices and their switching.
2.	To understand the operation, characteristics and performance parameters of controlled rectifiers.
3.	To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
4.	To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
5.	To understand the operation of AC Voltage controller and Cyclo converter with various Configurations.

UNIT - I	POWER SWITCHING DEVICES	9

Study of switching devices - Diode, SCR, DIAC,TRIAC, GTO, BJT, MOSFET, IGBT - Static and Dynamic characteristics – Gate triggering circuit and commutation circuit for SCR - Introduction to Driver and snubber circuits - Heat sink calculation.

UNIT - II	AC TO DC CONVERTERS	9

Introduction - Single Phase and Three Phase controlled Rectifiers - Effect of source inductance – performance parameters - Firing Schemes for converter – Dual converters, Applications - Solar PV Systems, Light Dimmer.

UNIT - III	DC TO DC CONVERTER	9

Step-down and step-up chopper - control strategy – Introduction to types of choppers - A, B, C, D and E - Switched mode regulators - Buck, Boost, Buck - Boost regulator, Introduction to Resonant Converters, Applications - Battery operated vehicles.

UNIT - IV	DC TO AC CONVERTERS	9

Single phase half bridge inverter and Full bridge inverter - Three phase voltage source inverters (both 120° mode and 180° mode) - Voltage & harmonic control - PWM techniques: Multiple PWM, Sinusoidal PWM, modified sinusoidal PWM - Introduction to Space Vector. Pulse Width Modulation - Current Source Inverter - Multilevel Inverter - Applications-Induction heating, UPS.

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UNIT - V	AC TO AC CONVERTERS	9
Single phase and three phase AC voltage Controllers – Control strategy - Power Factor Control – Multistage sequence control - Single Phase and Three Phase Cyclo Converters – Introduction to Matrix converters, Applications: welding.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Outline the operation, characteristic and turn on methods of different types of Power semiconductor devices.
CO2	Explain the operation of phase controlled Converters and its performance parameters.
CO3	Classify different types of DC-DC converter and switching regulators and explain its operation with control techniques.
CO4	Choose the different modulation techniques for pulse width modulated inverters and to infer the harmonic reduction methods.
CO5	Explain the operation of AC voltage controller and Cyclo converter with various configurations.

Text Books	
1.	M.H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, Fourth Edition, New Delhi, 2014.
2.	P.S.Bimbra "Power Electronics" Khanna Publishers, Fifth Edition, 2012.
3.	M.D. Singh and K.B. Khanchandani, "Power Electronics", Mc Graw Hill India, 2013.

Reference Books	
1.	Joseph Vithayathil, "Power Electronics, Principles and Applications", McGraw Hill Series, 6th Reprint, 2013.
2.	L. Umanand, "Power Electronics Essentials and Applications", Wiley, 2010.
3.	Ned Mohan Tore. M. Undel and, William. P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley and sons, Third Edition, 2003.
4.	S.Rama Reddy, „Fundamentals of Power Electronics", Narosa Publications, 2014.
5.	J.P. Agarwal, "Power Electronic Systems: Theory and Design", 1e, Pearson Education, 2002.

BoS Chairman

B.E. / B.TECH	19MEO601 - ENTREPRENEURSHIP DEVELOPMENT (Common to all Except MECH)	L	P	TU	C
		3	0	0	3

Course Objectives	
1.	To interpret the entrepreneurial aspects.
2.	To comprehend the distinct inspirational practices to execute entrepreneurial plans.
3.	To introduce various elements involved in establishing a business.
4.	To understand the sources of finance and accounting.
5.	To throw the light on various supporting institutions for the entrepreneurs.

UNIT - I	ENTREPRENEURSHIP	9
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.		

UNIT - II	MOTIVATION	9
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.		

UNIT - III	BUSINESS	9
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.		

UNIT - IV	FINANCING AND ACCOUNTING	9
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.		

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UNIT - V	SUPPORT TO ENTREPRENEURS	9
Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Classify and compare the entrepreneurship in society.
CO2	Identify the interpersonal attributes needed to become entrepreneur.
CO3	Demonstrate the various facets of business.
CO4	Summarize the components of finance and accounting.
CO5	Outline the comprehensive business entities.

Text Books	
1.	Donald F Kuratko, — Entrepreneurship – Theory, Process and Practice, 9th Edition, Cengage Learning, 2014.
2.	Khanka. S.S., —Entrepreneurial Developmentll S. Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.

Reference Books	
1.	Hisrich R D, Peters M P, — Entrepreneurship 8th Edition, Tata McGraw-Hill, 2013.
2.	Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011.

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Semester - VII

B.E.	B19AET701 – AVIONICS	T	P	TU	C
		3	0	0	3

Pre-Requisites : B19AEE503 - Control Engineering

Course Objectives	
1.	To introduce the basic of avionics and its need for civil and military aircrafts.
2.	To impart knowledge about the avionic architecture and various avionics data buses.
3.	To gain more knowledge on various avionics subsystems.
4.	To observe the concepts of aircraft display system.
5.	To gain knowledge about different navigation and satellite communication system.

UNIT - I	INTRODUCTION TO AVIONICS	8

Introduction to Avionics – Need for avionics in civil and military aircraft and space systems – integrated avionics and weapon systems – typical avionics subsystems, design, technologies – Introduction to digital computer and memories.

UNIT - II	DIGITAL AVIONICS ARCHITECTURE	9

Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.

UNIT - III	FLIGHT DECKS AND COCKPITS	9

Control and display technologies : CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.

UNIT - IV	INTRODUCTION TO NAVIGATION SYSTEMS	10

Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellite navigation systems – GPS - Indian Regional Navigation Satellite systems – Orbital and spacecraft problems – Progression of earth orbiting Satellite.

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UNIT - V	AIR DATA SYSTEMS AND AUTO PILOT	9
Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the typical avionics subsystems. (K2)
CO2	Build the digital avionics architecture with different data buses. (K3)
CO3	Analyze the various cockpit display performance. (K4)
CO4	Build navigation systems for an aircraft. (K6)
CO5	Design autopilot and air data systems. (K6)

Text Books	
1.	Albert Helfrick .D., “Principles of Avionics”, Avionics Communications Inc., 2004.
2.	Collinson.R.P.G. “Introduction to Avionics”, Chapman and Hall, 1996.

Reference Books	
1.	Middleton, D.H., Ed., “Avionics systems, Longman Scientific and Technical”, Longman Group UK Ltd., England, 1989.
2.	Pallet E.H.J., “Aircraft Instruments and Integrated Systems”, Pearsons, Indian edition 2011.
3.	Spitzer, C.R. “Digital Avionics Systems”, Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1993.
4.	Spitzer. C.R. “The Avionics Hand Book”, CRC Press, 2000.

BoS Chairman

B.E.	B19AET702 – COMPUTATIONAL FLUID DYNAMICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce Governing Equations of viscous fluid flows
2.	To introduce numerical modeling and its role in the field of fluid flow and heat transfer.
3.	To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.
4.	To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.
5.	To introduce Governing Equations of viscous fluid flows.

UNIT - I	GOVERNING EQUATIONS AND BOUNDARY CONDITIONS	8
Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent – Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD – Elliptic, Parabolic and Hyperbolic equations.		

UNIT - II	FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION	9
Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three-dimensional diffusion problems – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.		

UNIT - III	FINITE VOLUME METHOD FOR CONVECTION DIFFUSION	10
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.		

UNIT - IV	FLOW FIELD ANALYSIS	9
Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.		

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UNIT - V	TURBULENCE MODELS AND MESH GENERATION	9
Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Apply the governing equation for various physical boundary conditions. (K3)
CO2	Analyze the various finite difference and finite volume methods for diffusion problems. (K4)
CO3	Relate the various discretization methods to solve heat transfer problems. (K2)
CO4	Examine the various algorithms to analyze the different flow field problems. (K4)
CO5	Evaluate the various turbulence models with mesh generation techniques using software tools. (K5)

Text Books	
1.	Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 2017.
2.	Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd, Second Edition, 2007.

Reference Books	
1.	Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.
2.	Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3.	Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005.
4.	Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 2014.
5.	Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004 .

BoS Chairman

B.E.	B19AEP701 – AIRCRAFT SYSTEMS LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To train the students “ON HAND” experience in jacking and leveling of an aircraft.
2.	To recognize the concepts of aircraft control system check procedures.
3.	To realize the different types of tests to assess leakage and clogging.
4.	To enrich the knowledge on functional and pressure test on fuel system.
5.	To study about the wheel break units and maintenances in hydraulic and fuel systems.

List of Experiments

Expt. No.	Description of the Experiments
1.	Aircraft “Jacking Up” procedure
2.	Aircraft “Levelling” procedure
3.	Control System “Rigging check” procedure
4.	Aircraft “Symmetry Check” procedure
5.	“Flow test” to assess of filter element clogging
6.	“Pressure Test” To assess hydraulic External/Internal Leakage
7.	“Functional Test” to adjust operating pressure
8.	“Pressure Test” procedure on fuel system components
9.	“Brake Torque Load Test” on wheel brake units
10.	Maintenance and rectification of snags in hydraulic and fuel systems.
	Total Practical Hours : 60

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Course Outcomes : Students will be able to	
CO1	Experiment with the Aircraft to perform the Jacking UP and Levelling Procedure. (K3)
CO2	Experiment with the Aircraft to perform Rigging and symmetry check procedure. (K3)
CO3	Examine the Filter Clogging and hydraulic Leakage by Flow and Pressure test. (K4)
CO4	Inspect the operating Pressure and Fuel system components. (K4)
CO5	Evaluate the Brake units and Rectification of Snags of various Airframes system. (K5)

List of Equipment

Sl. No.	Name of the Equipment	Quantity	Experiment No.
1.	Serviceable aircraft with all above systems	1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
2.	Hydraulic Jacks (Screw Jack)	5	1, 2, 4, 8
3.	Trestle adjustable	5	1, 2, 4, 8
4.	Spirit Level	2	8
5.	Levelling Boards	2	8
6.	Cable Tensiometer	1	8
7.	Adjustable Spirit Level	1	8
8.	Plumb Bob	1	8

BoS Chairman

B.E.	B19AEP702 - FLIGHT INTEGRATION SYSTEMS AND CONTROL LABORATORY	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	To study about basic digital electronics circuits.
2.	To perform addition and subtraction of binary numbers.
3.	To gain knowledge about multiplexer and demultiplexer circuits.
4.	To study about encoder and decoder circuit.
5.	To perform stability analysis.

List of Experiments

Expt. No.	Description of the Experiments
1.	Addition/Subtraction of 8 bit and 16 bit data for control surface deflection.
2.	Sorting of Data in Ascending & Descending order for voting mechanism.
3.	Sum of a given series with and without carry for identifying flap data.
4.	Greatest in a given series &Multi-byte addition in BCD mode.
5.	Addition/Subtraction of binary numbers using adder and Subtractor circuits.
6.	Multiplexer & Demultiplexer Circuits.
7.	Encoder and Decoder circuits.
8.	Stability analysis using Root locus, Bode plot techniques.
9.	Design of lead, lag and lead –lag compensator for aircraft dynamics.
10.	Performance Improvement of Aircraft Dynamics by Pole placement technique.
	Total Practical Hours : 60

BoS Chairman

Course Outcomes : Students will be able to	
CO1	Apply the digital electronic circuit for control surface deflection. (K3)
CO2	Function the various microprocessor kit to study the flight control units. (K4)
CO3	Evaluate the electronic circuits to perform stability analysis. (K5))
CO4	Examine the encoding and decoding of the various circuit. (K4)
CO5	Analyze the stability using root locus and bode plot technics. (K4)

List of Equipment

Sl. No.	Name of the Equipment	Quantity	Experiment No.
1.	Microprocessor 8085 Kit	10	1, 2, 3, 4
2.	Adder/Subtractor Binary bits Kit	10	5
3.	Encoder Kit	10	7
4.	Decoder Kit	10	7
5.	Multiplexer Kit	10	6
6.	Demultiplexer Kit	10	6
7.	computers	10	8, 9, 10
8.	Regulated power supply	10	5, 6, 7
9.	Standard Mathematical analysis software	-	8, 9, 10
10.	Microprocessor 8085 Kit	10	1, 2, 3, 4

BoS Chairman

B.E.	B19AEP703 - PROJECT WORK PHASE - I	T	P	TU	C
		0	4	0	2

Course Objectives	
1.	Students in group carry out the literature survey on the topic of their core interest.
2.	Presentation on literature survey and definition of project work area and topic.
3.	Students in group should recognize the fabrication, analysis, experimentation, and design procedure to be followed in the future semester.
4.	Compilation of the idea on their work and submit the future work to be carried out in the project phase II.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on verbal presentation and the project report jointly by external and internal examiners constituted by the Head of the Department. The student should publish their literature review as a review paper in a peer reviewed journal is the minimal condition to be followed.

Total Practical Hours : 60

Course Outcomes : Students will be able to	
CO1	Formulate a real-world problem, identify the requirement and develop the design solutions. (K6)
CO2	Examine the literature relevant to the project.(K4)
CO3	Invent the technical ideas, strategies and methodologies. (K6)
CO4	Prioritize the new tools, algorithms, techniques that contribute to obtain the solution of the project. (K4)
CO5	Plan the methodology to be adopted to carry out in the project phase II.

BoS Chairman

Professional Elective - IV

B.E.	B19AEE701 - HELICOPTER THEORY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the student familiarize with the principles involved in helicopters.
2.	To study the performance and stability aspects of Helicopter under different operating conditions.
3.	To provide an introductory treatment of the aerodynamic theory of rotary - wing aircraft.
4.	To study the fundamentals of rotor aerodynamics for rotorcraft in hovering flight, axial flight, andforward flight modes.
5.	To perform blade element analysis, investigate rotating blade motion, and quantify basic helicopter performance.

UNIT - I	INTRODUCTION	9
Helicopter as an aircraft – Basic features – Layout, Generation of lift, Main rotor, Gearbox, tail rotor,power plant – considerations on blade, flapping and feathering – Rotor controls and various types ofrotor – Bladeloading, Effect of solidity – profile drag, compressibility – Blade area required,number of Blades, Blade form, Power losses – Rotor efficiency.		

UNIT - II	AERODYNAMICS OF ROTOR BLADE	9
Aerofoil characteristics in forward flight – Hovering and Vortex ring state – Blade stall, maximum lift of the helicopter calculation of Induced Power – High speed limitations; parasite drag, power loading, ground effect.		

UNIT - III	POWER PLANTS AND FLIGHT PERFORMANCE	9
Piston engines – Gas turbines – Ramjet principle, Comparative performance, Horsepower required – Range and Endurance, Rate of Climb – Best Climbing speed – Ceiling in vertical climb – Autorotation.		

UNIT - IV	STABILITY AND CONTROL	9
Physical description of effects of disturbances – Stick fixed Longitudinal and lateral dynamic stability – lateral stability characteristics – control response. Differences between stability and control of airplane and helicopter.		

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UNIT - V	ROTOR VIBRATIONS	9
Dynamic model of the rotor – Motion of the rigid blades – flapping motion, lagging motion, feathering motion, Properties of vibrating system – phenomenon of vibration, fuselage response, vibration absorbers – Measurement of vibration in flight – Rotor Blade Design: General considerations – Airfoil selection, Blade construction, Materials – Factors affecting weight and cost – Design conditions – Stress analysis.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Interpret Aerodynamics calculation of Rotor blade. (K2)
CO2	Relate the stability and control characteristics of Helicopter. (K2)
CO3	Compare the performance and control Rotor vibration. (K4)
CO4	Apply Momentum and simple blade element theories to helicopter’s rotor blades. (K3)
CO5	Analyze the power requirements in forward flight and associated stability problems of helicopter. (K4)

Text Books	
1.	John Fay, "The Helicopter and How It Flies", Himalayan Books 1995
2.	Lalit Gupta, "Helicopter Engineering", Himalayan Books New Delhi 1996

Reference Books	
1.	Joseph Schafer, "Basic Helicopter Maintenance", Jeppesen 1980
2.	R W Prouty, Helicopter Aerodynamics, Phillips Pub Co, 1993.

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B.E.	B19AEE702 – CRISIS MANAGEMENT IN AIRCRAFT INDUSTRY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart the knowledge the case studies of various causes, characteristics of crisis.
2.	To apply the management techniques already in vogue and apply them to the solutions of crisis problems.
3.	To gain knowledge on crisis management in an organization.
4.	To realize the typology and characteristics of the crises.
5.	To interpret the emergency responses scenarios such as bomb threat, hijack etc.

UNIT - I	INTRODUCTION TO CRISIS MANAGEMENT	9
Crisis management – Crisis management basics – Establishing a crisis management team – The role of the crisis manager – Organizational crisis and communication – Crisis checklist needs.		

UNIT - II	TYPOLOGIES AND STAGES OF CRISIS MANAGEMENT	9
Crisis typologies – Coombs typology – Characteristics of the crises – Consequences – Modeling crises – Crisis communication – Strategic communication Pre-crisis – Existing in pre-crisis phase – preparing for the worst –Post-crisis.		

UNIT - III	CRISIS MANAGEMENT AT AIRPORTS	9
Psychologyofcrisismanagementdecisions – Emergency response scenarios – Contingency plans – Damage control – Various Crisis at Airport – SOP for Bomb Threat – Mitigating Hijack Crisis Situation – Response to Acts of Unlawful Interference – Developing Plans.		

UNIT - IV	WORLD AIRLINES AND AIRPORTS, WORLD AVIATION BODIES	9
Airports – Civil, Military Training-Domestic/International – Passenger/Cargo Terminals –World Airlines – World's Major Airports IATA / ICAO – National Aviation Authorities & Role of State and Central Governments Airports AuthorityofIndia – The National Transportation Board – Director General of Civil Aviation.		

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UNIT - V	CRISIS IN AIRCRAFT INDUSTRY – CASE STUDIES	9
American airlines flight 191 – Delta airlines flight 191 – Trans world airlines flight 800 – Pan American World Airways flight 103 – US Air flight 427 – Value jet flight 592 – Malaysian Airlines MH370 – Ethiopian Airlines flight 302.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Outline the basics of Crisis management in the aeronautical industry. (K2)
CO2	Compare the different types of crisis and various types of methods. (K4)
CO3	Interpret the steps followed during the emergency situation in the aviation industry. (K2)
CO4	Outline the DGCA, IATA rules and regulations for airports. (K2)
CO5	Analyze the various aircrafts accidents in aviation. (K4)

Text Books	
1.	Cusick, Stephen K., Antonio I. Cortes, and Clarence C. Rodrigues. Commercial aviation safety. McGraw-Hill Education, 2017
2.	Gephart Jr, Robert P., C. Chet Miller, and Karin Svedberg Helgesson, eds. The Routledge Companion to Risk, Crisis and Emergency Management. Routledge, 2018.

Reference Books	
1.	Eriksson, Johan. Threat Politics: New Perspectives on Security, Risk and Crisis Management: New Perspectives on Security, Risk and Crisis Management. Routledge, 2017
2.	Price, Jeffrey, and Jeffrey Forrest. Practical aviation security: predicting and preventing future threats. Butterworth-Heinemann, 2016
3.	Information Resources Management Association. Crisis Management Concepts, Methodologies, Tools and Applications. IGI Global, 2013.

BoS Chairman

B.E.	B19AEE703 – NAVIGATION, GUIDANCE AND CONTROL OF AEROSPACE VEHICLES	T	P	TU	C
		3	0	0	3

Pre-Requisites : B19AEE503 - Control Engineering

Course Objectives	
1.	To impart the concept of Control system fundamentals and its analysis.
2.	To introduce the concepts and working principles of different navigation methods and guidance.
3.	To model of aerospace vehicles and flight control system.
4.	To gain the knowledge on different types of navigation and sensor systems.
5.	To impart the knowledge the autopilot flight control system.

UNIT - I	INTRODUCTION TO CONTROL SYSTEM	9

Introduction to Control System – open loop and closed loop control system –Transfer function poles and zeroes – block diagram reduction – signal flow graph – Mason's gain formula – Characteristics equation – concept of stability – Routh's stability Criteria – Root Locus.

UNIT - II	TIME AND FREQUENCY DOMAIN ANALYSIS	9

Time domain – Transient and Steady State Response – Time domain Specifications – Second Order system – Frequency Domain Analysis Closed Loop Frequency Response – Bode Plot - Polar Plot - Nyquist Stability Criteria - Stability Analysis from Bode Plot.

UNIT - III	INTRODUCTION TO NAVIGATION SYSTEMS	9

Introduction to navigation systems – Types Different co-ordinate systems – Transformation Techniques – Different types of radio navigation – Introduction to Inertial Sensors – INS components – Introduction to GPS – system description – basic principles – position and velocity determination.

UNIT - IV	INTRODUCTION TO GUIDANCE AND CONTROL	9

Introduction to guidance and control, Need for automatic flight control systems – Displacement Autopilot - Pitch Orientation Control system – Methods of Obtaining Coordinates, Yaw Orientation Control system, Lateral Autopilot, Missile Autopilot.

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UNIT - V	INTRODUCTION TO ADVANCED SYSTEMS	9
Introduction to Advanced systems – Introduction to Fly-by-wire flight control systems – Instrument Landing System – microwave landing system – Operating principles and design of guidance laws – Radar systems – command and housing guidance systems.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Outline the control system and assess its performance and stability using routh Hurwitz criterion and root locus. (K2)
CO2	Analyze time and frequency domain specifications and perform analysis using bode plot, polar plot and Nyquist stability criteria. (K4)
CO3	Inspect the skills effectively in design of control for aerospace vehicle systems.(K4)
CO4	Relate the working principles and specifications of navigation methods. (K1)
CO5	Categorize and assess the performance of autopilots, augmentation systems and missile guidance systems. (K4)

Text Books	
1.	Gopal.M., “Control System”, Tata McGraw Hill, 2008.
2.	Ching-Fang Lin, “Modern Navigation, Guidance and Control Processing”, Prentice Hall Inc., Englewood Cliffs, New Jersey, 1991.

Reference Books	
1.	Nelson R.C “Flight stability & Automatic Control”, McGraw Hill, Second Edition, 2007.
2.	Nagaraja, N.S. “Elements of Electronic Navigation”, Tata McGraw-Hill Pub. Co., 15th reprint, 2006.
3.	Collinson R.P.G. “Introduction to Avionics Systems”, Springer Science- Business Media B.V, 2011.

BoS Chairman

B.E.	B19AEE704 – NON-DESTRUCTIVE TESTING AND EVALUATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To study the various testing and physical characteristics of materials in NDT.
2.	To impart knowledge on the various evaluation methods related to NDT.
3.	To gain knowledge about the theories involved in NDT Methods.
4.	To study the principles and different scanning methods in the procedures of NDT.
5.	To gain knowledge about the industrial application of NDT in various fields.

UNIT - I	OVERVIEW OF NDT	9

NDT Versus Mechanical testing – Overview of the Non-Destructive Testing Methods for the detection of manufacturing defects as well as material characterization – Relative merits and limitations – Various physical characteristics of materials and their applications in NDT – Visual inspection – Unaided and aided.

UNIT - II	SURFACE NDE METHODS	9

Liquid Penetrant Testing - Principles – types and properties of liquid penetrants – developers – advantages and limitations of various methods – Testing Procedure – Interpretation of results – Magnetic Particle Testing – Theory of magnetism – inspection materials Magnetization methods – Interpretation and evaluation of test indications – Principles and methods of demagnetization – Residual magnetism.

UNIT - III	THERMOGRAPHY AND EDDY CURRENT TESTING (ET)	9

Thermography- Principles – Contact and non-contact inspection methods – Techniques for applying liquid crystals – Advantages and limitation – infrared radiation and infrared detectors – Instrumentations and methods – applications – Eddy Current Testing-Generation of eddy currents – Properties of eddy currents – Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation / Evaluation.

UNIT - IV	ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE)	9

Ultrasonic Testing - Principle – Transducers – transmission and pulse - echo method – straight beam and angle beam – instrumentation – data representation – A/Scan, B-scan, C-scan – Phased Array Ultrasound – Time of Flight Diffraction – Acoustic Emission Technique – Principle – AE parameters – Applications.

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UNIT - V	RADIOGRAPHY (RT)	9
Principle – interaction of X-Ray with matter – imaging – film and film less techniques – types and use of filters and screens – geometric factors – Inverse square, law, characteristics of films – graininess, density, speed, contrast, characteristic curves – Penetrometers – Exposure charts – Radiographic equivalence – Fluoroscopy – Xero-Radiography – Computed Radiography – Computed Tomography.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the fundamental concepts of NDT. (K2)
CO2	Categorize the different methods of NDE. (K4)
CO3	Explain the concept of Thermography and Eddy current testing. (K2)
CO4	Explain the concept of Ultrasonic Testing and Acoustic Emission. (K2)
CO5	Explain the concept of Radiography. (K2)

Text Books	
1.	Baldev Raj, T. Jayakumar, M. Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2014.
2.	Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010.

Reference Books	
1.	ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume - 17.
2.	ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing.
3.	Charles, J. Hellier," Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.
4.	Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005.

BoS Chairman

B.E.	B19AEE705 - AIRFRAME MAINTENANCE AND REPAIR	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the students to understand the Airframe components and the tools used to maintain the components.
2.	Defect investigation, methods to carry out investigation and the detailed maintenance and practice procedures.
3.	To perform the aircraft jacking and locate the CG for balancing.
4.	To inspect the hydraulic and pneumatic system mounted in the aircraft.
5.	To gain the knowledge on the handling and storage of hazardous materials.

UNIT - I	MAINTENANCE OF AIRCRAFT STRUCTURAL COMPONENTS	9

Equipment used in welding shop and their maintenance – Ensuring quality welds –Welding jigs and fixtures – Soldering and brazing – laser welding – Sheet metal repair and maintenance – Selection of materials – Repair schemes – Fabrication of replacement patches – Tools - power/hand – Repair techniques – Peening - Close tolerance fasteners – Sealing compounds – forming/shaping – Calculation of weight of completed repair – Effect of weight – change on surrounding structure – Sheet metal inspection - N.D.T. Testing – Riveted repair design – Damage investigation – Reverse engineering.

UNIT - II	PLASTICS AND COMPOSITES IN AIRCRAFT	9

Review of types of plastics used in airplanes – Maintenance and repair of plastic components – Repair of cracks and holes – various repairs schemes – Scopes – Cleaning of fibre reinforced plastic (FRP) materials prior to repair – Break test – Repair Schemes – FRP/honeycomb sandwich materials – laminated FRP structural members and skin panels – Tools/equipment – Vacuum-bag process – Special precautions – Autoclaves.

UNIT - III	AIRCRAFT JACKING, ASSEMBLY AND RIGGING	9

Airplane jacking and weighing and C.G. Location – Balancing of control surfaces – Inspection maintenance – Helicopter flight controls – Tracking and balancing of main rotor.

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UNIT - IV	REVIEW OF HYDRAULIC AND PNEUMATIC SYSTEM	10
Trouble shooting and maintenance practices – Service and inspection – Inspection and maintenance of landing gear systems – Inspection and maintenance of air-conditioning and pressurization system – water and waste system – Installation and maintenance of Instruments - handling - Testing – Inspection – Inspection and maintenance of auxiliary systems – Rain removal system – Position and warning system – Auxiliary Power Units (APUs).		

UNIT - V	SAFETY PRACTICES	9
Hazardous materials storage and handling – Aircraft furnishing practices – Equipments. Trouble shooting – Theory and practices.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Identify the damages and apply the repair techniques in aircraft structural equipment's. (K3)
CO2	Compare different types of plastics and composite repair procedures used in aircraft. (K2)
CO3	Inspect aircraft jacking, assembly and rigging. (K4)
CO4	Evaluate aircraft hydraulic & pneumatic system. (K5)
CO5	Utilize the safety practices for troubleshooting and material handling. (K3)

Text Books	
1.	Kroes, Watkins, Delp, "Aircraft Maintenance and Repair", McGraw Hill, New York, 1992.

Reference Books	
1.	Brimm D.J. Bogges H.E., "Aircraft Maintenance", Pitman Publishing corp., New York, 1940.
2.	Delp. Bent and Mckinely "Aircraft Maintenance Repair", McGraw Hill, New York, 1987.
3.	Larry Reithmeir, "Aircraft Repair Manual", Palamar Books, Marquette, 1992.

BoS Chairman

Professional Elective - V

B.E.	B191AEE706 – THEORY OF ELASTICITY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the student understand the elastic behavior of different structural components under various loadings and boundary conditions.
2.	To recognize the plane stress strain problem.
3.	To gain knowledge on the stress strain relations in the polar coordinates.
4.	To apprehend the various torsion theories and its applications to shafts.
5.	To gain knowledge on Navier's method and Levy's method for rectangular plates under different boundary conditions.

UNIT - I	BASIC EQUATIONS OF ELASTICITY	9

Definition of Stress and Strain – Stress - Strain relationships – Equations of Equilibrium – Compatibility equations – Boundary Conditions – Saint Venant's principle - Principal Stresses – Stress Ellipsoid – Stress invariants.

UNIT - II	PLANE STRESS AND PLANE STRAIN PROBLEMS	9

Airy's stress function – Bi-harmonic equations – Polynomial solutions – Simple two-dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams.

UNIT - III	ELASTICITY APPROACH TO AXISYMMETRIC PROBLEM	9

Equations of equilibrium – Strain - displacement relations – Stress – strain relations – Airy's stress function – Axi- symmetric problems – Introduction to Dunder's table – Curved beam analysis – Lame's, Kirsch, Michell's and Boussinesque problems – Rotating discs.

UNIT - IV	TORSION	9

Navier's theory – St. Venant's theory – Prandtl's theory on torsion – semi- inverse method and applications to shafts of circular – elliptical, equilateral triangular and rectangular sections. Membrane Analogy.

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UNIT - V	INTRODUCTION TO THEORY OF PLATES	9
Classical plate theory – Assumptions – Governing equations – Boundary conditions – Navier's method of solution for simply supported rectangular plates – Levy's method of solution for rectangular plates under different boundary conditions.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Make use of mathematical knowledge to solve problem related to structural elasticity. (K3)
CO2	Identify stress-strain relation in 3D, principal stress and principal strain. (K3)
CO3	Analyze a structure using Elasticity concepts. (K4)
CO4	Make use of analytical techniques to predict deformation, internal force and failure of simple solids and structural components. (K3)
CO5	Solve aerospace-relevant problems in plane strain and plane stress in Cartesian and polar coordinates. (K6)

Text Books	
1.	Ansel C Ugural and Saul K Fenster, "Advanced Strength and Applied Elasticity", 4th Edition, Prentice Hall, New Jersey, 2003.
2.	Bhaskar, K., and Varadan, T. K., "Theory of Isotropic/Orthotropic Elasticity", CRC Press USA, 2009.
3.	Timoshenko, S., and Goodier, T.N., "Theory of Elasticity", McGraw – Hill Ltd., Tokyo, 1990.

Reference Books	
1.	Barber, J. R., "Elasticity", Kluwer Academic Publishers, 2004.
2.	Sokolnikoff, I.S., "Mathematical Theory of Elasticity", McGraw – Hill, New York, 1978.
3.	Volterra & J.H. Caines, "Advanced Strength of Materials", Prentice Hall, New Jersey, 1991.
4.	Wang, C. T., "Applied Elasticity", McGraw – Hill Co., New York, 1993.

BoS Chairman

B.E.	B19AEE707 – AIR TRAFFIC CONTROL AND PLANNING	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To study the basic concepts involved in Air traffic control system.
2.	To identify the concepts of area control service, clearance, flight plans in Air traffic control system.
3.	To gain knowledge related to radar control systems.
4.	To distinguish about the formation of aerodrome data.
5.	To gain knowledge about the various services such as navigation, landing, location, aerodrome beacon etc.

UNIT - I	BASIC CONCEPTS	9

Objectives of air traffic control systems – Parts of ATC services – Scope and Provision of ATCs – VFR & IFR operations – Classification of ATS air spaces – Various kinds of separation – Altimeter setting procedures – Establishment, designation and identification of units providing ATS – Division of responsibility of control.

UNIT - II	AIR TRAFFIC SYSTEMS	9

Area control service, assignment of cruising levels – minimum flight altitude - ATS routes andsignificant points – RNAV and RNP – Vertical, lateral and longitudinal separations based on time / distance – ATC clearances – Flight plans – position report.

UNIT - III	FLIGHT INFORMATION SYSTEMS	9

Radar service, Basic radar terminology – Identification procedures using primary / secondary radar – performance checks – use of radar in area and approach control services – assurance control and co-ordination between radar / non radar control – emergencies – Flight information and advisory service – Alerting service – Co-ordination and emergency procedures – Rules of the air.

UNIT - IV	AERODROME DATA	9

Aerodrome data - Basic terminology – Aerodrome reference code – Aerodrome reference point – Aerodrome elevation – Aerodrome reference temperature – Instrument runway, physical Characteristics – length of primary / secondary runway – Width of runways – Minimum distance between parallel runways – obstacles restriction.

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UNIT - V	NAVIGATION AND OTHER SERVICES	9
Visual aids for navigation Wind direction indicator – Landing direction indicator – Location and characteristics of signal area – Markings, general requirements – Various markings – Lights, general requirements – Aerodrome beacon, identification beacon – Simple approach lighting system and various lighting systems – VASI & PAPI - Visual aids for denoting obstacles; object to be marked and lighter – Emergency and other services.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Categorize various kinds of separation and ATS air spaces. (K4)
CO2	Identify the ATS routes, clearances, flight plans and position report for the safe flight. (K3)
CO3	Examine the flight information system and rules of ATS. (K4)
CO4	Explain the basic aerodrome data and runway characteristics with obstacle restrictions. (K5)
CO5	Inspect the various markings, lights and visual aids for navigation services. (K4)

Text Books	
1.	AIP (India) Vol. I & II, “The English Book Store”, 17-1, Connaught Place, New Delhi.

Reference Books	
1.	“Aircraft Manual (India) Volume I”, latest Edition – The English Book Store, 17-1, Connaught Place, New Delhi.
2.	“PANS – RAC – ICAO DOC 4444”, Latest Edition, The English Book Store, 17-1, Connaught Place, New Delhi.

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B.E.	B19AEE708 – COMPUTER INTEGRATED MANUFACTURING AND SYSTEMS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To gain the basic knowledge in the process of manufacturing with the help of computers.
2.	To gain knowledge about the different production planning methods in computers.
3.	To study the coding system and analysis related to cellular manufacturing.
4.	To impart understand the different manufacturing system related to computer manufacturing application,
5.	To gain knowledge about the production of industrial robots with the help of computers.

UNIT - I	INTRODUCTION	9
Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control – Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system – Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.		

UNIT - II	PRODUCTION PLANNING, CONTROL AND COMPUTER AIDED PROCESS PLANNING	9
Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning - Control Systems - Shop Floor Control - Inventory Control – Brief on Manufacturing Resource Planning - II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.		

UNIT - III	CELLULAR MANUFACTURING	9
Group Technology (GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.		

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UNIT - IV	FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS)	9
Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control – Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.		

UNIT - V	INDUSTRIAL ROBOTICS	9
Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability – Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Summarize about the classical production system, the components of CIM. (K2)
CO2	Explain the concept of Computer Aided Process Planning (CAPP), Material Requirements Planning (MRP) and various Manufacturing support systems. (K2)
CO3	Illustrate the cellular manufacturing using Rank order, Clustering and Hollier method. (K2)
CO4	Explain Flexible Manufacturing system and applications of Automated Guided Vehicles in the implementation of CIM. (K5)
CO5	Identify the configurations of Industrial Robots, and their part programming. (K3)

Text Books	
1.	Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
2.	Radhakrishnan P., Subramanyan S. and Raju V., "CAD / CAM / CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2004.

Reference Books	
1.	Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.
2.	Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
3.	Rao P, N Tewari & T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.

BoS Chairman

B.E.	B19AEE709 – FATIGUE AND FRACTURE	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To know the basic principles involved in the structures due to fatigue.
2.	To study about the various theories related to the different aspects of fatigue behaviour.
3.	To gain knowledge about the different phases of fatigue life.
4.	To study the importance of fracture mechanics in aerospace application.
5.	To gain knowledge about the design and testing of structures related to fatigue.

UNIT - I	FATIGUE OF STRUCTURES	9

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams – Notches and stress concentrations – Neuber's stress concentration factors – Plastic stress concentration factors – Notched S.N. curves – Fatigue of composite materials.

UNIT - II	STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR	9

Low cycle and high cycle fatigue - Coffin – Manson's relation – Transition life – cyclic strain hardening and softening – Analysis of load histories – Cycle counting techniques – Cumulative damage – Miner's theory – Other theories.

UNIT - III	PHYSICAL ASPECTS OF FATIGUE	9

Phase in fatigue life – Crack initiation – Crack growth – Final Fracture – Dislocations – fatigue fracture surfaces.

UNIT - IV	FRACTURE MECHANICS	9

Strength of cracked bodies – Potential energy and surface energy – Griffith's theory – Irwin –Orwin extension of Griffith's theory to ductile materials – stress analysis of "cracked bodies - Effect of thickness on fracture toughness" – stress intensity factors for typical geometries.

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UNIT - V	FATIGUE DESIGN AND TESTING	9
Safe life and Fail-safe design philosophies – Characterization of Safe life – Crack growth – COD Test - Importance of Fracture Mechanics in aerospace structures – Application to composite materials and structures.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply the arithmetic knowledge to find the various relations on fatigue. (K3)
CO2	Explain the various techniques and relations related to the various aspects of fatigue behavior. (K2)
CO3	Analyze the various mechanisms and faces of fracture due to fatigue. (K4)
CO4	Analyze the various theories and geometries in the fracture mechanics. (K4)
CO5	Analyze the design philosophy, aerospace structures and testing due to fatigue. (K4)

Text Books	
1.	Barrois W, Ripely, E.L., “Fatigue of aircraft structure," Pergamon press. Oxford, 1983.
2.	Prasanth Kumar, "Elements of fracture mechanics", Wheeter publication, 1999.

Reference Books	
1.	Kare Hellan ,’Introduction to Fracture Mechanics’, McGraw Hill, Singapore,1985
2.	Knott, J.F., “Fundamentals of Fracture Mechanics,” - Buterworth& Co., Ltd., London, 1983.
3.	Sih C.G., “Mechanics of fracture.” Vol - I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.

BoS Chairman

B.E.	B19AEE710 – AEROENGINE MAINTENANCE AND REPAIR	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To make the students to familiarize with the Aircraft engine maintenance procedure and practice.
2.	To gain knowledge of basics of Aeronautics and engine components.
3.	To gain knowledge on inspection and maintenance of the jet engine.
4.	To identify the defects by using NDT procedures,
5.	To perform the overhauling procedure to new engines.

UNIT - I	CALIBRATION OF PISTON ENGINES	9

Carburation and Fuel injection systems for small and large engines - Ignition system components - spark plug detail - Engine operating conditions at various altitudes – Engine power measurements – Classification of engine lubricants and fuels – Induction, Exhaust and cooling system - Maintenance and inspection check to be carried out – Inspection and maintenance and troubleshooting – Inspection of all engine components – Daily and routine checks – Overhaul procedures – Compression testing of cylinders – Special inspection schedules – Engine fuel, control and exhaust systems – Engine mount and super charger – Checks and inspection procedures.

UNIT - II	PROPELLERS	9

Propeller theory – operation, construction assembly and installation – Pitch change mechanism – Propeller axially system – Damage and repair criteria – General Inspection procedures – Checks on constant speed propellers – Pitch setting, Propeller Balancing, Blade cuffs, Governor / Propeller operating conditions – Damage and repair criteria.

UNIT - III	JET ENGINES	9

Types of jet engines – Fundamental principles – Bearings and seals - Inlets - compressors - turbines - exhaust section – classification and types of lubrication and fuels- Materials used – Details of control, starting around running and operating procedures – Inspection and Maintenance - permissible limits of damage and repair criteria of engine components - internal inspection of engines - compressor washing – field balancing of compressor fans – Component maintenance procedures – Systems maintenance procedures – use of instruments for online maintenance – Special inspection procedures – Foreign Object Damage - Blade damage.

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UNIT - IV	TESTING AND INSPECTION	9
Symptoms of failure – Fault diagnostics – Case studies of different engine systems – Rectification during testing equipment's for overhaul – Tools and equipment's requirements for various checks and alignment during overhauling – Tools for inspection – Tools for safety and for visual inspection – Methods and instruments for non-destructive testing techniques – Equipment for replacement of parts and their repair – Engine testing: Engine testing procedures and schedule preparation – Online maintenance.		

UNIT - V	OVERHAULING	9
Engine Overhaul – Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components – Trouble Shooting – Procedures for trouble shooting – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Apply maintenance procedure to Aircraft Engines. (K3)
CO2	Interpret the propellor theory and its different characteristics. (K5)
CO3	Apply non-destructive testing procedures to identify the defects. (K3)
CO4	Identify the engine components and faults. (K3)
CO5	Apply overhauling procedure to new engines. (K3)

Text Books	
1.	Kroes& Wild, "Aircraft Power plants ", 7th Edition - McGraw Hill, New York, 1994.

Reference Books	
1.	Turbomeca, " Gas Turbine Engines ", The English Book Store ", New Delhi, 1993.
2.	United Technologies Pratt & Whitney, "The Aircraft Gas turbine Engine and its Operation", TheEnglish Book Store, New Delhi.

BoS Chairman

Open Elective - III

B.E.	B19AGO701- PRODUCTION TECHNOLOGY FOR AGRICULTURAL MACHINERY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basic concepts of engineering materials
2.	To know the principles of machining and welding concepts
3.	To remember the farm mechanization and sowing implements
4.	To learn about the plant protection equipment
5.	To create knowledge on harvesting machinery

UNIT - I	ENGINEERING MATERIALS	9

Engineering materials - classification - Mechanical properties of materials, strength, elasticity, plasticity, stiffness, malleability, ductility, brittleness, toughness, hardness, resilience, machinability, formability, weldability. Steels and cast irons: Carbon steels, their classification - low, mild, medium & high carbon steel, their properties & applications. Wrought iron, cast iron. Alloy steels: Stainless steel, tool steel.

UNIT - II	MACHINING AND WELDING	9

Basic principles of lathe - machine and operations - Basic description of machines and operations of Shaper - Planner, Drilling, Milling & Grinding - classification of welding processes. Gas welding, types of flames and their applications. Electric Arc welding. Resistance welding, Soldering & Brazing processes and their uses.

UNIT - III	TILLAGE AND SOWING IMPLEMENTS	9

Mould board plough - attachments – mould board shapes and types. Disc plough – force representation on disc – Types of disc ploughs – Subsoiler plough - Rotary plough – Chisel plough - Cultivators - types - construction. Disc harrows - Bund former – Rotavator - ridger – leveller. Basin lister - Wetland preparation implements – Crop Planting – methods – row crop planting systems – Devices for meeting seeds – furrow openers – furrow closers – types – Types of seed drills and planters – Seed cum fertilizer drills – paddy transplanters.

UNIT - IV	WEEDING AND PLANT PROTECTION EQUIPMENT	9

Weeding equipment – hand hoe – long handled weeding tools – dryland star weeder – wetland conoweeder and rotary weeder – Engine operated and tractor weeders Sprayers – types - classification – methods of atomization, spray application rate, droplet size determination – volume median diameter, numerical median diameter – drift control.

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UNIT - V	HARVESTING AND THRESHING MACHINERY	9
Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder, combine harvesters, balers, threshers, combine losses.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand concepts of engineering materials and steel properties
CO2	Outline the different machining and welding process
CO3	Understand the different tillage and sowing implements
CO4	Illustrate the concepts of plant protection equipments.
CO5	Summarize the knowledge on harvesting mechanism

Text Books	
1.	"Manufacturing Engineering and Technology", Kalpakjian and Schmid, Pearson, 2010.
2.	Hajra Choudry, "Elements of workshop technology - Vol II", Media promoters, 2002.
3.	Jagdishwar Sahay. Elements of Agricultural Engineering. Standard Publishers Distributors, Delhi 6.,2010.
4.	Michael and Ohja. Principles of Agricultural Engineering. Jain brothers, New Delhi., 2005.

Reference Books	
1.	Gupta. K.N., and Kaushik, J.P., 1998, Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi.
2.	Arthur. D., et. al. 1998, General Engineering Workshop Practice, Asia Publishing House, Bombay.
3.	Chapman W.A.J., Workshop Technology, 1992, Part I, II, III, E.L.B.S. and Edward Amold Publishers Ltd, London.
4.	Kepner, R.A., et al. Principles of farm machinery. CBS Publishers and Distributers, Delhi. 99, 1997.
5.	Harris Pearson Smith et al. Farm machinery and equipment. Tata McGraw-Hill pub., New Delhi.,1996.
6.	Srivastava, A.C. Elements of Farm Machinery. Oxford and IBH Pub. Co., New Delhi, 1990.
7.	https://nptel.ac.in/courses/126/105/126105009/

BoS Chairman

B.E.	B19BMO701 - TELEMEDICINE	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To gain the knowledge on the basic principles for telemedicine.
2.	To understand the legal aspects of telemedicine.
3.	To learn the key principles for telemedicine standards.
4.	To study the concepts for secure transmission of data.
5.	To know health education, mobile telemedicine and it applications.

UNIT - I	INTRODUCTION TO TELEMEDICINE	9

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Telehealth, Tele care, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine.

UNIT - II	ETHICAL, SECURITY AND LEGAL ASPECTS OF TELEMEDICINE	9

Confidentiality, patient rights and consent : confidentiality and the law, the patient - doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues, intellectual property rights, Security in Telemedicine systems - Access control, Fire wall, Encryption, Authentication, Digital certificate, Digital Timestamp.

UNIT - III	TELEMEDICINE STANDARDS	9

Principles of Multimedia - Text, Audio, Video, data, PSTN, POTS, ANT, ISDN, Internet, Wireless Communication - GSM satellite and Micro wave, Modulation techniques, Types of Antenna, Satellite communication, Mobile hand-held devices and mobile communication. Internet technology and telemedicine using worldwide, Video and audio conferencing.

UNIT - IV	DATA ACQUISTION AND STORAGE SYSTEM	9

Acquisition System - Camera, Scanners, Display Systems - Analogue Devices, LCD, Laser Displays, Holographic Representation, Virtual Screen devices, Storage System - Magnetic System, Optical System, Solid State Disk.

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UNIT - V	APPLICATIONS OF TELEMEDICINE	9
Telemedicine access to health care services, health education and self-care. Introduction to robotics surgery, telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability.		
		Total Instructional hours : 45

Course Outcomes : At the end of the course, the student should be able to	
CO1	Recall the basic concepts of telemedicine and health
CO2	Interpret the legal aspects of Telemedicine
CO3	Explain telemedicine standards in communication
CO4	Make use of data acquisition and storage.
CO5	Illustrate about the medical applications and usage of telemedicine

Text Books	
1.	Norris, A.C. "Essentials of Telemedicine and Telecare", Wiley, 2002.
2.	Wootton, R., Craig, J., Patterson, V. (Eds.), "Introduction to Telemedicine. Royal Society of Medicine" Press Ltd., Taylor & Francis 2006.
3.	O'Carroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), "Public Health Informatics and information Systems", Springer, 2003.

Reference Books	
1.	Ferrer - Roca, O., Sosa - Iudicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2002.
2.	Simpson, W. Video over IP. A practical guide to technology and applications. Focal Press Elsevier, 2006.
3.	Mohan Bansal, "Medical Informatics", Tata McGraw-Hill, 2004.

BoS Chairman

B.TECH.	B19BTO701 - FUNDAMENTALS OF NANOTECHNOLOGY	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the basics of nanomaterials and their characteristics.
2.	To gain knowledge on the relationship between nano and biosystems.
3.	To acquire information on nanobiocomposites.
4.	To enhance skill and knowledge on analysis of nanomaterials and
5.	To apply the knowledge and skills of nanotechnology in medicine and related fields.

UNIT - I	INTRODUCTION TO NANOTECHNOLOGY	9
Definition- history of nanomaterials- classification of nanomaterials, Properties of nanomaterials – concept of nanoscale engineering - size and confinement effects.		

UNIT - II	SYNTHESIS AND CHARACTERIZATION OF NANOPARTICLES	9
Strategies for nano architecture, bottom-up, top down and functional approaches; Chemical and physical synthesis of nanoparticles - characteristics of nanoparticles; Characterization of nanoscale materials using UV spectroscopy, TEM, AFM/STM, XRD and FTIR.		

UNIT - III	INTERLINKING BIOLOGY WITH NANOTECHNOLOGY	9
Bionanomaterials – DNA, protein and lipids based nanostructures- synthesis, characterization and applications; Bionanopores-Biological synthesis of nanoparticles – bacteria, fungi, yeast and plants-mechanism; Molecular Self-assembly in biology.		

UNIT - IV	BIOLOGICAL FUNCTIONALISATION OF NANOMATERIALS	9
DNA / protein - gold nanoparticle conjugates; DNA nanostructures for mechanics and computing; DNA as smart glue - DNA analyser as biochips; Biologically inspired nanocomposites; Peptide nanostructures and their applications – electronics, antibacterial agents.		

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UNIT - V	APPLICATION OF NANOBIOTECHNOLOGY	9
Antimicrobial activity of nanoparticles and its mechanism; Nanoanalytics - Quantum dots - Bioconjugates in cell and tissue imaging; Diagnosis of cancer and other diseases using bionanosystems; Drug and gene delivery; Protein targeting- targeting signals, translocation and sorting; Micelles for drug delivery; Proteins and DNA coupled nanoparticles for biosensors; Nanotechnology in agriculture.		
		Total Instructional hours : 45

Course Outcomes : At the end of the course student will be able to	
CO1	Understand the fundamentals of nanoscience and technology.
CO2	Explain synthesis and characterization of nanoparticles.
CO3	Understand the potential applications of bionanomaterials in various fields.
CO4	Understand the design and development of health related nanomaterials.
CO5	Apply bionanomaterials in various fields.

Text Books	
1.	Rao CNR, A Muller and AK Cheetham, "The Chemistry of Nanomaterials - Synthesis, Properties and Applications", John Wiley & Sons, 2006.
2.	Pradeep T, "Nano: The Essentials", Tata McGraw Hill, New Delhi, 2007.
3.	Niemeyer CM, and CA Mirkin, "Nanobiotechnology: Concepts, Applications and perspectives", John Wiley & Sons, 2004.

Reference Books	
1.	Nicolini C, "Nanobiotechnology and Nanobiosciences", Pan Stanford Publishing Pvt. Ltd, 2009.
2.	Goodsell SD, "Bionanotechnology - Lessons from Nature", Wiley-Liss, Inc, 2004.
3.	Bhushan B, "Handbook of Nanotechnology", Springer, Heidelberg, 2006.

BoS Chairman

B.E.	B19CSO701 - FUNDAMENTAL OF CLOUD COMPUTING (Common to all Except CSE, AI & DS, CSBS)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the basic concepts of Computer Networks and Cloud Computing.
2.	To understand the broad perceptive design of cloud architecture and model.
3.	To study the concept of Virtualization and design of cloud Services
4.	To be familiar with the storing data in cloud and secure to data in cloud.
5.	To apply different cloud programming model as per need and design the trusted cloud Computing system.

UNIT - I	CLOUD COMPUTING FUNDAMENTALS	9

Introduction to computer networks - evolution of computer networks and its uses – Types of Networks - Advantages and Disadvantages of Computer Network - Introduction to Cloud Computing - Essential characteristics, Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT - II	CLOUD ARCHITECTURE AND MODELS	9

NIST Cloud Computing Reference Architecture - Cloud Models: Characteristics – Cloud Services – IaaS, PaaS, SaaS – Public vs Private Cloud – Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

UNIT - III	CLOUD VIRTUALIZATION	9

Basics of Virtualization - Types of Virtualizations - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data - Center Automation.

UNIT - IV	CLOUD COMPUTING STORAGES AND SECURITY	9

Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3 - Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

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UNIT - V	CLOUD TECHNOLOGIES AND ADVANCEMENTS	9
Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine - Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Compare the strengths and limitations of cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Outline various virtualization concepts.
CO4	Summarize the core issues of cloud such as storage, security, and privacy.
CO5	Show Cloud Services with appropriate tools.

Text Books	
1.	Curtis Franklin, Jr. ,Brian J.S. Chee, “Securing the Cloud: Security Strategies for the Ubiquitous Data Center”, CRC Press, 2019.
2.	Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation, Management and Security ‖, CRC Press, 2017.

Reference Books	
1.	Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, “Mastering Cloud Computing”, TMH, 2013.
2.	Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.

BoS Chairman

B.E. / B.TECH	B19ECO701 – INTRODUCTION TO COMMUNICATION SYSTEMS (Common to all Except ECE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce the concept of basic Analog and Digital Communication Systems.
2.	To understand the various modulation techniques for Analog and digital communication Systems.
3.	To perform a block-diagram design of the transmitter and receiver for a basic Analog and Digital Communications System.
4.	To identify the performance, in terms of bit error rate, of a Digital Communication System.
5.	To study the wireless channel and Mobile Communication Systems.

UNIT - I	ANALOG COMMUNICATIONS	9

Basic concepts of Linear Modulation and Demodulation – Modulation Index - Power relation in AM wave - double and single sideband - Generation and Detection of Amplitude Modulation - Hilbert transform -analytic signal.

UNIT - II	ANGLE MODULATIONS	9

Frequency Modulation-comparison of frequency modulation and amplitude modulation - narrowband and wideband FM - Bessel functions - Carson's rule - bandwidth - Generation and Demodulation of frequency and phase modulation - Phase-locked loops.

UNIT - III	DIGITAL COMMUNICATIONS	9

Nyquist sampling theorem – Pulse amplitude modulation, Pulse code modulation – quantization noise, delta modulation, DPCM, ADPCM, Multiplexing and Multiple Access Techniques – FDM and FDMA, TDM and TDMA, CDMA.

UNIT - IV	DIGITAL MODULATION TECHNIQUES	9

Binary Phase Shift Keying - Binary Frequency Shift Keying - Pulse Amplitude Modulation (PAM), On - Off Keying OOK. Optimum receiver structures for digital communication - matched filtering, co-relation detection, probability of error.

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UNIT - V	WIRELESS CHANNEL AND MOBILE COMMUNICATION	9
Overview of wireless systems - capacity of wireless channel - Examples of Wireless Communication Systems - Paging system, Cordless telephones systems, Cellular telephone Systems - Cellular concept - Large and small Scale Fading.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the basic concepts of Analog Communication Systems.
CO2	Use of Angle Modulation techniques for Analog Communication.
CO3	Identify and describe different techniques in modern Digital Communications.
CO4	Explore various Digital Modulation Techniques.
CO5	Analyse the performance of wireless channels for Mobile Communication.

Text Books	
1.	Thepdore. S. Rapport, "Wireless Communications: principles and practice", 2nd Eidtion, pearson education, india, 2009.
2.	B.P. Lathi, "Modern Digital and Analog Communication systems", 4th Edition, Oxford university press, 2010.
3.	S. Haykin , " Communication systems", 3/e John Wiley, 2007.

Reference Books	
1.	David Tse and Pramod Viswanath, " Fundamentals of wireless communications" Wiley series in Telecommunications, cambridge university press, 2005.
2.	J.G.Proakis, M.Salehi, " Fundamentals of Communication Systems" - Pearson education 2006.
3.	H. P. Hsu, Schaum outline series, "Analog and Digital Communications" , TMH, 2006.
4.	Andrea Goldsmith, " Wireless Communications", Cambridge University Press, 2005.

R. Gowri

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B.E. / B.TECH	B19EEO701 – HYBRID ELECTRIC VEHICLE (Common to all Except EEE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To present a comprehensive overview of Electric and Hybrid Electric Vehicles.
2.	To understand the concept of hybrid electric vehicles and its operations.
3.	To impart knowledge on applications of drives in hybrid electric vehicles.
4.	To impart knowledge on vehicular communication in hybrid electric vehicles.
5.	To provide knowledge about various possible energy storage technologies that can be used in hybrid electric vehicles.

UNIT - I	INTRODUCTION TO HYBRID ELECTRIC VEHICLES	9
History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basics of vehicle performance, vehicle power source characterization, transmission characteristics and mathematical models to describe vehicle performance.		

UNIT - II	HYBRID ELECTRIC DRIVE - TRAIN	9
Basic concept of electric traction, Transmission configuration - Components - Gears - Differential - Clutch – Brakes, Regenerative braking, motor sizing. Hybrid traction: Various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel Efficiency Analysis.		

UNIT - III	ELECTRIC COMPONENTS IN HYBRID AND ELECTRIC VEHICLES	9
Electric Drives in HEV/EVs, Classification and Characteristics, configuration and Control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives and Switched Reluctance Motor drives for HEV/EVs applications, Drive System efficiency.		

UNIT - IV	SIZING THE DRIVE SYSTEM	9
Performance matching of Electric Machine and the Internal Combustion Engine (ICE), Sizing the propulsion motor, Communications, supporting subsystems, sizing the power electronic devices and Energy Storage Technology.		

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UNIT - V	ENERGY MANAGEMENT STRATEGIES	9
Introduction to energy management strategies used in hybrid and electric vehicle, classification – implementation issues. Battery based energy storage: fuel cell based and super capacitor based energy storage and its analysis. Hybridization of different energy storage devices. Case study: Volvo XC90 T8 Plug-In Hybrid, Nissan X-Trial hybrid		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Infer the hybrid electric vehicles and its impact on environment.
CO2	Outline the working of hybrid electric drive train.
CO3	Interpret the electric components used in hybrid and electric vehicles.
CO4	Illustrate the various communication protocols and technologies used in vehicle. networks
CO5	Explain the different energy storage systems for vehicle applications.

Text Books	
1.	M. Ehsani, Y. Gao, S. Gay and Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design”, CRC Press, 2015.
2.	Iqbal Hussain, “Electric & Hybrid Vechicles – Design Fundamentals”, Second Edition, CRC Press, 2011.
3.	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2009.

Reference Books	
1.	Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
2.	Chris Mi, MA Masrur, and D W Gao, "Hybrid Electric Vehicles- Principles and Applications with Practical Perspectives", Wiley, 2011.
3.	Davide Andrea, "Battery management Systems for Large Lithium-Ion Battery Packs", Artech House, 2010.
4.	Sira -Ramirez, R. Silva Ortigoza, ‘Control Design Techniques in Power Electronics Devices’, Springer, 2006.
5.	James Larminie and John Lowry, “Electric Vehicle Technology”, Wiley Publishers, 2003.

BoS Chairman

B.E. / B.TECH	B19MEO701 – 3D PRINTING AND TOOLING (Common to all Except MECH)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To explore the technology used in additive manufacturing.
2.	To develop CAD models for 3D printing.
3.	To acquire knowledge, techniques and skills to select relevant additive manufacturing process.
4.	To select a 3D printing process for an application.
5.	To produce a product using 3D Printing or Additive Manufacturing (AM).

UNIT - I	INTRODUCTION TO ADDITIVE MANUFACTURING (AM)	9
Overview – History – Need – classification - Additive Manufacturing Technology in product development – Materials for Additive Manufacturing.		

UNIT - II	CAD AND REVERSE ENGINEERING	9
Basic concept – 3D scanning – digitization techniques – Model reconstruction – data processing for reverse engineering - Additive Manufacturing Technology: CAD model preparation – Part orientation and support generation – Model slicing – Tool path generation.		

UNIT - III	LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING	9
Classification – liquid based system – stereo lithography apparatus (SLA) – principle, process, advantages and applications – solid based system – Fused Deposition Modeling – principle, process, advantages.		

UNIT - IV	LASER BASED ADDITIVE MANUFACTURING SYSTEMS	9
Selective laser sintering – principles of SLS process – process, advantages and applications, 3D Printing - principle, process, advantages - Laser Engineered Net Shaping (LENS).		

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UNIT - V	RAPID TOOLING AND APPLICATIONS OF ADDITIVE MANUFACTURING	9
Principles and typical process for quick batch production of plastic and metal parts through quick tooling – applications for Aerospace, defence, automobile, Bio-medical and general engineering industries		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Understand the importance of Additive Manufacturing.
CO2	Apply technique of CAD and reverse engineering for geometry transformation in Additive Manufacturing.
CO3	Define the various process used in Additive Manufacturing.
CO4	Identify and select suitable process used in Additive Manufacturing.
CO5	Understand the basic concept of quick tooling and additive manufacturing application.

Text Books	
1.	Lan Gibson, David W. Rosen and Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2.	Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing”, Hanser Publisher, 2011.
3.	Khanna Editorial, “3D Printing and Design”, Khanna Publishing House, Delhi.

Reference Books	
1.	J.D. Majumdar and I. Manna, “Laser-Assisted Fabrication of Materials”, Springer Series in Material Science, 2013.
2.	Dougles Bryden, “CAD and Prototyping for Product Design”, 2014.
3.	CK Chua, Kah Fai Leong, “3D Printing and Rapid Prototyping - Principles and Applications”, World Scientific, 2017.

J.P. [signature]

BoS Chairman

Semester - VIII

Professional Elective - VI

B.E.	B19AEE801 – STRUCTURAL DYNAMICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To distinguish the basic concepts on mechanical systems with matrix approach.
2.	To gain knowledge about the different types of vibration systems.
3.	To study about different modes of vibration.
4.	To gain knowledge about different energy methods.
5.	To study about the natural characteristics of large sized problems using approximate methods.

UNIT - I	FORCE DEFLECTION PROPERTIES OF STRUCTURES	9
Constraints and Generalized coordinates – Virtual work and generalized forces – Force – Deflection influence functions – stiffness and flexibility methods.		

UNIT - II	PRINCIPLES OF DYNAMICS	9
Free and forced vibrations of systems with finite degrees of freedom – Response to periodic excitation – Impulse Response Function – Convolution Integral.		

UNIT - III	NATURAL MODES OF VIBRATION	9
Equations of motion for Multi degree of freedom Systems – Solution of Eigen value problems – Normal coordinates and orthogonality Conditions – Modal Analysis.		

UNIT - IV	ENERGY METHODS	9
Rayleigh's principle – Rayleigh – Ritz method – Coupled natural modes – Effect of rotary inertia and shear on lateral vibrations of beams – Natural vibrations of plates.		

UNIT - V	APPROXIMATE METHODS	9
Approximate methods of evaluating the Eigen frequencies and eigen vectors by reduced, subspace, Lanczos, Power, Matrix condensation and QR methods.		
		Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Illustrate the various options of mathematical modeling of structures. (K2)
CO2	Evaluate the response of structures under various dynamically loaded conditions. (K5)
CO3	Analyze natural modes of vibration of structures. (K4)
CO4	Measure the natural frequency for multi degree of freedom system. (K5)
CO5	Explain numerical and approximate methods of evaluating natural modes of vibration. (K5)

Text Books	
1.	Hurty. W.C. and M.F. Rubinstein, "Dynamics of Structures", Prentice Hall of India Pvt. Ltd., New Delhi 1987.
2.	Tse. F.S., Morse. I.E. and Hinkle. H.T., "Mechanical Vibrations : Theory and Applications", Prentice Hall of India Pvt. Ltd, New Delhi, 2004.

Reference Books	
1.	Ramamurthi. V., "Mechanical Vibration Practice and Noise Control" Narosa Publishing House Pvt. Ltd, 2008.
2.	Timoshenko. S.P., and D.H. Young, "Vibration Problems in Engineering", John Willey & Sons Inc., 1984.
3.	Vierck. R.K., "Vibration Analysis", 2nd Edition, Thomas Y. Crowell & Co Harper & Row Publishers, New York, U.S.A. 1989.

BoS Chairman

B.E.	B19AEE802 – CIVIL AVIATION RULES AND REGULATION	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To gain knowledge about the objectives of airworthiness.
2.	To study about the procedure in defect recording, monitoring, and investigations.
3.	To enrich knowledge about approval of organization in different categories and procedures related to registration, revalidation of aircraft.
4.	To distinguish about the procedures in issues of AME Licenses.
5.	To gain knowledge about registration, balance control, issue of tax permit type approval of aircraft componants.

UNIT - I	AIRWORTHINESS	9
Responsibilities of operators – owners – procedure of CAR issue, amendments – objectives and targets of airworthiness directorate – airworthiness regulations and safety oversight of engineering activities of operators – C.A.R. Series – "B" Issue Approval of Cockpit Check List – Minimum Equipment list – Preparation and use of cockpit checklist and emergency list.		

UNIT - II	C.A.R. SERIES C: DEFECT RECORDING, MONITORING, INVESTIGATION AND REPORTING	9
Defect recording, reporting, investigation, rectification and analysis – Reporting and rectification of defects observed on aircraft – Analytical study of in-flight readings & recordings – Maintenance control by reliability method – C.A.R. Series D: Reliability and Aircraft Maintenance Programmes Reliability Programmes (engines) – aircraft maintenance programme & their approval – On condition maintenance of reciprocating engines – TBO revision programme – Fixing routine maintenance periods and component TBOs.		

UNIT - III	C.A.R. SERIES E: APPROVAL OF ORGANISATIONS	9
Approval of organizations in categories A,B,C,D,E,F,&G – Requirements of infrastructure at stations other than parent base – C.A.R. Series F – Air Worthiness and Continued Air Worthiness – Procedure relating to registration of aircraft – Procedure for issue / revalidation of type certificate of aircraft and its engines / propeller – issue/revalidation of Certificate of Airworthiness – Requirements for renewal of Certificate of Airworthiness.		

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UNIT - IV	C.A.R. SERIES: L - M	9
Procedure and Issue of AME License – classification and experience requirements – Mandatory Modifications / Inspections.		

UNIT - V	C.A.R. SERIES T AND X	9
Flight testing of aircraft for issue of C of A – Registration Markings of aircraft – Weight and balance control of an aircraft – Provision of first aid kits & Physician-s kit in an aircraft –Use furnishing materials in an aircraft – Aircraft log books – Document to be carried on board on Indian registered aircraft – Procedure for issue of tax permit – Procedure for issue of type approval of aircraft components and equipments including instruments.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Explain the scope and provisions of framing civil aviation rules for airlines operations. (K2)
CO2	Apply the reliability methods for aircraft maintenance operation. (K3)
CO3	Explain the procedure of issue and renewal for aircraft registration process. (K2)
CO4	Analyze the importance/influence of Aircraft Maintenance Engineering Certification. (K4)
CO5	Analyze the physical aids and primary documents carried during the aircraft operation. (K4)

Text Books	
1.	"Aeronautical Information Circulars (relating to Airworthiness) from DGCA 7 AAI", 2000 and 2006.
2.	"Aircraft Manual (India)", Volume Latest Edition, The English Book Store, 17-1, Connaught Circus, New Delhi.

Reference Books	
1.	Advisory Circulars from DGCA 2003 & 2015.
2.	"Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness)" - Published by DGCA, The English Book Store, 17- 1, Connaught Circus, New Delhi 2000.

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B.E.	B19AEE803 – ROCKETS AND MISSILES	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To gain knowledge about the classification of rockets and missile.
2.	To give exposure on rockets and missile aerodynamics.
3.	To identify the motion of rocket in free space and gravitational field.
4.	To enrich the knowledge in staging of rockets and missile.
5.	To recognize about the control systems of rockets and missile.

UNIT - I	CLASSIFICATION OF ROCKETS AND MISSILES	6

History of rockets and missiles – Various methods of classification of missiles and rockets – Basic aerodynamic characteristics of surface to surface, surface to air, air to surface and air to air missiles – Examples of various Indian space launch vehicles and missiles – Current status of Indian rocket and missile programme.

UNIT - II	ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD	10

One Dimensional and Two-Dimensional rocket Motions in Free Space and Homogeneous Gravitational Fields – description of Vertical, Inclined and Gravity Turn Trajectories – Determination of range and Altitude, Simple Approximations to Burnout Velocity and altitude-estimation of culmination time and altitude.

UNIT - III	AERODYNAMICS OF ROCKETS AND MISSILES	10

Airframe Components of Rockets and Missiles – Forces Acting on a Missile While Passing Through Atmosphere – Classification of Missiles – methods of Describing Aerodynamic Forces and Moments – Lateral Aerodynamic Moment – Lateral Damping Moment and Longitudinal Moment of a Rocket – lift and Drag Forces – Drag Estimation.

UNIT - IV	STAGING AND CONTROL OF ROCKETS AND MISSILES	10

Multistage of rockets and ballistic missiles – Multistage Vehicle Optimization – Stage Separation Dynamics – Stage Separation Techniques in atmosphere and in space, Introduction to aerodynamic and jet control methods – various types of aerodynamic control methods for tactical and short range missiles – aerodynamic characteristics - various types of rocket thrust vector control methods.

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UNIT - V	ROCKET PROPULSION SYSTEMS AND MATERIALS FOR ROCKETS AND MISSILES	9
Ignition System in rockets – types of Igniters– Design Consideration of liquid Rocket Combustion Chamber, Injector Propellant Feed Lines, Valves, Propellant Tanks Outlet and propellant feed Systems – Propellant Slash and Propellant Hammer – Elimination of Geysering Effect in Missiles – Selection of Materials – Special Requirements of Materials to Perform under Adverse Conditions.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Classify the different types of rockets and missiles with respect to Indian and International standard. (K2)
CO2	Apply the aerodynamics of rockets and missiles. (K3)
CO3	Determine the range & altitude of rocket motion in free space and gravitational field. (K5)
CO4	Evaluate the multi staging philosophy of rockets and missiles. (K5)
CO5	Apply the various thrust vector control methods for rockets & missiles. (K3)

Text Books	
1.	Cornelisse, J.W., “Rocket Propulsion and Space Dynamics”, J.W., Freeman & Co. Ltd., London, 1982.
2.	Sutton, G.P., et al., “Rocket Propulsion Elements”, John Wiley & Sons Inc., New York, 1993.

Reference Books	
1.	Mathur, M. and Sharma, R.P., “Gas Turbines and Jet and Rocket Propulsion”, Standard Publishers, New Delhi 1998.
2.	Parker, E.R., “Materials for Missiles and Spacecraft”, McGraw-Hill Book Co. Inc., 1982.

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B.E.	B19AEE804 – HYPERSONIC AERODYNAMICS	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To introduce fundamental concepts and features peculiar to hypersonic flow to students to familiarize them with the aerodynamical aspects of hypersonic vehicles.
2.	To gain knowledge on basics of hypersonic and supersonic aerodynamics.
3.	To distinguish the general hypersonic flow theory.
4.	To gain knowledge on various interaction of boundary layers in hypersonic flow.
5.	To realize the role of chemical and temperature effects in hypersonic flows.

UNIT - I	FUNDAMENTALS OF HYPERSONIC AERODYNAMICS	9

Introduction to hypersonic aerodynamics – differences between hypersonic aerodynamics and supersonic aerodynamics – concept of thin shock layers and entropy layers – hypersonic flight paths – hypersonic similarity parameters – shock wave and expansion wave relations of inviscid hypersonic flows.

UNIT - II	SIMPLE SOLUTION METHODS FOR HYPERSONIC INVISCID FLOWS	9

Local surface inclination methods – Newtonian theory – modified Newtonian law – tangent wedge and tangent cone and shock expansion methods – approximate methods - hypersonic small disturbance theory – thin shock layer theory.

UNIT - III	VISCOUS HYPERSONIC FLOW THEORY	9

Boundary layer equations for hypersonic flow – hypersonic boundary layers – self similar and non-self-similar boundary layers – solution methods for non-self-similar boundary layers – aerodynamic heating and its adverse effects on airframe.

UNIT - IV	VISCOUS INTERACTIONS IN HYPERSONIC FLOWS	9

Introduction to the concept of viscous interaction in hypersonic flows – Strong and weak viscous interactions – hypersonic viscous interaction similarity parameter – introduction to shock wave boundary layer interactions.

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UNIT - V	HIGH TEMPERATURE EFFECTS IN HYPERSONIC FLOWS	9
Nature of high temperature flows – chemical effects in air – real and perfect gases – Gibb's free energy and entropy – chemically reacting boundary layers – recombination and dissociation.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Compare the hypersonic and supersonic aerodynamics concept. (K2)
CO2	Apply thin shock layer theory and shock expansion method for hypersonic inviscid flow. (K3)
CO3	Identify the aerodynamic heating due to viscous boundary layers of hypersonic flow. (K3)
CO4	Illustrate the strong and weak viscous interactions in hypersonic flow. (K2)
CO5	Analyze the chemical effects in the hypersonic boundary layer. (K5)

Text Books	
1.	John D. Anderson. Jr., "Hypersonic and High Temperature Gas Dynamics", Mc.Graw hillSeries, New York, 1996.

Reference Books	
1.	John D. Anderson. Jr., "Modern Compressible flow with historical Perspective", Mc.Graw HillPublishing Company, New York, 1996.
2.	John T. Bertin, "Hypersonic Aerothermodynamics", published by AIAA Inc., Washington.D.C., 1994.

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B.E.	B19AEE805 – WIND TUNNEL TECHNIQUES	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To identify the principles behind the model testing.
2.	To gain knowledge about the types and functions of wind tunnels.
3.	To enrich knowledge about the calibration of subsonic and supersonic tunnels.
4.	To gain knowledge about the conventional measurement techniques.
5.	To study the special wind tunnel techniques.

UNIT - I	LOW SPEED WIND TUNNELS	9

Classification –non-dimensional numbers-types of similarities – Layout of open circuit and closed circuit subsonic wind tunnels – design parameters-energy ratio - HP calculations – Calibration methods.

UNIT - II	HIGH SPEED WIND TUNNELS	9

Blow down, in draft and induction tunnel layouts and their design features –Transonic, and supersonic tunnels – peculiar features of these tunnels and operational difficulties – sample design calculations and calibration methods.

UNIT - III	SPECIAL WIND TUNNEL TECHNIQUES	9

Types of Special Wind Tunnels – Hypersonic, Gun and Shock Tunnels – Design features and calibration methods – Intake tests – store carriage and separation tests – wind tunnel model design for these tests.

UNIT - IV	WIND TUNNEL INSTRUMENTATION	9

Instrumentation and sensors required for both steady and unsteady measurements – Force measurements using three component and six component balances – calibration of measuring instruments – error estimation and uncertainty analysis.

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UNIT - V	FLOW VISUALIZATION AND NON-INTRUSIVE FLOW DIAGNOSTICS	9
Smoke and Tuft grid techniques – Dye injection special techniques – Oil flow visualization and PSP techniques – Optical methods of flow visualization – PIV and Laser Doppler techniques – Image processing and data deduction.		
Total Instructional hours : 45		

Course Outcomes : Students will be able to	
CO1	Apply the various principles for testing the different models. (K3)
CO2	Analyze the functions of wind tunnels to rectify special problems in different speed regions. (K4)
CO3	Evaluate the calibration process and flow measurements using tunnels. (K5)
CO4	Measure the force, velocity & pressure by using conventional measurement techniques. (K5)
CO5	Evaluate the unsteady force and pressure by special techniques to design the wind tunnel model. (K5)

Text Books	
1.	NAL-UNI Lecture Series 12:" Experimental Aerodynamics", NAL SP 98 01 April 1998.
2.	Rae, W.H. and Pope, A., "Low Speed Wind Tunnel Testing", John Wiley Publication, 1984.

Reference Books	
1.	Bradsaw "Experimental Fluid Mechanics".
2.	Lecture course on Advanced Flow diagnostic techniques 17-19 September 2008 NAL, Bangalore.
3.	Pope, A., and Goin, L., "High Speed Wind Tunnel Testing", John Wiley, 1985.
4.	Rathakrishnan, E., “Instrumentation, Measurements, and Experiments in Fluids,” CRC Press – Taylor & Francis, 2007.
5.	Short term course on Flow visualization techniques, NAL , 2009.

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Open Elective - IV

B.E. / B. TECH.	B19AGO801 – AGRICULTURE FINANCE, BANKING AND COOPERATIVES (Common to all Except AGRI)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To impart knowledge on principles basic agriculture finance system.
2.	To understand the different farm financial analysis
3.	To acquire the knowledge on different functions of financial institutions
4.	To understand banking and cooperation for agricultural and agro based industries and financial system
5.	To know the functions of various institutions involved in farm financing crop insurance products.

UNIT - I	AGRICULTURAL FINANCE - NATURE AND SCOPE	9

Agricultural Finance: Definition, Importance, Nature and Scope - Agricultural Credit: Meaning, Definition, Need and Classification - Sources of credit - Role of institutional and non - Institutional agencies: Advantages and Disadvantages - Rural indebtedness: consequences of rural indebtedness - History and Development of rural credit in India.

UNIT - II	FARM FINANCIAL ANALYSIS	9

Principles of Credit - 5C's, 5R's and & 7P's of Credit - Project Cycle and Management - Preparation of bankable projects / Farm credit proposals - Feasibility - Time value of money: Compounding and Discounting - Appraisal of farm credit proposals - Undiscounted and discounted measures - Repayment plans - Farm Financial Statements: Balance Sheet, Income Statement and Cash Flow statement - Financial Ratio Analysis.

UNIT - III	FINANCIAL INSTITUTIONS	9

Institutional Lending Agencies - Commercial banks: Nationalization, Agricultural Development Branches - Area Approach - Priority Sector Lending - Regional Rural Banks, Lead bank, Scale of finance - Higher financial institutions: RBI, NABARD, AFC, ADB, World Bank and Deposit Insurance and Credit Guarantee Corporation of India - Microfinance and its role in poverty alleviation - Self-Help Groups - Non -Governmental Organizations - Rural credit policies followed by State and Central Government - Subsidized farm credit, Differential Interest Rate (DIR), Kisan Credit Card (KCC) Scheme - Relief Measures and Loan Waiver Scheme and Know Your Customer (KYC).

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UNIT - IV	CO-OPERATION	9
Co-operation: Philosophy and Principles - History of Indian Cooperative Credit Movement: Pre and Post-Independence periods and Cooperation in different plan periods - Cooperative credit institutions: Two tier and three tier structure, Functions: provision of short term and long term credit, Strength and weakness of cooperative credit system, Policies for revitalizing cooperative credit: Salient features of Vaithiyananthan Committee Report on revival of rural cooperative credit institutions, Reorganisation of Cooperative credit structure in Andhra Pradesh and single window system and successful cooperative credit systems in Gujarat, Maharashtra, Punjab etc, - Special cooperatives: LAMPS and FSS: Objectives, role and functions - National Cooperative Development Corporation (NCDC) and National Federation of State Cooperative Banks Ltd., (NAFSCOB) - Objectives and Functions.		

UNIT - V	BANKING AND INSURANCE	9
Negotiable Instruments: Meaning, Importance and Types - Central Bank: RBI - functions - credit control - objectives and methods: CRR, SLR and Repo rate - Credit rationing - Dear money and cheap money - Financial inclusion and Exclusion: Credit widening and credit deepening monetary policies. Credit gap: Factors influencing credit gap - Non - Banking Financial Institutions (NBFI) – Preparation of Bankable Projects - Assessment of crop losses, Determination of compensation - Crop insurance: Schemes, Coverage, Advantages and Limitations in implementation - Estimation of crop yields - Livestock, insurance schemes - Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Acquiring the knowledge on sources of Agricultural Micro-Macro financing and credit systems.
CO2	Understanding the history of financing agriculture in India.
CO3	Learning the significance and limitations of crop insurance.
CO4	Developing the knowledge on cooperative systems.
CO5	Creating the knowledge on insurance policies and financial system.

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Text Books	
1.	Muniraj, R., "Farm Finance for Development", Oxford & IBH, New Delhi, 1987.
2.	Subba Reddy S. and P. Raghu Ram, "Agricultural Finance and Management", Oxford & IBH, New Delhi, 2011.
3.	Lee, W.F., M.D. Boehlje, A.G. Nelson and W.G. Murray, "Agricultural Finance", Kalyani Publishers, New Delhi, 1998.
4.	Mammoria, C.B. and R.D. Saxena, "Cooperation in India", Kitab Mahal, Allahabad, 1973.
5.	Patnaik, V.E. and A.K. Roy, "Cooperation and Cooperative Management", Kalyani Publishers, Ludhiana, 1988.

Reference Books	
1.	Ghosal, S N., "Agricultural Financing in India", Asia Publishing House, Bombay, 1966.
2.	John, J.Hamptron., "Financial Decision Making: Concepts, Problems and Cases", Prentice-Hall of India, New Delhi, 1983
3.	https://www.nabard.org/

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B.E. / B. TECH.	B19BMO801 – HOSPITAL MANAGEMENT (Common to all Except BME)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand the fundamentals of hospital administration
2.	Learn human resource management in hospital
3.	Know the market-related research process
4.	Explore various information management systems and relative supportive services.
5.	Learn the quality and safety aspects of the hospital.

UNIT - I	OVERVIEW OF HOSPITAL ADMINISTRATION	9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning - Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio-Medical Waste Management.

UNIT - II	HUMAN RESOURCE MANAGEMENT IN HOSPITAL	9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD –Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT - III	MARKETING RESEARCH PROCESS	9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behavior - Model of consumer behavior - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT - IV	HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES	9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy – Food Services - Laundry Services.

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UNIT - V	QUALITY AND SAFETY ASPECTS IN HOSPITAL	9
Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Explain the principles of Hospital administration.
CO2	Identify the importance of Human resource management.
CO3	List various marketing research techniques.
CO4	Identify Information management systems and its uses.
CO5	Summarize the quality and safety procedures followed in hospitals.

Text Books	
1.	R.C.Goyal, "Hospital Administration and Human Resource Management", PHI, 4th Edition, 2006.
2.	G.D.Kunders, "Hospitals – Facilities Planning and Management", TMH, 5th Reprint, New Delhi, 2007.

Reference Books	
1.	Cesar A.Caceres and Albert Zara, "The Practice of Clinical Engineering", Academic Press, New York, 1977.
2.	Norman Metzger, "Handbook of Health Care Human Resources Management", 2nd Edition Aspen Publication Inc. Rockville, Maryland, USA, 1990.
3.	Peter Berman "Health Sector Reform in Developing Countries", Harvard University Press, 1995.

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4.	William A. Reinke “Health Planning For Effective Management”, Oxford University Press, 1988.
5.	Blane, David, Brunner, “Health and SOCIAL Organization: Towards a Health Policy for the 21st Century”, Eric Calrendon Press, 2002.
6.	Arnold D. Kalcizony & Stephen M. Shortell, “Health Care Management”, 6th Edition, Cengage Learning, 2011.

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B.E. / B. TECH.	B19BTO801 – BIOLOGICAL WASTE MANAGEMENT (Common to all Except BT)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To develop conceptual schematics for biological treatment of wastes.
2.	To understand the role of microbes in waste treatment
3.	To equip students to understand the basics of biodegradation and bioremediation.
4.	To provide the overview integrated biotechnology approaches for effective waste management.

UNIT - I	INTRODUCTION	9

Industrial waste generation, disposal and environmental impacts; Toxicity of industrial effluents and Bioassay tests; Brief introduction about Regulatory requirements and pollution control boards. Biological treatment processes – objectives; Choice of treatment method; Environmental impact and other considerations in planning the treatment.

UNIT - II	MICROBIAL TREATMENT OF WASTE WATER	9

Biological waste water treatment-Aerobic suspended growth; Aerobic attached-growth (TF, RBC, PBR); Anaerobic suspended growth; Anaerobic attached growth; Advanced tertiary process:-Solids removal; Biological nitrogen removal; Biological phosphorus removal; Disinfection.

UNIT - III	BIODEGRADATION	9

Aerobic vs. anaerobic Degradation; Mechanism of biodegradation; Microbial basis of Biodegradation; Biodegradation of Xenobiotics; Microbial degradation of pesticides. Role of nanoparticles in biodegradation.

UNIT - IV	BIOREMEDIATION	9

Introduction of Bioremediation; advantages and applications; Types of bioremediation; Natural (attenuation); ex situ and in situ; Bioaugmentation and biostimulation; Solid phase and slurry phase bioremediation; Phytoremediation. Case study on bioremediation of xenobiotic compounds.

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UNIT - V	INTEGRATED BIOTECHNOLOGY FOR WASTE MANAGEMENT	9
Bioenergy – biogas and biodiesel; Biosorption, mechanism of biosorption; Biosensors and its application in environmental issues; Biomonitoring; Biotransformation, mineral leaching, mining and mineral biotechnology – reference to copper and iron.		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Understand the industrial waste generation and its environmental impact
CO2	Understand the role microbes in waste water treatment.
CO3	Explain the mechanism of biodegradation of organic wastes.
CO4	Understand the bioremediation of toxic compounds.
CO5	Understand the integrated biotechnology methods for waste management.

Text Books	
1.	Eckenfelder W W, "Industrial Water Pollution Control", Mc-Graw Hill, 1999.
2.	Metcalf and Eddy, “Waste Water Engineering – Treatment and reuse”, Tata McGraw-Hill, New Delhi, 2003.
3.	Agarwal S K, “Environmental Microbiology”, APH Publishing Corporation, New Delhi, 2009.
4.	Chatterji A K, “Introduction to Environmental Biotechnology”, PHI Learning Pvt. Ltd., New Delhi, 2011.
5.	Maier R M, IL Pepper and CP Gerba, “Environmental Microbiology”, Academic Press. 2000.
6.	Pelczar M J, ECS Chan and N R Kreig, “Microbiology”, 5th Ed., Tata McGraw-Hill, New Delhi, 2002.

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B.E. / B. TECH.	B19CSO801 – FUNDAMENTALS OF IOT (Common to all Except CSE, AI & DS, CSBS)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To understand and gain complete knowledge about internet of things.
2.	To study about network protocols.
3.	To learn basic programming and IoT tools.
4.	To understand the basics of embedded systems in IoT.
5.	To explore various IoT applications

UNIT - I	INTRODUCTION	9
Basics of IoT, Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, Functional Blocks of IoT, Communication Models & APIs, Machine to Machine, Difference between IoT and M2M.		

UNIT - II	NETWORK AND COMMUNICATION ASPECTS	9
Wireless Medium Access Issues, MAC Protocol Survey, Survey Routing protocols, Sensor Deployment & Node Discovery, Data Aggregation & Dissemination.		

UNIT - III	ISSUES AND CHALLENGES IN IOT	9
Design Challenges, Development Challenges, Security Challenges, Issues related to Privacy, Standards and Regulation.		

UNIT - IV	DEVELOPING INTERNET OF THINGS	9
Introduction to different IoT Tools, Developing Applications through IoT Tools, Developing Sensor based Application through Embedded System Platform, Implementing IoT concepts with examples.		

UNIT - V	DOMAIN SPECIFIC APPLICATIONS	9
IoT applications - Home Automation-Agriculture- Health care - Surveillance Applications - Smart Grid - Introduction to Industrial IoT (IIoT).		
Total Instructional hours : 45		

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Course Outcomes : Students will be able to	
CO1	Explain the concepts of Internet of Things
CO2	Analyze basic protocols in Wireless Sensor Network
CO3	Outline the issues of IoT application design in different domains
CO4	Illustrate the use of IoT tools and its performance
CO5	Identify the IoT concepts and applications

Text Books	
1.	Perry Lea, “Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security”, Packt, 2018.
2.	David Hanes, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco press, 2017.

Reference Books	
1.	Samuel Greengard, “The Internet of Things”, MIT Press, 2015.
2.	Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Wiley, 2012.
3.	Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", 2010.

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B.E. / B. TECH.	B19ECO801 – WIRELESS TECHNOLOGIES (Common to all Except ECE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To provide basic understanding about wired and wireless communication.
2.	To have an exposure to Internet of Things and applications.
3.	To know the basic wireless network security.
4.	To get exposed to antenna systems.
5.	To understand various satellite communication.

UNIT - I	FUNDAMENTALS OF COMMUNICATION	9

Basics of Communication, Spectrum - FCC, Transceiver design and its Components, Wired and wireless communication. Modulation techniques, OSI Layers, TCP/IP Protocols 1G to 5G developments; 3G, 4G and 5G cell architecture.

UNIT - II	INTERNET OF THINGS	9

Introduction, IoT- Architecture, IEEE 802.15.4, M2M and IoT Protocols, SCADA and RFID Protocols, Architecture and Applications - Bluetooth, Zigbee, LORA, 6LOWPAN, Wi-Fi, WIMAX.

UNIT - III	WIRELESS NETWORK SECURITY	9

Cryptography, Integrity, Authentication and Key management, Wireless Threats – Hacking 802.11, Eavesdropping, Jamming, Cyber-crimes and awareness – countermeasures, Wireless Security.

UNIT - IV	ANTENNA SYSTEMS	9

Introduction, Types of Antennas, Radiation Mechanisms and Measurements, Dipole, Monopole, Mobile Phone Antenna, Smart Antennas, RFID antennas, Automotive Antenna, Reconfigurable Antennas, SAR measurements.

UNIT - V	SATELLITE COMMUNICATION	9

Basic principles, Kepler's law, Types of satellites – LEO, MEO and GEO. Launch Vehicles, Satellite Subsystems and Satellite links, Applications – GPS, Mobile communication and TV broadcast, Navigation systems, Modern Navigation systems.

Total Instructional hours : 45

R. Gowri

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Course Outcomes : Students will be able to	
CO1	Analyze the wired and wireless communication and networks.
CO2	Develop Internet of Things for various applications
CO3	Apply security protocols in Wireless Networks
CO4	Discover various antenna systems for Wireless Technologies
CO5	Explain the Satellite Communication technologies

Text Books	
1.	John G Proakis, MasoudSalehi, "Communication Systems Engineering" Prentice Hall, 1994.
2.	Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things- Key applications and Protocols", Wiley 2012.

Reference Books	
1.	Dennis Roddy, "Satellite Communication", 4th Edition, Tata McGraw-Hill, 2009.
2.	Behrou A. Forouan, "Data Communication and Networking", 5th Edition, Tata McGraw Hill, 2013.
3.	Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", VPT, 1st Edition, 2014.
4.	AfifOsseiran, Jose.F.Monserrat and Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016.
5.	KasunMaduranga Silva Thotahewa(Author), Jean-Michel Redoute(Author), Mehmet Rasit Yuce, "Ultra Wideband Wireless Body Area Networks", Springer, 2016.
6.	Timothy Pratt and Charles W.Bostain, "Satellite Communications", John Wiley and Sons, 2nd Edition, 2012.
7.	M. Richharia, "Satellite Systems for Personal Applications", John Wiley, 2010.
8.	Balanis. A, "Antenna Theory Analysis and Design", 3rd Edition, John Wiley and sons, New York, 1982.
9.	William Stallings, "Cryptography & Network Security - Principles and Practices", Pearson Education, 4th Edition, 2006.

R. Gowri

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B.E. / B. TECH.	B19EEO801 – ENERGY CONSERVATION AND MANAGEMENT (Common to all Except EEE)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To acquire the knowledge about the current energy scenario and importance of energy conservation, audit and management.
2.	To understand about the economics associated with energy conservation.
3.	To understand about the different electrical systems and the methods of improving energy efficiency.
4.	To improve the thermal efficiency by designing suitable systems for heat recovery and co-generation.
5.	To understand how to conserve energy in Major utilities.

UNIT - I	INTRODUCTION	9

Energy - Power – Past and Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers- Instruments for energy auditing - energy security- Material and energy balance diagrams.

UNIT - II	ECONOMICS	9

Energy Economics – energy pricing - Fixed and variable costs, Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing – ESCO concept.

UNIT - III	ELECTRICAL SYSTEMS	9

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT - IV	THERMAL SYSTEMS	9

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation – Steam Distribution and Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization and Insulators - Waste Heat Recovery- Cogeneration.

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UNIT - V	ENERGY CONSERVATION IN MAJOR UTILITIES	9
Energy conservation in Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets		
		Total Instructional hours : 45

Course Outcomes : Students will be able to	
CO1	Interpret the basic knowledge of current energy scenario and importance of energy Conservation and management
CO2	Summarize the knowledge of economics associated with energy conservation
CO3	Apply the methods of improving energy efficiency in different electrical systems
CO4	Make use of the heat utilization, saving and recovery in different thermal systems
CO5	Interpret the knowledge of energy conservation in Major utilities

Text Books	
1.	Murphy W.R. and G.Mckay Butter worth, “Energy Management”, Heinemann Publications, 2013.
2.	Guide books for National Certification Examination for Energy Managers and Energy Auditors, Book 1, 2, 3 & 4. Bureau Energy Efficiency, a statutory body under Ministry of Power, Government of India, New Delhi. 2005.
3.	W.C.Turner, “Energy Management Handbook”, John Wiley and Sons, Fifth edition, 2013.

Reference Books	
1.	Amlan Chakrabarti, Energy Engineering and Management, Prentice hall India 2011.
2.	John.C.Andreas, “Energy Efficient Electric Motors”, Marcel Dekker Inc Ltd – 2nd edition; 2015.
3.	Paul o’ Callaghan, “Energy Management”, Mc-Graw Hill Book Company – 1st edition; 2012.
4.	Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publications, Washington, 1988.
5.	www.em-ea.org/gbook1.asp

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B.E. / B. TECH.	B19MEO801 – LEAN SIX SIGMA (Common to all Except MECH)	T	P	TU	C
		3	0	0	3

Course Objectives	
1.	To describe about introduction to Six Sigma.
2.	To discuss the importance of Set up time, TQM, 5S, VSM.
3.	To describe about introduction to lean manufacturing.
4.	To study the various tools for lean manufacturing.
5.	To describe about lean involvement and culture.

UNIT - I	INTRODUCTION TO SIX SIGMA	9
Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation.		

UNIT - II	SET UP TIME REDUCTION, TQM, 5S, VSM	9
Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.		

UNIT - III	INTRODUCTION TO LEAN MANUFACTURING	9
Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.		

UNIT - IV	LEAN TOOLS AND METHODOLOGY	9
Primary tools – , Workplace organization – Stability - Just-In-Time – Takt time - One piece flow – Pull, Cellular systems, , Six Sigma. SMED: Single minute exchange of dies –theory and practice of the SMED system - TPM, Pillars of TPM, Conditions for TPM success,TPM implementation process - Overall Equipment Effectiveness - computation of OEE.		

UNIT - V	LEAN INVOLVEMENT AND CULTURE	9
Necessity of involvement – Waste of Humanity – Activities supporting involvement – Kaizen Circle Activity – Practical Kaizen Training – Key factors in Practical Kaizen Training – Lea Culture – Standardization – Standards and abnormality control – 'Five Why' analysis.		
		Total Instructional hours : 45

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Course Outcomes : Students will be able to	
CO1	Understand the fundamental principle of six sigma
CO2	Apply techniques, skills and modern engineering tools necessary for production design
CO3	Understand the principles of Lean Manufacturing
CO4	Identify the various lean tools and methodologies
CO5	Understand the implementation of lean and work culture in shop floor

Text Books	
1.	Dennis P, “Lean Production Simplified: A Plain Language Guide to the World's Most powerful Production System”, Productivity Press, New York, 2009.
2.	Liker J. and Meier D., “The Toyota Way”, Field book, McGraw-Hill, 2010.
3.	N.Gopalakrishnan, “Simplified Lean Manufacture”, PHI, 2010.

Reference Books	
1.	Devadasan S. R., Mohan Sivakumar V., Murugesh R. and Shalij P.R., “Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities”, Prentice Hall of India Learning Limited, New Delhi, 2012.
2.	Gopalakrishnan N., “Simplified Lean Manufacture: Elements, Rules, Tools and implementation”, Prentice Hall of India Learning Private Limited, India, 2010.
3.	Bill Carr ira, “Lean Manufacturing that Works: Powerful Tools for Dramatically Reducing Wastes and Maximizing Profits”, Prentice Hall of India Learning Private Limited, India, 2009.
4.	Don Tapping, Tom Lu ster and Tom Shuker, “Value Stream Management: Eight Steps to Planning, Mapping and Sustaining Lean Improvements”, Productivity Press, New York, USA, 2007.

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B.E.	B19AEP801 – PROJECT WORK PHASE - II	T	P	TU	C
		0	16	0	8

Course Objectives	
1.	To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
2.	To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of maximum four Members work on a topic approved by the head of the department and Review Committee constituted by the Head of the Department(Project Phase – I). The group prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews by a review committee constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Controller of Examination based on oral presentation and the project report. Students are also encouraged to present/publish their Project Work in National Conferences and Journals.

Course Outcomes : Students will be able to	
CO1	Identify a problem of a current relevance to society. (K3)
CO2	Create and select the suitable solution methodology for the given complex engineering problem in Aeronautical Engineering. (K6)
CO3	Inference the design, materials and fabrication of the aircraft developed for the given Applications. (K4)
CO4	Develop system integration, project management skill and problem-solving skills. (K3)
CO5	Analyze the given complex engineering problem in Aeronautical Engineering using appropriate software. (K4)

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