SANJAY GHODAWAT UNIVERSITY KOLHAPUR

Sanjay Ghodawat University (SGU) is established in the Academic Year 2017-18, as a State Private University under Govt. of Maharashtra Act No. XL of 2017 dated 3rd May 2017, with the approval of the UGC and the state Government. "For the true measure of giving is giving without measure." Spread across 150 Acres, Sou. Sushila Danchand Ghodawat Charitable Trust's Sanjay Ghodawat University (SGU) is situated in serene atmosphere amidst idyllic hills and lush green meadows to study in harmony with Nature. The Institution aspires to run along the lines of best-in- the-world education and become a world-class institution where teaching-learning process gets a far deeper meaning. SGU always stands as the guiding star of brilliance, quality and deliverance beyond expectations. Innovativeness and Creativity are the hallmarks of a genius enterprise and SGU stands to be a stage where these qualities would be nurtured, encouraged and blossomed. The genius is incomplete without the sense of social responsibility and SGU's ultimate goal remains the development of an attitude of gratitude that freely gives back without expectations.

The Sanjay Ghodawat University stands as a beacon of light to guide the younger generation of the day on the right path to fulfilment in career and life. The USP of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching- learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution oriented thinking promotion, stress on research and innovation, international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University.

The university will help students develop as a unique individual-to be educated as a whole person, intellectually, emotionally, socially, ethically, and spiritually. The educational program designs are worked out meticulously in line with best in class universities with special focus on:

- Flexible Choice Based Credit System
- OBE - Outcome Based Education System
- Experiential Learning
- Project Based Learning

- Case Based Learning
- Training need analysis based on Performance Appraisal System
- Active Learning tools for effective delivery
- Mentoring / Proctorship
- On line learning /Self learning platforms
- Flipped Classroom concept
- Effective Student Feedback Mechanism

VISION

Internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind.

MISSION

- To prepare students for life-long learning and leadership in a global academic culture
- To create intellectual manpower relevant to the industry and society at large
- To collaborate with institutions of international repute for academic excellence
- To promote research and development through conducive environment
- To encourage entrepreneurship and skill development programs

CORE VALUES

- Integrity
- Transparency
- Accountability
- Equality
- Empathy
- Stewardship

QUALITY POLICY

Sanjay Ghodawat University is committed to establish high standards in value-based quality education to enhance and nurture young minds to excel in their chosen profession and develop into socially responsible citizens through resourceful collaboration, innovation and research

CHOICE BASED CREDIT SYSTEM (CBCS)

The credit based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

University Grants Commission has come up with the Choice Based Credit System (CBCS) programme in which the students have a choice to choose from the prescribed courses, which are referred as core, elective or minor or soft skill courses and they can learn at their own pace and the entire assessment is graded-based on a credit system. The basic idea is to look into the needs of the students so as to keep up-to-date with development of higher education in India and abroad. CBCS aims to redefine the curriculum keeping pace with the liberalization and globalization in education. CBCS allows students an easy mode of mobility to various educational institutions spread across the world along with the facility of transfer of credits earned by students.

Where the students can choose the prescribed courses, as the core, and elective or soft skill courses, from a range of options, rather than to simply consume what the curriculum offers. They can learn at their own pace and the assessments are graded based on a credit system. It provides an opportunity for students to have a choice of courses or subjects within a programmed resembling a buffet, against the mostly fixed set of subjects now being offered (except for the limited choice of electives in professional degrees and postgraduate programmers) with the flexibility to complete the programmed by earning the required number of credits at a pace decided by the students.

The UGC has always initiated measures to bring efficiency and excellence in the Higher Education System of India. The basic motive is to expand academic quality in all aspects, right from the curriculum to the learning-teaching process to examination and evaluation systems. However, so far multiple methods are followed by different universities across the country towards examination, evaluation and grading system. Considering this diversity, the implementation of the choice based credit system seems to be a good system in assessing the overall performance of a student in a universal way of a single grading system.

OUTCOME BASED EDUCATION (OBE) MODEL

Sanjay Ghodawat University (SGU) has implemented OBE model of education, which is a learner centered approach. SGU has witnessed a sea change in the entire academic systems with implementation of all three components of OBE – Design, Delivery and Assessment. The SGU model of autonomy focuses on experiential learning which believes in learning by doing. This is achieved through hands on experience, industrial assignments, mini projects and live problem solving and collaboration with industries.

SGU is set in to dynamics of transformation and witnessing a shift in focus from teaching to learning and entire academic system of SGU is designed to provide multiple learning opportunities for students to acquire and demonstrate the Knowledge, Skills and Attitudes (KSA) for rewarding career.

The Vision and Mission of the Management, contribution from eminent BOG members and knowledgeable members of Academic Council and Board of Studies, the motivation and drive of the Director, the relentless efforts of the fellow Deans and Head of Departments and all teaching and non teaching staff along with commitment to learning of students made it possible to successfully transform the institute and stand out to carve a niche for itself as an Institute of repute.

OBE is an approach of curriculum design and teaching that focuses on what students should be able to do (attained) at the end of course/ program. Outcome based education (OBE) is student-centered instruction model that focuses on measuring student performance through outcomes. Outcomes include knowledge, skills and attitudes (KSA). Its focus remains on evaluation of outcomes of the program by stating the knowledge, skill and behavior a graduate is expected to attain upon completion of a program and after 4 – 5 years of graduation. In the OBE model, the required knowledge and skill sets for a particular degree is predetermined and the students are evaluated for all the required parameters (Outcomes) during the course of the program.

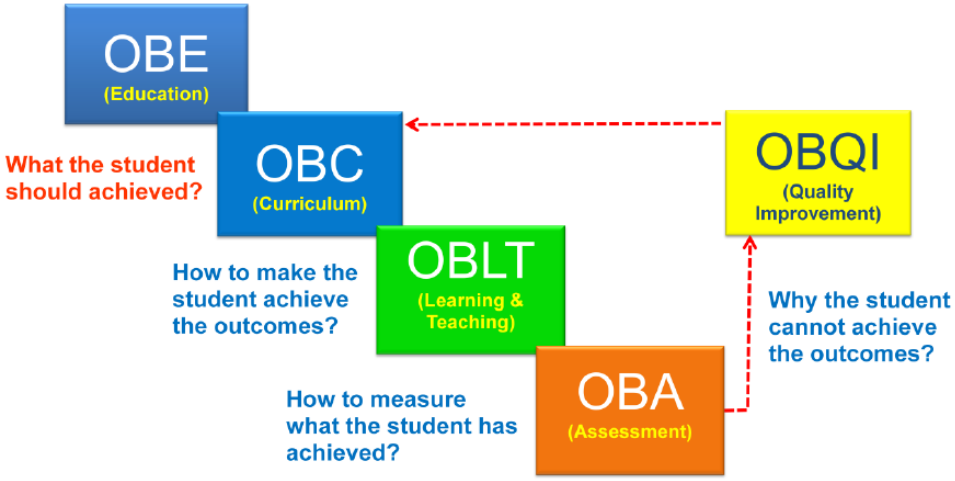
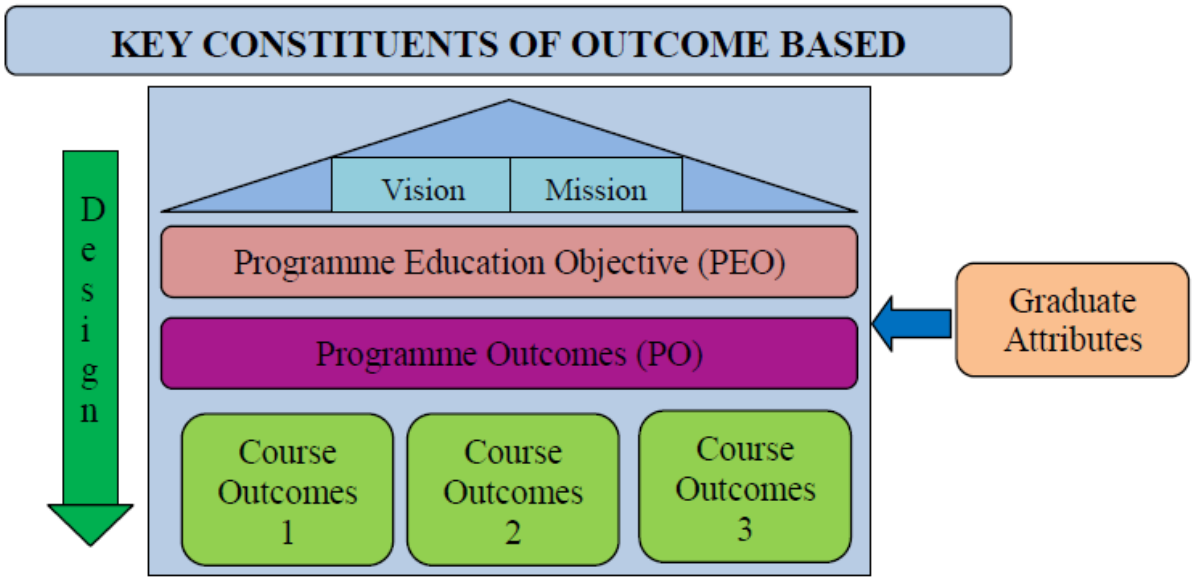


Figure 1: OBE flows and desciption



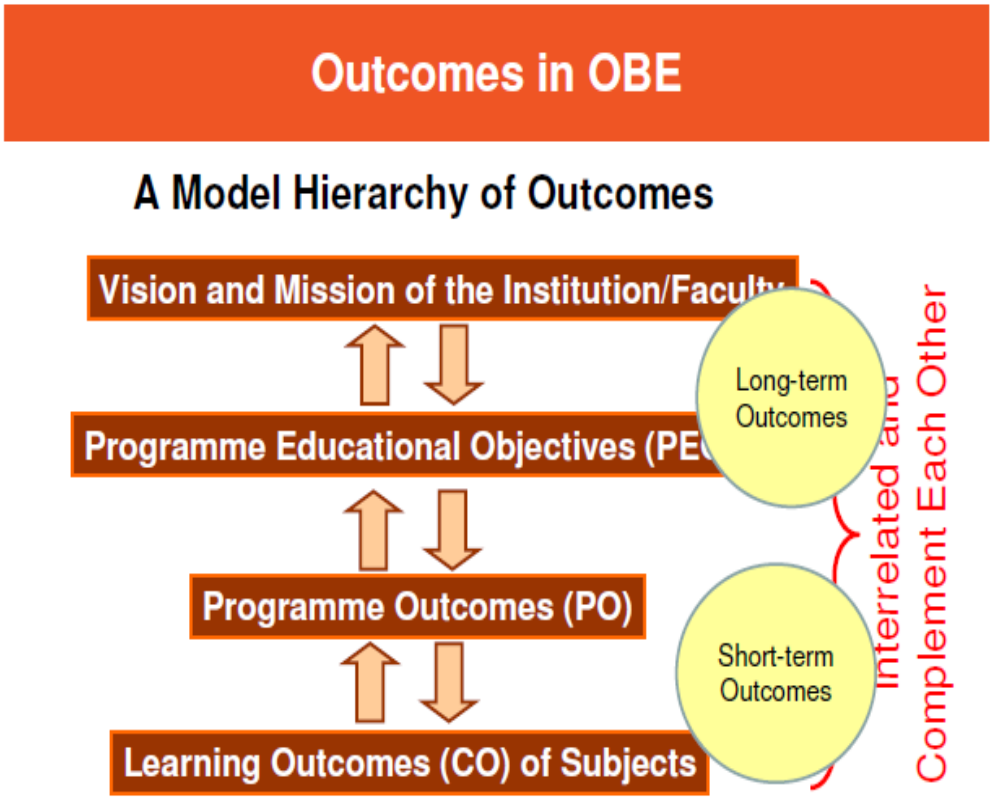
The OBE model measures the progress of the graduate in three parameters, which are

- Program Educational Objectives (PEO)
- Program Outcomes (PO)
- Course Outcomes (CO)

Program Educational Objectives (PEO) are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. PEO's

are measured 4-5 years after graduation. Program outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. They must reflect the Graduate attributes. Course outcomes are the measurable parameters which evaluates each students performance for each course that the student undertakes in every semester.

The various assessment tools for measuring Course Outcomes include Tests and End Semester Examinations, Tutorials, Assignments, Project work, Labs, Presentations, Employer/Alumni Feedback etc,. These course outcomes are mapped to Graduate attributes and Program outcomes based on relevance. This evaluation pattern helps Institutions to measure the Program Outcome. The Program Educational Objective is measure through Employer satisfaction survey (Yearly), Alumni survey (Yearly), Placement records and higher education records.



Special Features of OBE

- OBE is an educational process that focuses on what students **can do** or the **qualities** they should develop after they are taught.
- OBE involves the restructuring of curriculum, assessment and reporting practices in education to reflect the achievement of high order learning and mastery rather than accumulation of course credits.
- Both structures and curricula are designed to achieve those **capabilities** or **qualities**.
- Discourages traditional education approaches based on direct instruction of facts and standard methods.
- It requires that the students demonstrate that they have learnt the required skills and content.

Sanjay Ghodawat University Kolhapur

(Established as a State University under Government of Maharashtra Act No XL dated 3rd May 2017)

Academic and Examination Rules and Regulations

Approved in the second Academic Council Meeting held on 9th May, 2018 and to be implemented from academic year 2018-19. [Version R0]

Sanjay Ghodawat University Kolhapur

Kolhapur - Sangli Highway, A/p Atigre - 416 118,
Tal. - Hatkanangale, Dist. Kolhapur,
Maharashtra, India

(Implemented from Academic year 2018-19)

Academic and Examination Rules and Regulations

1.0 Preamble

The Sanjay Ghodawat University (SGU) stands for quality and excellence. It aims at nurturing the young talent and grooming them into responsible citizen and a value added human resource. Outcome Based Education (OBE) model is adopted to enhance the effectiveness of teaching learning process and Credit Based semester system is implemented.

The focus of the University is its research based curriculum and academically oriented teaching staff. The world class ambience and infrastructure helps the students to easily accommodate themselves in an environment that is conducive to the teaching- learning process. Hands on experience, challenge based case studies, maximum participation of students in the classroom, use of modern digital technology, smart classrooms, solution oriented thinking promotion, stress on research and innovation, international tie ups, choice based credit system for flexibility in choosing areas of interest etc. are some of the features of the University.

Vision of SGU is internationally recognized university of excellence in creating and disseminating knowledge through value-based quality education leading to betterment of mankind. To achieve the vision SGU has developed state-of-the-art infrastructure that promotes conducive ambience promoting innovation and research. Create intellectual manpower relevant to the industry and society at large. Foster mutually beneficial partnership with alumni, industry and academia. Inculcate ethics and values to develop socially responsible citizens and promote entrepreneurship.

SGU is offering various programs through schools such as School of Technology, School of Commerce and Management, School of Sciences and School of Arts.

SGU has implemented the outcome-based Education (OBE) system and Credit based Evaluation System in all the schools.

The rules and regulations mentioned in this document are applicable to all the Under Graduate (UG) and Post Graduate programs offered by the Sanjay Ghodawat University from the academic year 2018-19. The rules and regulations stated under here are subject to revisions / refinements, updates and modifications and amendments by Academic Council (AC) from time to time and applicable to all batches including those already undergoing programs in different year and are binding on all stakeholders including students, faculty, parents and University authorities.

The academic programs of the University shall be governed by rules and regulations approved by the Academic Council from time to time. Academic council is the supreme and statutory academic body that governs all academic matters of the university and the decisions of the academic council are final and binding in the matters related to academics.

2.0 Definition of Terms

1. University: University means Sanjay Ghodawat University, Kolhapur
2. Academic Year: The period of the year during which students attend university for all academic activities, usually it starts from first of July and ends on 30th of June next year.
3. **Semester:** Academic Year is divided in to 2 parts called Semester, Odd Semester which starts from July and Even Semester which starts from January.
4. **Duration of Semester**: Total duration of semester is usually 20weeks per semester including instructions, examination and evaluation. Total instructional days are 90 per semester.
5. **Course:** It is a Subject that is in a semester. The course may consist of Theory/Practical/Project/Seminar during semester. Usually taught by instructor in a class. e.g. Physics, Chemistry, Engineering Mechanics, Workshop etc.
6. **Program:** Collection of Courses is called Program. B Tech in Mechanical Engineering,
7. M Tech in Civil Engineering, Bachelor of Business Administration. Bachelor of Science etc.
8. **Department:** Department is a unit of the school which offers one or more programs.
9. **Contact Hours:** Time of students in class/laboratory with instructor. Usually in the range of 26-30 Hrs./Week. For the purpose of uniformity one contact hour is measured as 60 minutes
10. **Academic Council (AC):** Means apex academic body governing the academic programs responsible for framing policy, rules and regulations.
11. **Board of Examination (BOE):** Central body responsible for framing policy ,rules and regulations for Examination.
12. **Board of Studies (BOS):** Departmental academic body to govern the academics of programs(BOS)offered by department.

3.0 Curriculum:

3.1. Curriculum:

Every program has a prescribed structure which, in general, is known as Curriculum. It prescribes courses to be studied in each semester. The booklet containing courses structure along with detail syllabus for each course of each

program is updated periodically and made available on the website.

3.2. Semesters:

SGU implements a credit based semester system. The academic year is divided into two regular semesters. The semesters that begin in July are known as Odd semester and the semester that begin in January are known as Even semesters. Total duration of each semester is generally of 20 weeks including the period of examination, evaluation and grade declaration.

3.3. Course Credit System/Structure:

In general, a certain quantum of work measured in terms of credits is laid down as the requirement for a particular program. Calculation of number of credits for a course in any semester is as per Table 3.1

Table 3.1: Calculation of number of credits for a course

Sr. No.	Course	Credits
1	Lecture of 1 hour/week	**1**
2	Tutorial of 1 hour/week	**1**
3	Practical / Laboratory / Drawing/mini-project of two hours/ week	**1**
4	Seminar (1 hour per week)	**1**

There are mainly two types of courses- viz. Theory courses and Laboratory courses. Generally a theory course consists of Lecture hours (L) and Tutorial hours (T). Tutorial hours may not be assigned to a particular theory course if it has a separate laboratory course. Laboratory course consists of practical hours (P) for which a student works in a Laboratory/Drawing Hall/Workshop. The other courses required to be taken by a student include seminar, mini project, and project at various levels of the program.

A student shall earn credits for a particular course by fulfilling the minimum academic requirements for attendance and evaluation. No credits shall be awarded if a student satisfies the minimum attendance requirements but fails to meet minimum evaluation requirements.

The total number of credits required for completing a program shall be mentioned in the course structure. The total number of credits in a semester which a student

registers shall generally be 20--25. The maximum number of credits per semester shall not exceed 30

3.4 Audit Course:

3.4.1 A student may have to register for an audit course in a semester which could be institute requirement or department requirement.

3.4.2 An audit course may include either a) a regular course required to be done as per structure or required as pre-requisite of any higher level course or b) the programmes like practical training, industry visits, societal activities etc.

3.4.3 Audit course shall not carry any credits but shall be reflected in Grade Card as "PP"/"NP" depending upon the satisfactory performance in the semester evaluation as per the course curriculum structure.

4.0 Course Registration:

4.1 Every student must register for the courses that he/she wants to study for earning credits at the beginning of each semester on the prescribed dates announced from time to time and shall be mandatory for every student till he/she completes the program. Only after registration his/her name shall appear in the roll list of each of such courses.

4.2 Students shall be required to fill up a Course Registration Form which shall be made available to them by the Student section of Administration office after payment of required fees.

4.3 Registration, according to rules, should be carried out as per the schedule given in academic calendar. Late registration may be permitted only for valid reasons and on payment of late registration fees. In any case, registration must be completed before the prescribed last date for registration, failing which his/her studentship shall be liable to be cancelled. Students having dues outstanding towards the institute or hostel shall be permitted to register only after clearing such dues.

4.4 In-absentia registration may be allowed only in rare cases at the discretion of the Dean Academics and with prior permission.

4.5 For registration in an odd semester, the student must have earned all the credits of the pre-previous year and at least 2/3rd credits of the previous year. For example, for registration of the 5^{th} semester courses (i.e. 3^{rd} year of program), a student must have earned all the credits of the first year and 2/3rd credits of the second year. Similarly for registration of the 7^{th} semester courses (i.e. 4^{th} year of program), a student must have earned all the credits of the second year and 2/3rd credits of the third year. However, if 2/3rd calculation turns out to be a mixed number (integer + fraction) then only the integer part of that number shall be considered for taking decision related with this clause.

4.6 A student registered in odd semester shall be eligible to register for the courses offered in the even semester of that year irrespective of his/her SGPI or the number of credits earned by him/her in that odd semester.

5 .0 Lateral Entry For B Tech Programs

Post diploma students in engineering and B.Sc. Graduates can have lateral entry at third semester of the program. Such admissions are governed by the rules of regulatory bodies like AICTE New Delhi and Directorate of Technical Education Maharashtra state and Sanjay Ghodawat University for Admission criteria and shall undergo all academic requirements as specified by the Academic council.

For such students there shall not be First Year Performance Index (FYPI). Semester Performance Index (SGPI) and Cumulative Performance Index (CGPI) shall be calculated from the third semester onwards taking into consideration the courses undergone by them at Sanjay Ghodawat University Kolhapur.
Registration of the students not covered by the cases mentioned above shall be decided by the Academic Council. Such students shall undergo the academic program as specified by the Academic Council. Such odd entry students shall not be eligible for any medals or awards instituted by the institute.

6.0 Change of Program:

This is applicable to B Tech Program only. Students shall be eligible to apply for Change of Program after completing the first two semesters. The following rules/ guidelines shall be used for considering their applications for change:

6.1 The change of program shall be permitted strictly on merit basis subject to the rules of admissions prevailing at the time of such change.

6.2 Students without fail grades and/or backlogs shall be eligible to apply for change of program and can give their choices in the order of preference.

6.3 The request for change of program by a student from program A to program B shall be considered if number of students of program B does not exceed the sanctioned capacity of program B and also the minimum strength required to run the program as decided by Academic Council.

6.4 All such transfers can be effected only once at the beginning of the second academic year of the 4-year UG program. No application for change of program during subsequent academic years shall be entertained.

7. 0 Facilitation to Students:

7.1 Faculty Advisor:

On joining the institute, a student or a group of students shall be assigned to a faculty advisor who shall be mentor for a student throughout his/her tenure in the institute. A student shall be expected to consult the faculty advisor on any matter relating to his/her academic performance and the courses he/she may take in various semesters / summer term. A Faculty advisor shall be the person to whom the parents/guardians should contact for performance related issues of their ward. The role of a faculty advisor is as outlined below:

The role of the Faculty Adviser is outlined below:

a. Guide the students about the rules and regulations governing the courses of study for a particular degree.
b. Advise the students for registering courses as per curriculum given. For this purpose the Faculty Adviser has to discuss with the student his/her academic performance during the previous semester and then decide the number and nature of the courses for which s/he can register during the semester as per the curriculum.
c. Approve the registration of the students.
d. Advice students to overload/ drop one or more courses/activities based on her/his academic performance as per the prescribed rules.
e. At the end of the first semester/year, the Faculty Adviser may even advise a reduced load program for a poorly performing student.
f. Pay special attention to weak students and carefully monitor performance of students recommended for slow track option.
g. Advice students for Course Adjustment / Dropping of courses during the Semester within the stipulated time frame given in the Academic calendar.
h. Advice students seeking semester drop either during the ongoing semester or before the commencement of the semester. FA has to ensure strict compliance of rules and regulations laid down for this purpose. Recommend the cases to the appropriate authorities for consideration.
i. Make revised plan of study for weak/bright students based on their semester wise performance.
j. Suggest modalities for course/credit requirements for the students recommended for exchange program.
k. Guidance and liaison with parents of students for their performance.
l. To ensure that students are not permitted to re-register for courses, which they have already passed.
m. Inform students that any academic activity (course / Lab. / seminar / project / noncredit requirement etc.) undergone without proper registration will not be counted towards the requirements of his/her degree.
n. Strictly warn students that if she/he fails to register during any semester without prior approval, his/her studentship is liable to be cancelled.

- Keep the students updated about the Academic Administration of the University.

7 .2. Helping Weaker Students:

A student with backlog/s should continuously seek help from his/her faculty advisor, Head of the Department and the Dean of respective schools. Additionally, he/she must also be in constant touch with his/her parents/local guardians for keeping them informed about academic performance. The university also shall communicate to the parents/guardians of such student at least once during each semester regarding his/her performance in in-in various tests and examination and also about his/her attendance. It shall be expected that the parents/guardians too keep constant touch with the concerned faculty advisor or Head of the Department, and if necessary - the Dean of the respective school.

8. 0 Discipline And Conduct:

8.1 Every student shall be required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which shall tend to bring down the prestige of the university.

8.2 Any act of indiscipline of a student reported to the Dean, Student Development, shall be discussed in a Disciplinary Action Committee of the institute. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated.

8.3 If a student while studying in the university is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government he/she shall be liable to be expelled from the institute without any notice.

8.4 If a student is involved in any kind of ragging, the student shall be liable for strict action as per provisions in the Maharashtra anti-ragging act.

8.5 If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission shall be cancelled and he/she shall be expelled from the university and fees paid shall be forfeited.

8.6 If a student is found guilty of malpractice in examinations then he/she shall be punished as per the recommendations of the Grievance Redressed Committee (CRC) constituted by Board of Examinations.

8.7 Every admitted student shall be issued photo identification (ID) card which must be retained by the student while he/she is registered at Sanjay Ghodawat University Kolhapur. The student must have valid ID card with him/her while in the University Campus.

8.8 Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another, student shall be subjected to disciplinary action.

8.9 The valid ID card must be presented for identification purpose as and when demanded by authorities. Any student refusing to provide an ID card shall be subjected to disciplinary action.

8.10 Students should switch off the Mobiles during the Instructional hours and in the academic areas of university Building, Library, Reading room etc. Strict action will be taken if students do not adhere to this.

8.11 During the conduct of any Tests and Examination students must not bring their mobiles. A student in possession of the mobile whether in use or switched off condition will face disciplinary action and will be debarred from appearing for the Test / Examination.

9.0 Academic Calendar

The academic activities of the institute are regulated by Academic Calendar and is made available to the students/ faculty members and all other concerned in electronic form or hard copy. It shall be mandatory for students / faculty to strictly adhere to the academic calendar for completion of academic activities

10.0 Attendance:

10.1 Regular 100% attendance is expected from all students for every registered course in lectures, tutorial, laboratory, projects, mini-projects and other courses mentioned in program curriculum. Hence, attendance is compulsory and shall be monitored during the semester rigorously. Students shall be informed at the end of every month if they are failing short of attendance requirements.

10.2 A Maximum of 25% absence for the attendance may be permitted only on valid grounds such as illness, death in family of blood relations (Father, Mother, Sister, and Brother) and any other emergency reason which is beyond the control of the student and shall be approved by the authorities in respective departments.

10.3 If a student fails to put up 75% attendance individually in each course, the student will be put under X grade category and student will be debarred form attending the End Semester Examination (ESE) and Re-Exam for that semester in that course. However, student has an option to re-register for the course whenever it is offered next time or he can appear for 100% examination for which he will be awarded two grade penalties. Student's FET, CAT1 and CAT2 marks are treated as null and void.

10.4 The maximum number of days of absence for students participating in Co-curricular activities /Sports/ Cultural events during a semester shall not exceed 10. Any waiver in this context shall be on the approval of the Academic council only after the recommendation by Dean Academics of the university

The HOD and Dean of the respective school shall report and recommend to Academic council the cases of students not having 75% attendance as per the records of course instructor. After rigorously analyzing these cases AC may take a decision to debar such

student from End-Semester Examination (ESE) for that course. Such a student shall re-register for that course as and when it is offered next. ISE and MSE evaluations of such a student for this course during regular semester shall be treated as null & void.

10.5 A student remaining absent during ESE of a course either on medical ground (Accident and/or hospitalization of a student) or any other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister) or due to representing University at university/state level in sports/co-curricular activities shall be treated as per the rules of Sec 12.6.2 and 11.1.2

The critical cases of absenteeism which are not covered by any of the above clauses shall be reported by concerned Head of Department to Academic dean and all such cases the decision of Academic council is final.

11.0 Modes of Assessment:

11.1Assessment of Theory Courses:

11.1.1 A student shall be evaluated for his/her academic performance in a theory course through Faculty Evaluation Theory (FET), Continuous Assessment Tests (CAT1 and CAT2) and End Semester Examination (ESE).

11.1.2 The relative weightage for the theory courses having ESE shall be generally as shown in the Table 11.1.2

Table 11.1.2: Weightage for the theory courses in %

FET	CAT1	CAT2	ESE
20	15	15	50

The details of the weightage of each course shall be listed in the structures of each program.

11.1.3 FET shall be based on student's performance in assignments, quizzes, seminars, Course projects and field assignments, term papers, etc. The mode of FET shall be decided and announced by the Course Instructor at the beginning of the course.

11.1.4 CAT1 shall generally be of one hour duration for each course and shall be held as per the schedule declared in the Academic calendar for that Semester. The test will be based on first two units of the course.

11.1.5 CAT2 shall generally be of one hour duration for each course and shall be held as per the schedule declared in the Academic calendar for that semester based on unit 3 and unit 4 of the syllabus.

11.1.6 ESE is of three hours comprehensive examination having the weightage of 60% for unit 5 and 6 and 20 to unit 1 to unit 4. It is of 100 marks

11.1.7 All examinations and evaluations shall be compulsory. Credits for a course shall be awarded only if a student satisfies evaluation criteria and acquires the necessary minimum grade.

11.1.8 There shall be no re-examination for CAT1 and CAT2 of the courses having all the three components of evaluation viz. FET, CAT1 CAT2 and ESE. However, a student remaining absent for CAT1 and CAT2 for representing the institute in state level or university level sports/co-curricular activities (on prior recommendation and approval from) or on valid grounds such as illness, death in family or other emergency reason which is beyond control of a student (on approval by the head of department and dean of respective school shall be considered for Make- up examinations.

11.1.9 A student remaining absent for ESE of a course either due to medical reason (Accident and/or hospitalization of a student) or other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister) or due to representing college at university/state level in sports/co-curricular activities shall be awarded with grade "I". Such a student shall be allowed to appear for make-up examination scheduled along with re-examinations of other courses. The student shall apply to COE with proper documentary evidence to appear for make-up examination. After make-up examination, a student shall be entitled to an appropriate grade as per Table I of Sec. 10.1.2 based on his/her performance during the regular semester and in make-up examination.

11.2 Assessment of Laboratory Courses:

11.2.1 The assessment of laboratory course shall be continuous and based on turn-by-turn supervision of the student's work and the quality of his/her work as prescribed through laboratory journals and his/her performance in viva-voce examinations uniformly distributed throughout the semester. Where ESE for the laboratory course is specified ESE shall be based on performing an experiment followed by an oral examination. The relative weightage for FEP and ESE for assessment of laboratory courses shall be 50% each for FEP and ESE and a minimum performance of 20 in both ISE and ESE separately shall be required to get the passing grade.

11.2.2 ESE for laboratory course shall normally be held before the ESE for theory courses and shall be conducted by a panel of examiners appointed by COE from the panel of

experts approved by BOS. This activity shall be coordinated by Department Examination Coordinator (DEC) in consultation with HOD of the respective department.

11.2.3 Student failed in ESE of a laboratory course in a regular semester shall be eligible to appear for 100% examination conducted alongwith ESEs of laboratory courses of the subsequent semester. Such examination shall be fairly comprehensive (generally of 3 hours similar to POE i.e. Practical-Oral-Examinations) to properly judge his/her practical skill and theoretical knowledge for that laboratory course. He/She shall suffer one grade penalty.

12.0 The Grading System:

Absolute Grading System (AGS) is adopted based on absolute numerical marks obtained by the student during all stages of evaluation for a course.

12.1. Award of Grade (Regular Semester):

12.1.1For every course registered by a student in a semester, he/she shall be assigned a grade based on his/her combined performance in all components of evaluation scheme of a course as per the structure. The grade indicates an assessment of the student's performance and shall be associated with equivalent number called a grade point.

12.1.2The academic performance of a student shall be graded on a ten point scale. The Absolute Grading System is followed. Letter grades, the guidelines for conversion of marks to letter grades and their equivalent grade points are as given in Table

Table 12.1.2: Grade Table for Regular Semester

Marks Obtained	Grade Letter GL	Grade Point GP	Performance Description
90-100	**O**	**10**	Outstanding
80-89	**A+**	**09**	Excellent
70-79	**A**	**08**	Very Good
60-69	**B+**	**07**	Good
50-59	**B**	**06**	Above Average

45-49	**C**	**05**	Average
40-44	**P**	**04**	Pass
00-39	**F**	**00**	Fail
-	**Ab**	**00**	Absent
-	**X**	**00**	Detained (Failed)
-	**Satisfactory**	-	Pass in Non Credit Courses
-	**Un Satisfactory**	-	Failed in Non Credit Courses

12.1.3 A student shall pass the course if he/she gets any grade in the range "O" to "P".

12.1.4 "FF" grade shall be awarded to a student in a course if he/she gets less than 20 marks jointly in the FET, CAT1, and CAT2 & ESE for a theory course and in PET & ESE for a laboratory course. A course shall then be eligible to apply for re-examination. A student failed in laboratory course shall be eligible to apply only for 100% examination conducted with the laboratory examinations of the subsequent semester. In both cases, a student has to suffer one grade penalty.

13 Assignment of X Grade

Grade "X" in a regular course shall be given to a student if he/she falls in any of the following categories.

13.1.1 A student does not maintain the minimum 75% attendance in any of the theory or laboratory courses.

13.1.2 A student has not completed most of the Evaluations like FET, CAT1 and CAT2 due to non-medical reasons (for example when a student has missed all or most of the components of internal evaluation conducted by the instructor in that semester).

13.1.3 The performance of a student is less than 20 in FET, CAT1 and CAT2 Combined.

13.1.4 A student is guilty of any academic malpractice during semester (Such cases shall be dealt by Grievance Redressed and Discipline Committee).

In above four cases grade "X" shall be declared one week before ESE and intimated to the Academic Office and COE immediately thereafter. Such a student shall not be permitted to take the ESE of that course.

13.1.5 Grade "X" may be given to a student if

13.1..5.1 A student eligible for ESE remains absent for ESE of a course with no written intimation to Exam Cell within four days after the respective ESE is over.

13.1.5.2 A student is guilty of any academic malpractice during examination. (Such cases shall be dealt by Grievance Redressal Committee).

In 13.1.5.2 grade "X" in that course shall be declared after Grievance Redressed Committee confirms the academic malpractice.

In above two cases when a student gets "X " grade in a course, then this shall be treated as "FF" for the purpose of calculation of Semester Performance Index (SGPI) and First Year Performance Index (FYPI) or Cumulative Performance Index (CGPI).

Following rules apply to the student who has obtained grade "X" in a regular semester:

13.1.6.1 A student obtaining grade "X" in a course in a regular semester or during examination shall be not be allowed to appear for End semester examination and also Re ESE conducted before the beginning of the next semester. His/her FET, CAT1 and CAT2 evaluations for all courses shall be treated as null and void. He/She needs to re-register for courses of that semester in the next academic year whenever they are offered and undergo all evaluations along with fresh regular students for which he will get one grade penalty.

13.1.6.2 Grade "I" shall be declared in a theory/laboratory course if a student has satisfactory performance FET, CAT1, CAT2 and has fulfilled the 75% attendance requirement, but has not appeared for ESE due to genuine reasons. Such students shall be eligible for the make-up examination of ESE only on medical grounds/valid reasons and on production of authentic medical certificate or other supporting document/s (as required by the University) to the COE within ten days after the respective examination is over. The application form with requisite amount of fees must be submitted to the Exam Cell before the last date of filling such application forms for make-up examinations. These examinations shall be based on 100% syllabus and shall be scheduled before the commencement of the subsequent semester for theory courses and along with ESEs of laboratory courses of the subsequent semester. A student with "I" grade when appears for the make-up examination shall be eligible to obtain a regular performance grade ("O" to "F") as per Table 11.1.2 depending on his/her overall performance in FET, CAT1 ,CAT2 and make-up examination. If a student fails to appear for make-up examination too, a grade "XX" shall be awarded to him/her. Thus "I" is only a temporary grade and shall be replaced by a valid grade only after make-up examination.

13.2 There shall be a few audit courses as per the policies of the institute or as decided by DPC of respective program. The grade "PP" (Passed)/ "NP" (Not Passed) shall be awarded for such courses depending upon the performance of a student evaluated by the faculty in-charge. No grade points shall be associated with these grades and performance in these courses shall be not taken into account in the calculation of the performance indices (SGPI, CGPI). However, the award of the degree shall be subject to obtaining a "PP" grade in all such courses.

13.3 Award of Grades for Re-Examination:

13.3.1 A student who has obtained grade "F" in regular semester shall be eligible to appear for re-examination conducted before the commencement of the next regular semester. In such cases FET, CAT1 and CAT2 marks are carried forward and a student has to suffer one grade penalty

13.3.2A student shall apply for re-examination before the last date of such application and shall appear for re-examination.

13.3.3 50% weightage similar to ESE shall be given to re-examination and there is one grade penalty.

13.3.4 A student who has obtained "F" grade in ESE of a regular semester and has not availed re-examination option or a student who has obtained "F" grade in both ESE and re-examination shall be eligible to choose one of the two options below to clear his/her backlog:

- Re-registration for the next regular semester course whenever that course is offered.
- Appearing for ESE of the course when conducted...
  A student detained in a regular semester due to either a) by obtaining "X" grade or b) by involvement in academic malpractice or c) by breaking the institute code of conduct and discipline can re-register for the course when offered next

Following rules apply for these cases:

13.4.1 In first case i.e. Re- registration the earlier performance of a student in all the evaluations of that course shall be treated as null and void. The student has to undergo all the evaluations after re-registration.

13.4.2 Grades for Third and Subsequent attempts:

If A student opts for ESE or Re ESE who previously had obtained grade "F" in a course in two attempts, his/her FET, CAT1 and CAT2 performance of the regular semester shall be considered for evaluation and He/She has to suffer two grade penalty for the third attempt and for 4^{th} and subsequent attempts shall be awarded a grade "P" or "F" or "X" based on his/her performance.. However, if a student takes more than three chances

(regular examination being the first chance, re-examination being the second chance, to clear a course, then the maximum passing grade that he/she can get shall be only "P". Thus a student has to suffer a grade penalty by accepting a lower grade than that obtained in the regular examination, re-examination, or examination for a re-registered course.

14. CALCULATION OF PERFORMANCE INDICES:

14.1. Semester Grade Point Average (SGPA)

The performance of a student in a one specific semester is indicated by SGPA. SGPA is a weighted average of the grade points obtained in all courses registered by the students during the semester. SGPA can be calculated by following equation.

$$SGPA = S_i = \frac{\sum_{i=1}^{n} C_i P_i}{\sum_{i=1}^{n} C_i}$$

Where, i = 1,2,3…….n are number of courses during semesters. C = No of credits associated with that course and P = Grade point earned in that course. SGPA will be rounded off to two decimal places.

14.2 Cumulative Grade Point Average (CGPA)

The total cumulative performance of a student at the end of specific semester is indicated by CGPA. An up-to-date assessment of the overall performance of a student for the courses from the first semester onwards till completion of the program shall be obtained by calculating Cumulative Grade Point Average (CGPA).

CGPA is a weighted average of the SGPA obtained in all semesters by the students during the semesters. CGPA can be calculated by following equation.

$$CGPA = \frac{\sum_{j=1}^{n} C_j S_j}{\sum_{j=1}^{n} C_j}$$

Where, j = 1,2,3…….n are number of semester during program. C = Total No of credits in the semester for which CGPA is to be calculated.

CGPA will be rounded off to two decimal places.

Conversion of CGPA to percentage marks for CGPA ≥ 4.5 can be obtained using equations. Percentage marks = (CGPA x 10) – 7.5.

14.3For the students acquiring "I" grade (which is only a temporary grade) in any of the courses, SGPA, CGPA shall be calculated only after make-up examination.

14.4. First Year Performance Index (FYPI): (Applicable For B. Tech Programs Only)

14.2.1 For a student registered in Sanjay Ghodawat University Kolhapur right from the First semester, First-Year-Performance-Index (FYPI) shall be calculated as weighted average of the grade points obtained in all the courses registered by him/her in semesters I and II only.

$$FYPI = \frac{\sum_i C_i g_i}{\sum_i C_i}$$

Where summation is for all the courses registered by a student in first two semesters. FYPI shall be calculated when SPI for the second semester is calculated. FYPI shall be rounded off to two decimal places.

14.2.2 FYPI shall reflect all the courses undergone by a student in the first year including the courses in which he/she has failed. FYPI may get modified in the subsequent semesters whenever a student clears his/her first year backlog courses.

14.2.3If a student has been awarded "I" grade in the regular semester course of the first year then, FYPI shall be calculated after the make-up examination on the basis of the grade obtained by that student in a make-up examination.

14.2.4 If a student has obtained grade "F" or "X" at any time in any of the courses registered by him, then zero grade points corresponding to these grades shall be taken into consideration for calculation of FYPI.

15 Maximum Duration for Completing the Program

Maximum duration for completing any program UG/PG offered by Sanjay Ghodawat University is respective program duration plus two additional years.

Maximum duration for getting the B. Tech degree for students admitted in the first semester of UG program is, program duration plus two additional years (i.e. 12 Semesters and 6 academic years) For lateral entry student academic admitted in the third semester shall be (10 Semester and 5 Years).

The maximum duration of the program includes the period of withdrawal, absence and different kind of leaves permission to student but excludes the period of rustication of the student from the university however genuine case an confidential of valid reason may be referred to academic council for extending this limit by additional criteria

16 NFTE (Not Fit For Technical Education) (Applicable to B Tech program only)

It is mandatory for the student to earn all credits of first year specified for semester I & II or eligible for ATKT as per the rules to seek admission to semester III of second year in three years from the date of admission to avoid NFTE. If a student fails to become eligible for admission to Semester III in three year form the date of his admission, he shall be declared as "Not Fit for Technical Education" leading to discontinuation of his/her registration with the university. Such cases should be put up in the academic council.

17. Academic Progress Rules (ATKT Rules):

17.1 A student shall be allowed to register for the courses of the next year's odd semester only if he/she has earned all the credits of the previous year and has earned at least 75% credits of the current year. If 75% calculation turns out to be a mixed number (integer + fraction) then only the integer part of that number shall be considered for deciding the eligibility for ATKT.

At the end of 1st year a student shall be allowed to keep terms (ATKT) to 2nd year of study provided he/she attends course work prescribed for 1st year with prescribed attendance and successfully earned at least 75% of the total credits specified for 1st year program.

For Example: Total credits for B. Tech first year 2017-18, are 45 (Total of Semester I and II). A Student should earn mininum75% of the 45 Credits i.e. 33.15 (Rounded to 33 Credits). A student can go to next higher class with a maximum backlog of 12 credits of semester I & II of the first year.

Student, who fails to earn those credits, cannot register for next semester, either it can re-registrar for the course and credits or can use the next opportunity to earn the credits when exams are conducted. .

(b) At the end of 2nd year a candidate shall be allowed to keep terms to 3rd year of study provided he/she attends course work prescribed for 2nd year with prescribed attendance, and successfully cleared 1st year program and at least 75% of total credits prescribed for 2nd year program.

(c) At the end of 3rd year a candidate shall be allowed to keep terms to final year of study provided he/she attendants course work prescribed for 3rd year with prescribed attendance, and should have completed 2nd year program and 75% of total credits prescribed for 3rd year program.

All such candidates fulfilling the above criteria shall be declared as FAILED, ATKT.

A student shall be allowed to take admission for odd semester of next academic year only if he/ she have earned all the credits of the previous year and 75% happens to be a decimal, it is rounded to only integer part.

18 Semester Grade Report:

18.1 Semester grade report reflects the performance of a student in that semester (SGPI) and also his/her cumulative performance for the first year (FYPI) and also the cumulative performance since the third semester of his/her study (CGPA).

18.2 The semester grade card issued at the end of each semester/ summer term to each student shall contain the following.

- The credits for each course registered for that semester.
- Any audit course/s undertaken by a student in a Semester.
- The letter grade obtained in each course.
- The total number of credits earned by a student for the first year separately.
- The total number of credits earned by a student since the 3rd semester onwards.
- SGPI, FYPI, CGPI.
- A list of backlog courses, if any.
- Remarks regarding eligibility of registration for the next semester.

18.3Semester grade card shall not indicate class or division or rank however a conversion from grade point index to percentage based on CGPI shall be indicated on the final grade card of the program.

19 Award of Degree:

Following rules prevail for the award of degree.

- A student has registered and passed all the prescribed courses under the general institutional and departmental requirements.
- A student has obtained CGPI $\geq$ 4.75.
- A student has paid all the institute dues and satisfied all the requirements

prescribed.

- A student has no case of indiscipline pending against him/her.
- Academic Council shall recommend the award of degree to a student who is declared to be eligible and qualified for above norms.

20.0 Grace Marks

- Maximum total grace marks will be 1 % of the total theory credit courses x 100 subjected
- To maximum 6 marks in that semester.
- Grace marks will be given candidate for change in grades for theory credit courses, i.e. from
- Fail to pass grade only and will be reflected in final ESE marks.
- The grace marks are applicable only for maximum 1/3rd courses (rounded to higher Integer part i.e. if there are 4 theory courses then 4/3 = 1.33 = 2 courses).
- Maximum grace marks will be distributed in maximum courses
- Benefit of grace marks is not applicable for any medal/award.
- Applicable to theory and (Theory + Practical Courses). If is not applicable for Practical courses.
- Scheme for grace marks only can be used when the student will pass in all courses of That semester.

21.0 CGPA Improvement Policy for Award of Degree:

An opportunity shall be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.75 to improve his/her grade by allowing him/her to appear for ESE examinations of maximum two theory courses of seventh semester. Such examinations shall be scheduled along with re-examinations/make-up examinations. However, CGPA shall be limited to 4.75 even though the performance of a student as calculated through modified CGPA becomes greater than 4.75.

Conclusions:

The academic policies regarding conduct of programs in Sanjay Ghodawat University Kolhapur are published in this document. The Academic Council shall reserve the right to modify these policies as and when required from the point of view of achieving academic excellence. In special and abnormal cases (i.e. the cases not covered through above rules) the decision of the (Chairman, Academic Council shall be final and shall be binding on all concerned.

Chairman

Academic Council

Sem. V									
Course Code	Course Title	L	T	P	C	Evaluation Scheme			
						Component	Exam	WT(%)	Min.Pass %
AET301 (PC9)	Aerodynamics-II	3	-	-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AET303 (PC10)	Aircraft Structures- I	3	-	-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AET305 (PC11)	Aircraft Materials	3	-	-	3	Theory	FET	20	40
							CAT I	15	40
							CAT II	15	
							ESE	50	40
AET307 (PE1)	Program Elective I	3	-	-	3	Theory	FET	20	40
							CAT I	15	40
							CAT II	15	
							ESE	50	40
AET313 (PC12)	Aircraft Structures- I-Lab	-	-	2	1	Practical	FET	50	40
							ESE	50	40
AET315 (PC13)	Aircraft Material Lab	-	-	2	1	Practical	FET	50	40
							ESE	50	40
AET319 (PE2)	Program Elective I-Lab		--	2	1	Practical	FET	100	40
AET321 (UE1)	Foreign Language/Scholastic Aptitude	3	-	-	NC	Theory	FET	100	40
AET323 (PC14)	Software Proficiency Program-I			4	2	Practical	FET	100	40
Total		**15**	**00**	**10**	**17**	**Total Hrs: 25, Total Credits: 17**			

	Aircraft Design and Analysis (Vertical 1)	Aircraft Operations and Maintenance (Vertical 2)
Elective -I	Composite Materials and Structures	Aircraft general Engineering and Maintenance
	UAV Design	Aircraft Electrical Systems Maintenance

Course: Aerodynamics- II **Code: AET301**
Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Explain**[2] the Properties of Compressible flow
CO2	**Analyze**[4] different shock waves
CO3	**Analysis**[4] on compressible flow over different devices
CO4	**Explain**[2] significance of linear flow
CO5	**Analysis**[4] of supersonic flow using linear theory

Unit No. **Contents** **Lecture Hrs**

Unit 01 **Aspects of Compressible Flow**

A Brief Review of Thermodynamics: Perfect Gas, Internal Energy and Enthalpy, First Law of Thermodynamics, Entropy and the Second Law of Thermodynamics, Isentropic Relations. Compressibility, Governing Equations for Inviscid, Compressible Flow, Stagnation Conditions, Some Aspects of Supersonic Flow: Shock Waves — 7

Unit 02 **Normal Shock Waves**

The Basic Normal Shock Equations, Speed of Sound, Special Forms of the Energy Equation, Calculation of Normal Shock-Wave Properties, Measurement of Velocity in a Compressible Flow- Subsonic Compressible Flow, Supersonic Flow. — 7

Unit 03 **Oblique Shock and Expansion Waves**

Oblique Shock Relations**,** Supersonic Flow over Wedges and Cones**,** Shock Interactions and Reflections, Detached Shock Wave in Front of a Blunt Body, Prandtl-Meyer Expansion Waves, Shock-Expansion Theory: Applications to Supersonic Airfoils. — 7

Unit 04	**Compressible Flow through Nozzles, Diffusers and Wind Tunnels** Governing Equations for Quasi-One-Dimensional Flow, Nozzle Flows, Diffusers, Supersonic Wind Tunnels.	7
Unit 05	**Linear Theory** Velocity Potential Equation, Linearized Velocity Potential Equation, Prandtl-Glauert Compressibility Correction, Improved Compressibility Corrections, Critical Mach number- Comment on the Location of Minimum Pressure (Maximum Velocity), Drag-Divergence Mach number: Sound Barrier, Area Rule, Supercritical Airfoil.	6
Unit 06	**Linearized Supersonic Flow** Derivation of the Linearized Supersonic Pressure Coefficient Formula, Application to Supersonic Airfoils, Viscous Flow: Supersonic Airfoil Drag.	6

Text Books

01 J D Anderson. Fundamental of Aerodynamics, McGraw hill Education, 5thedn, 2011.

02 Hughton and carpenter. Aerodynamics for Engineering Students, Butterworth-Heinemann – 5thedn.2003

03 E Radhakrishnan. Gas Dynamics. Prentice Hall India learning Pvt. Ltd. 5th Revised edn, 2014.

Course: Aircraft Structure-I **Code: AET303**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Solve**[3] the numerical problems on symmetrical and unsymmetrical bending of an open and closed, thin-walled beams
CO2	**Analyze**[4] the deflections of beam and the section properties for various geometries
CO3	**Calculate**[4] shear and torsion of beams
CO4	**Apply**[3] combined loading to find structural behaviour on different sections
CO5	**Evaluate**[5] the idealization of beam

Unit No. **Contents** **Lecture Hrs**

Unit 01 **Symmetrical and unsymmetrical Bending of open and closed, thin-walled beams**
Symmetrical bending- Neutral Plane and Neutral Axis and Direct Stress Distribution.
Unsymmetrical bending- Sign convention and notation, Direct stress distribution due to bending, Position of the neutral axis, Load Intensity, shear force and bending moment, relationships, general case. 7

Unit 02 **Deflections due to bending and approximation of thin walled section**
Determination of beam deflection due to bending for cantilever and simply supported beam using singularity function.
Calculation of section properties- Parallel axes theorem, Theorem of perpendicular axes, Second moments of area of standard sections, Product second moment of area, Approximations for thin-walled sections. 7

Unit 03 **Shear of beams**
General stress, strain and displacement relationships for open and 7

	single cell closed section thin-walled beam, Shear of open section beams, Shear of closed section beams.	
Unit 04	**Torsion of beams** Torsion of closed section beams- Displacements associated with the Bredt–Batho shear flow, Condition for zero warping at a section, Torsion of open section beams	7
Unit 05	**Combined open and closed section beams** Bending, Shear and Torsion of combined open and closed section beam.	6
Unit 06	**Structural idealization** Idealization of a panel, Effect of idealization on the analysis of open and closed section beams, Deflection of open and closed section beams	6

Text Books

01 Megson, T.M.G. Aircraft Structures for Engineering Students, Edward Arnold, 1989
02 Peery, D. J. and Azar, J.J. Aircraft Structures, McGraw-Hill, New York, 2nd Edition, 1993.
03 Stephen P. Timoshenko & S. Woinowsky Krieger. Theory of Plates and Shells, McGraw-Hill, Singapore, 2nd edn, 1990.

Course: Aircraft Materials **Code: AET305**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Explain**[2] properties of different materials and alloys
CO2	**Explain**[2] different manufacturing processes of aircraft materials
CO3	**Select**[3] appropriate materials for different aircraft components
CO4	**Explain**[2] the physical properties of plastics used in aircraft construction
CO5	**Analyze**[4] different constituents required to fabricate advanced composite materials by selecting approriate fabrication methods

Unit No.	Contents	Lecture Hrs
Unit 01	**Aircraft Steels** Carbon Steels, Nickel Steels, Nickel-chromium Steels, Molybdenum Steels, Chrome-vanadium Steels, Special Steels, Theory of Heat Treatment, Practical Heat Treatment	6
Unit 02	**Wrought Aluminum Alloys** Nomenclature, Classification of Wrought Alloys, Corrosion, Alclad Aluminum Alloy, Extrusions, Forgings, Spot-welding Aluminum Alloys, Heat Treatment of Aluminum-Alloy, Aluminum-Alloy Castings	7
Unit 03	**Magnesium and Titanium Alloys** Magnesium Alloys Physical Properties, Magnesium-alloy Castings, Wrought Magnesium Alloys, Titanium Alloys Physical Properties, Forging, Hydrogen Embrittlement, Descaling and Pickling, Casting and Machining	7
Unit 04	**Plastics** Classification, Manufacturing Processes – Molding, Casting, Extruding, Laminating. Physical Properties, Working Properties,	7

	Uses, Transparent materials, Rubber and synthetic rubber	
Unit 05	**Composite materials** Classification of Composite materials - based on structure and based on matrix. Advantages of composites, application of composites, Functional requirements of reinforcement and matrix. FIBERS: Preparation, properties and applications of glass fibers, carbon fibers, Kevlar fibers and metal fibers Properties and applications of whiskers, particle reinforcements.	7
Unit 06	**Manufacturing of Advanced Composites** Polymer matrix composites: Preparation of Moulding compounds and prepregs, Hand layup method, Autoclave method, Filament winding method, Compression moulding, Reaction injection moulding. Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostaticpressing.	6

Text Books

01 George F. titter Ton. Aircraft materials and processes, 5th edn, Himalayan books
02 Jones R.M. Mechanics of composite materials, McGraw-hill, Kogakusha Ltd., Tokyo
03 Van Vlack.L.H., Materials Science for Engineers, Addison Wesley, 1985.

Course: Composite Materials and Structure (Elective–I) **Code: AET307A**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Explain**[2] the Micro and Macro mechanics aspects of composite materials
CO2	**Analyze**[4] the stresses and strains in a laminate using laminated plate theory
CO3	**Analyze**[4] the elastic properties and predict the failure layer of fiber reinforced composites
CO4	**Explain**[2] the theory of coating used in composite material
CO5	**Explain**[2] various concepts of sandwich construction and bending and shear flow in beam

Unit No.	Contents	Lecture Hrs
Unit 01	**Micromechanics** 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	7
Unit 02	**Macro mechanics** Generalized Hooke's Law – Elastic constants for anisotropic, orthotropic and isotropic materials – macro mechanics – stress-strain relations with respect to natural axis, arbitrary axis, and determination of in plane strengths of a lamina – experimental characterization of lamina. Failure theories of a lamina.	7
Unit 03	**Laminated Plate Theory** Governing differential equation for a laminate. Stress – strain relations for a laminate. Different types of laminates in plane and flexural constants of a laminate.	7
Unit 04	**Stresses and strain in laminate** Hygrothermal stresses and strains in a laminate. Failure analysis of	7

a laminate. Impact resistance and interlaminar stresses. Netting analysis

Unit 05	**Theory of Coating** Relation between stresses in coating and specimen, use of failure theories in brittle coating, moiré method of strain analysis	6
Unit 06	**Sandwich Constructions** Basic design concepts of sandwich construction – materials used for sandwich construction – failure modes of sandwich panels – bending stress and shear flow in composite beams.	6

Text Books

01 Madhuji Mukhapadhyay. Mechanics of Composite Materials, University Press, 2004.

02 Autar K Kaw.Mechanics of Composite Materials, CRC Press, 1997.

03 Agarwal, B.D., and Broutman, L.J. Analysis and Performance of Fibre Composites. John Wiley and Sons. Inc., New York, 1995.

04 Lubin, G.Handbook on Advanced Plastics and Fibre Glass, Von Nostrand Reinhold Co., New York, 1989.

Course:Unmanned Aerial Vehicle Design **Code: AET307B**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Explain**[2] UAVs and their classification
CO2	**Apply**[3] design parameters for UAVs design
CO3	**Apply**[3] design algorithm for configuring UAV layout
CO4	**Analyze**[4] weight estimation and wing sizing for different UAV
CO5	**Analyze**[4] performance and stability of UAVs

Unit No. **Contents** **Lecture Hrs**

Unit 01 **Basics of fixed-wing UAVs**
Introduction to fixed-wing UAVs and their classification, measurement of flight velocity and standard atmosphere, anatomy of airplane and airfoil nomenclature — 7

Unit 02 **Design Parameters of UAVs**
Basic design parameters, generation of lift and drag, lifting line theory, design algorithm: case study design algorithm: mission requirements — 7

Unit 03 **Design Algorithm of UAVs**
Feasible design parameters configuration layout: interpreting airfoil data, Cl vs AOA and drag polar, airfoil selection, configuration layout: planform geometry selection — 7

Unit 04 **Weight Estimation and Wing Sizing**
Weight and CG Estimation, wing sizing, Analytical parameter estimation analytical parameter estimation, battery charging, electrical propulsion, common propulsion systems — 7

Unit 05	**Performance Analysis** Introduction to airfoil performance, equation of motion, thrust required and power required, calculation of performance parameters and selection of power plant, climb performance, engine sizing, power plant selection,	6
Unit 06	**Stability Analysis** Effect of variation of CG location and static stability (Longitudinal static stability), Contribution of tail in static stability and neutral point, Simulation and Detailed Sizing	6

Text Books

01 Daniel P. Raymer. Aircraft Design: A Conceptual Approach
02 Reg Austin. Unmanned Aircraft Systems: UAVs Design Development and Deployment
03 Andrew J. Keane and James P. Scanlan. Small Unmanned Fixed-wing Aircraft Design: A Practical Approach

Course: Aircraft General Engineering and Maintenance(Elective –I) Code: AET307C

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT–I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Explain**[2] the different safety and ground handling Procedure of aircraft
CO2	**Explain**[2] ground movement of aircraft
CO3	**Calculate**[3] the weight and balance of different Aircraft
CO4	**Select**[4] the appropriate inspection methods for different aircraft based on DGCA standards
CO5	**Select**[4] the different Hand tools and special Tools for various maintenance activities

Unit No.	Contents	Lecture Hrs
Unit 01	**Maintenance of Safety** Shop Safety, Flight Line Safety, Fire Protection	7
Unit 02	**Aircraft ground handling and support equipment** Tie Down Procedure, Securing Light Aircraft, Securing Heavy Aircraft, Tie down Procedure for sea planes, Tie down procedure for ski planes, Tie down procedure for Helicopter, Procedure for securing weight shift control aircraft, Towing of Aircraft, Taxiing Aircraft, Taxi Signal, Servicing Aircraft Air Oil and Fluid	7
Unit 03	**Ground Movement of Aircraft** Engine Starting and operations, Reciprocating Engines, Hand cranking Engines, Extinguishing Engine Fire, Turbo prop Starting Procedure, Turbo fan starting Procedures, Auxiliary Power Units, Unsatisfactory turbine engine Starts, Hot start, Hung Start, Engine Will not Start, Ground Support Equipments, Fuel Servicing Aircraft	7
Unit 04	**Aircraft Weight and Balance** Need and requirements for Aircraft weighing, Weight and Balance Terminology, Procedure for weighing Aircraft, loading an Aircraft For weight, Weight and Balance extreme conditions, Equipment Change and Aircraft Alteration, use of Ballast, Helicopter weight	7

	and Balance, Weight and Balance for large airplanes	
Unit 05	**Inspection fundamentals** Basic Inspection techniques, preparation, Aircraft Logs, Checklists, Publications, Routine/Required Maintenance, ATA iSpec 2200, Special Inspection, Special Flight Permits, Non Destructive Testing, inspection of Composites	6
Unit 06	**Hand Tools and Measuring Devices** General Purpose Tools, Metal Cutting Tools, Taps and Dies, Layout and Measuring Tools, special tools	6

Text Books

01 FAA, Aviation Maintenance Technician Hand Book,FAA-H-8083-30

02 A&P Mechanic, Aircraft Hand Book, FAA Himalayan Book House Delhi 1996

Course: Aircraft Electrical System Maintenance **Code: AET307D**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Discuss**[2] the basics of Electrical Theory
CO2	**Explain**[2] different Aircraft elements and their maintenance
CO3	**Apply**[3] the electrical concepts in aviation industry
CO4	**Describe**[2] principles, operation and troubleshooting of aircraft systems
CO5	**Analyze**[4] power distribution systems in aircraft

Unit No. **Contents** **Lecture Hrs**

Unit 01 **Electrical Theory**

Ohms law, Kirchoff's laws and Electromagnetic Induction; their applicability in the aircraft industry. Alternating Current and calculation of Instantaneous value, RMS value, frequency and amplitude from the given data; star and delta connections and calculation of power in three phase system. Series and parallel resonance of AC circuits and their use; calculation of resonant frequency of a circuit from a given information; effect of change in the frequency on the impedance, current and phase angle. Composition, performance (stability and tolerance) and limitations of the fixed resistors (carbon composition, carbon film, wire wound and metallic film) and description of various types of variable resistors — 7

Unit 02 **Aircraft Batteries**

Construction and principle of operation of Lead acid and Nickel Cadmium batteries, composition of electrolytes and plates. Effect of temperature on capacity, specific gravity, electrolyte resistivity, charger and discharger rates; effect of specific gravity on freezing temperature and resistivity of electrolytes. — 7

	Methods of charging of batteries; precautions and procedures during charging; mixing and neutralization of electrolytes; importance of ventilation of battery compartments. Knowledge of the inspections to determine conditions and serviceability of batteries; common battery defects and their rectification	
Unit 03	**Generators and Motors** Construction, principle of operation and characteristics of DC and AC Generators and Motors. Knowledge of the construction, principles of operation of voltage regulators; and paralleling of generators. Detailed knowledge of the functional tests, adjustments and trouble shooting of generators and motors. Speed control and reversing the direction of motors.	7
Unit 04	**Servomechanisms and Amplifiers** Construction and principles of auto transformers, single and three phase transformers. Construction and principles of operation of saturable reactors and magnetic amplifiers; bias; phase sensitive half wave and inputs and outputs, polarity sensitive inputs and outputs, pushpull outputs and effects of stage gains and cascading on time response Construction, principle and operation of servo motors and rate generators; system response to displacement (position) and rate (velocity) command signals; purpose of pullup and rate feedback signals; causes of hunting and methods of damping; troubleshooting of servomechanism	7
Unit 05	**Aircraft System** Principle of operation, inspection and trouble shooting of aircraft galley equipments, aircraft lights, and electrical components and indicating circuits for Landing Gear, Flap System and Air-conditioning system etc. Operation and inspection of Aircraft Fire and Smoke Detection and Protection System.	6
Unit 06	**Power Distribution** Electrical power distribution systems, the operation and construction of static inverters, rotary inverters and transformer rectifier units.	6

Text Books

01 E. H. J. Pallet “Aircraft electrical systems. 3rdedn, Longman Scientific & Technical, 1987.
02 Thomas K Eismin. Aircraft Electricity and Electronics”, Sixth Edition, McGraw Hill Professional, 2013
03 David Wyatt, Mike Tooley. Aircraft Electrical and Electronic Systems” Second Edition Taylor & Francis Group, 2018

Course: Aircraft Structure-I Lab **Code: AET313**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks - 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Calculate**[3] stress and strain in various beams and column sections
CO2	**Evaluate**[5] the concept of various theorems
CO3	**Determine**[3] the structural behaviour of beams due to combined bending and torsion
CO4	**Calculate**[3] shear centre for various sections used in aircraft structure
CO5	**Apply**[3] the NDT techniques in various aircraft structural components

List of Experiments

1. Measurement of strain using strain gauges
2. Conduct Bending tests to determine to find Stress and deflections of beams for various end conditions.
3. Verification of Maxwell's theorem
4. Verification of Castiglianos theorems, Influence coefficients.
5. Compression tests on long and short columns, Critical buckling loads, South well plot.
6. Combined bending and Torsion of a Hollow Circular Tube
7. Unsymmetrical Bending of a Cantilever Beam
8. Determination of Shear Centre location for open sections
9. Determination of Shear Centre location for closed sections
10. Determination of Stresses in the Pressure Vessels
11. To inspect the structural defects using non – destructive testing

Course: Aircraft Material Lab **Code: AET315**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Examine**[3] microstructure of metals
CO2	**Analyze**[4] the material characteristics and its behavior under given test condition.
CO3	**Determine**[3] the hardness of given sample with different methods
CO4	**Analyze**[4] the hardness of a given material at different temperatures
CO5	**Analyze**[4] fatigue and corrosion characrterization of composite materials

List of Experiments

1. To determine Brinell's Hardness number
2. To determine Rockwell Hardness Test
3. To conduct Impact Tests
4. Microstructure Examination of Metals
5. To analyse the hardening behaviour of the material by Jominy End Quench Test
6. To Fabricate Laminated Composites
7. To characterize the given Composite Materials
8. Conduct test for Fatigue and Corrosion Characterization of Composite Materials
9. Case Study on Ferrous Alloys &Non-Ferrous Alloys in Aircraft Industry

Course: Composite Materials and Structures Lab **Code: AET319A**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Select**[3] appropriate constituents to form CFRP/GFRP laminate
CO2	**Prepare**[3] FRP laminate by hand layup method
CO3	**Conduct**[3] tests on composite materials with different loading Conditions
CO4	**Analyze**[4] properties of Composite material
CO5	**Analyze**[4] Fatigue testing under different conditions

List of Experiments

1. Demonstration of FRP Composites with application
2. Preparation of FRP/CFRP composite samples
3. To conduct tensile testing of CFRP/GFRP
4. To conduct compression testing of CFRP/GFRP
5. To conduct flexural testing of CFRP/GFRP
6. Preparation of FRP Laminate by Hand layup method
7. Perform fatigue tensile testing of CFRP/GFRP
8. Perform fatigue compression testing of CFRP/GFRP
9. Perform fatigue Flexural testing of CFRP/GFRP

Course: UAV Design Lab **Code: AET319B**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Design**[3] UAV using fundamental calculations
CO2	**Develop**[5] Fixed wing and Rotary wing UAV
CO3	**Perform**[3] autopilot integration and calibration of UAV
CO4	**Perform**[3] testing of UAV
CO5	**Compare**[3] real time and simulator for operation of UAVs

List of Experiments

1. Demonstration of Component of airplanes with their functions and also electronics required
2. Design and Construction of wing
3. Design and Construction of tail plane
4. Design and Construction of fuselage
5. Assembly of airplane and Engine and controls mounting.
6. Practice on Simulator and flying.
7. Design method of Quad copter
8. Selection of motors and other electronics.
9. Assemble of parts of UAV
10. Demonstration of Autopilot integration, calibration and testing.
11. Hands on practice on flight simulator
12. Hands on practice on Flying of quad copter

Course :Aircraft General Engineering and Maintenance Lab **Code: AET319C**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Perform**[3] the Various Maintenance Checks
CO2	**Investigate**[3] Maintenance and Inspection of Assembled Aircraft
CO3	**Perform**[3] the various test in aircraft before departure for safe operation
CO4	**Perform**[3] preflight inspection of aircraft to confirm flight condition
CO5	**Perform**[3] starting procedure of aircraft engine and other components

List of Experiments

1. Perform Aircraft Jacking Up procedure
2. Perform Aircraft Leveling procedure
3. Inspect Control System Rigging check procedure
4. Inspect Aircraft Symmetry Check procedure
5. Flow test to assess of filter element clogging
6. Conduct pressure Test to assess hydraulic External/Internal Leakage
7. Conduct functional Test to adjust operating pressure
8. Conduct pressure Test procedure on fuel system components
9. Pre flight inspection of aircraft to confirm flight condition
10. Perform starting Procedure of Aircraft

Course Aircraft Electrical System Maintenance Lab **Code: AET319D**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Inspect**[3] the different aircraft electrical system
CO2	**Test**[3] various elctrical systems for their proper functioning
CO3	**Analyze**[4] & Troubleshoot DC Generators systems
CO4	**Perform**[3] the experiment on communication and navigation systems on Aircraft
CO5	**Perform**[3] the experiment on Fire Warning/ overheat detection and Extinguishing systems

List of Experiments

1. Demonstration of Alarus CH 2000 Electrical systems
2. Testing Cessna DC Alternator Charging system
3. Testing Light Twin Electrical systems
4. To check Air Transport Indication Electrical systems
5. Inspect Aircraft Indication and Warning systems
6. Inspect and identify Aircraft Antenna
7. To Analyze & Troubleshoot DC Generators system
8. To check Communications and Navigation sysyems in cockpit
9. To demonstrate Fire Warning/ overheat detection and Extinguishing systems

Sem. VI									
Course Code	Course Title	L	T	P	C	Evaluation Scheme			
						Component	Exam	WT(%)	Min.Pass %
AET302 (PC15)	Aircraft Structure - II	3	-	-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AET304 (PC16)	Flight Mechanics	3	-	-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AET306 (PC17)	Aircraft Design	3	-	-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AET308 (PE3)	Program Elective II	3	-	-	3	Theory	FET	20	40
							CAT I	15	
							CAT II	15	
							ESE	50	40
AET314 (PC18)	Flight Mechanics Lab		-	2	1	Practical	FET	50	40
							ESE	50	40
AET316 (PC19)	Aircraft Design Lab		-	2	1	Practical	FET	50	40
							ESE	50	40
AET318 (PE4)	Program Elective Lab II		-	2	1	Practical	FET	50	40
							ESE	50	40
AET320 (PC20)	Mini Project (Hard/Soft)		--	2	1	Practical	FET	100	40
AET322 (PC21)	Internship Training (Assessment)		-	-	1	Practical	FET	100	40
AET324 (PC22)	Software Proficiency Program-II			4	2	Practical	FET	100	40
AET326 (UE2)	Foreign Language/Scholastic Aptitude	3	-	-	NC	Theory	FET	100	40
Total		**15**	**00**	**12**	**19**	**Total Hrs: 27, Total Credits: 19**			

Course: Aircraft Structure-II **Code: AET302**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Apply**[3] various concepts of mechanics of materials to solve real time structural problems
CO2	**Analyze**[4] the various loads that acts in aircraft components
CO3	**Analyze**[4] plate deflection and bending under various loading conditions
CO4	**Apply**[3] various failure theories to solve aircraft structural problems
CO5	**Explain**[2] various aircraft structural repair and practices

Unit No. **Contents** **Lecture Hrs**

Unit 01 **Review of Concepts** 7
Introduction, Review of Hooke's Law, Principal stresses, Equilibrium and Compatibility, Determinate structures, St. Venant's principle, Conservation of energy, Stress transformation, Stress strain relations.

Unit 02 **Aircraft Structures and Loads** 7
Sectional properties of structural members and their loads, Types of structural joints, Type of Loads on structural joints, Aerodynamic loads, Inertial loads, Loads due to engine, Actuator loads, Maneuver Loads, V-n diagrams Applications, Gust loads, Ground loads, Ground conditions, Miscellaneous loads.

Unit 03 **Structural Analysis of Aircraft Structures** 7
Theory of Plates - Analysis of plates for bending, stresses due to bending, Plate deflection under different end conditions, Strain energy due to bending of circular, rectangular plates, Plate buckling, Compression buckling, shear buckling, Buckling due to in plane bending moments, Analysis of stiffened panels in buckling, Rectangular plate buckling, Analysis of stiffened panels in post buckling, Post buckling under shear
Theory of Shells-Analysis of shell panels for buckling, Compression loading, Shear loading / Shell shear factor,

	Circumferential buckling Stress.	
Unit 04	**Statically indeterminate Structure** Propped Cantilever-Fixed Fixed Beams-Clapeyrons Three moment Equation-Moment Distribution Method.	7
Unit 05	**Failure Theory** Maximum Stress Theory-Maximum Strain Theory-Maximum Shear Stress Theory-Distortion Theory-Maximum Strain Energy Theory-Applications to aircraft structural problems.	6
Unit 06	**Aircraft Structural Repair** Types of structural damage, Non-conformance, Rework, Repair, Allowable damage Limit, Repairable damage limit, Overview of ADL Analysis, Types of repair, repair considerations and best practices	6

Text Books

01 The Elements of Aircraft Preliminary Design – Roger D. Schaufele, Aries Publications, 2000

02 Aircraft Structural Maintenance by Dale Hurst, Avotek publishers, 2nd Edition, 2006

Course: Flight Mechanics **Code: AET304**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Apply**[3] the cruising flight performance characteristic to solve at different flight conditions
CO2	**Apply**[3] the maneuvering flight performance characteristic to solve at different flight conditions
CO3	**Explain**[2] the aerodynamics characteristics at different altitudes and its importance
CO4	**Solve**[3] various Stability numerical problems and its derivatives of aircraft
CO5	**Analyze**[4] different axes of aircraft for its stability during maneuvering

Unit No. **Contents** **Lecture Hrs**

Unit 01 **CRUISING FLIGHT PERFORMANCE** 7

Forces and moments acting on a flight vehicle - 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 - Variation of thrust, power with velocity and altitudes for air breathing engines

Unit 02 **MANOEUVERING FLIGHT PERFORMANCE** 7

Range and endurance - Climbing and gliding flight (Maximum rate of climb and steepest angle of climb, minimum rate of sink and shallowest angle of glide) -Turning performance (Turning rate turn radius). Bank angle and load factor – limitations on turn - V-n diagram and load factor

Unit 03 **AERODYNAMIC CHARACTERISTICS and IMPORTANCE OF STABILITY, STABILITY DERIVATIVES** 7

Airfoils, wings and bodies: geometry, nomenclature. Aerodynamic characteristics. Effect of geometry, Reynolds Number, Mach Number. Measures of aerodynamic performance. Performance augmentation methods.

Degree of freedom of a system - Static and dynamic stability - Need for stability in airplanes - Purpose of controls -Inherently and marginally stable airplanes

Unit 04	**STATIC LONGITUDINAL STABILITY** Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion - Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points-Symmetric maneuvers - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing.	7
Unit 05	**LATERAL AND DIRECTIONAL STABILITY** 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.	6
Unit 06	**DYNAMIC STABILITY** Introduction to dynamic longitudinal stability: - Modes of stability, effect of freeing the stick - Brief description of lateral and directional. Dynamic stability - Spiral, divergence, Dutch roll, auto rotation and spin.	6

Text Books

01 Nelson, R.C. Flight Stability and Automatic Control, McGraw-Hill Book Co., 2004
02 McCornick. W., Aerodynamics, Aeronautics and Flight Mechanics, John Wiley, NY, 1979
03 Mc.Cormic, B.W., Aerodynamics, Aeronautics and Flight Mechanics, John Wiley 1995

Course: Aircraft Design **Code: AET306**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Explain**[2] various methodologies of aircraft design, configuration and layout of aircrafts.
CO2	**Analyze**[4] the different Parameters to Design Aircraft
CO3	**Analyze**[4] the sizing and constraint of aircraft engine in terms of estimation of design gross weight
CO4	**Explain**[2] the concepts of Operational and Environmental Issues
CO5	**Analyze**[4] advanced supersonic aircraft design concepts

Unit No.	Contents	Lecture Hrs
Unit 01	**Aircraft Design** Three phases in aircraft design, Review of computer based aircraft design methodologies, differences between LTA and HTA aircraft, type of civil and military aircraft	7
Unit 02	**Configuration and Layout** Types and comparison of wing, tail, fuselage, landing gear, wing-tail combinations, power plant (types, numbers, locations), unconventional aircraft configurations.	7
Unit 03	**Sizing and Constraint Analysis** Initial sizing, estimation of design gross weight, rubber engine sizing and fixed engine sizing, refined sizing method and constraint analysis.	7
Unit 04	**Estimation Methodologies** Lift and drag coefficient, design loads, component mass breakdown, acquisition cost, direct operating cost.	7
Unit 05	**Operational and Environmental Issues** Range-payload diagram, Theory of V-n diagram, noise and emission levels, special considerations such as stealth,	6

	survivability, maintainability.	
Unit 06	**Advanced Concepts in Aircraft Design** Supersonic aircraft design, very large aircraft, morphing aircraft.	6

Text Books

01 Raymer, D. P., Aircraft Design - A Conceptual Approach, AIAA Educational Series, 4th Ed., 2006
02 Brandt, S. A., Stiles, R. J., Bertin, J. J., Whitford, R., Introduction to Aeronautics: A Design Perspective, AIAA Educational Series, 2nd ed., 2004.
03 Jenkinson, L. R., Simpkin, P. and Rhodes, D., Civil Jet Aircraft Design, Arnold Publishers, London, 1999
04 Fielding, J., Introduction to Aircraft Design, Cambridge Aerospace Series, Cambridge University Press, 1999.

Course: Finite Elements Method **Code AET308A**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Explain**[2] the basic principles and procedure of FEM
CO2	**Formulate**[3] simple engineering problems using FEM
CO3	**Analyze**[4] the complex engineering problems using FEM
CO4	**Evaluate**[5] axis symmetric problems related to higher order elements
CO5	**Analyze**[4] dynamic problem in different sections

Unit No.	Contents	Lecture Hrs
Unit 01	**FEM Basics:** Need for sue of FEM – Advantages and Disadvantages of FEM Matrix algebra – Terminologies relating to matrices, methods of solution of linear algebraic equations. Eigen values and Eigen vectors, Simple numeric Gaussian Quadrature – 1 pt. 2pt and 3pt formula.	7
Unit 02	**Continuum Methods** Variational methods Rayleigh-Ritz methods applied to simple problems on axially loaded members cantilever. Simply supported and fixed beam with point loads and UDL Galerkin method as applied to simple elasticity problem.	7
Unit 03	**FEM-Basic Definitions** DisplacementmethodNodaldegreesoffreedomdifferentcoordinatesystems shape functions. Lagrangian polynomial; complete Formulation of bar-truss- beam-triangular-quadrilateral Tetrahedral hexahedral elements.	7
Unit 04	**Boundary Conditions** SPC and MPC. Methods of handling boundary conditions eliminating method-penalty method. Simple numericals, ISO parametric sub parametric super parametric elements Convergence criteria – requirements of convergence of a displacement model.	7

Unit 05	**Higher Order Elements** Bar–triangular quadrilateral elements. Tetrahedral and hexahedral elements (non-Formulation)–Pascal triangle – Pascal pyramid. Introduction to axis symmetric problems-formulation of axis symmetric triangular element.	6
Unit 06	**Dynamic Analysis** Formulating-element mass matrics for 1D and 2D element, computation of eigen value and vector for simple one Dimensional analysis	

Text Books

01 Introduction to Finite Elements in Engineering" by T R Chandrupatla and A D Belegundu, Pearson

02 Introduction to the Finite Element Method by J N Reddy,McGraw-Hill Education.

03 Daryl L.Logon, A First course in Finite Element Methods, Thomson Learning 3rd Edi. 2001

04 Hutton, Fundamentals of Finite Element Method, Mc Graw Hill, 2004.

05 Robert Cook, Concepts & Applications of FEA, etal – Jonhwilley& sons 2002

Course: Vibrations and Aero Elasticity **Code: AET308B**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Analyze**[3] single degree & multi degree of freedom systems.
CO2	**Apply**[3] the methods to calculate force and deflection of the structure
CO3	**Apply**[3] the approximation methods for various system
CO4	**Evaluate**[5] frequencies and dynamic response of continuous systems
CO5	**Explain**[2] the role of aero elasticity in aircraft

Unit No. **Contents** **Lecture Hrs**

Unit 01 **BASIC CONCEPTS** 7
Simple Harmonic Motion, Terminology, Degrees of freedom, Newton's Law, D'Alembert's principle, Energy Methods, Rayleigh's and Equilibrium Method.

Unit 02 **SINGLE DEGREE OF FREEDOM SYSTEMS** 7
Free vibrations, Damped vibrations, Forced vibrations, with and without damping, Support excitation, Vibration measuring instruments

Unit 03 **MULTI DEGREES OF FREEDOM SYSTEMS** 7
Two degrees of freedom systems ,Static and dynamic couplings Vibration absorber, Principal coordinates, Principal modes and orthogonal condition ,Eigen value problems, Hamilton's principle, Lagrangian equation and application ,Vibration of elastic bodies, Vibration of strings, Longitudinal, Lateral and Torsional vibrations.

Unit 04 **FORCE DEFLECTION PROPERTIES OF STRUCTURES** 7
Constraints and generalized coordinates, Virtual work and generalized forces, Force, deflection influence functions, stiffness and flexibility methods.

Unit 05 **APPROXIMATE METHODS** 6

	Approximate methods of evaluating the Eigen frequencies and the dynamics response of continuous systems, Matrix methods of dynamic stress analysis, Rayleigh's and Holzer Methods and Matrix Iteration to find natural frequencies	
Unit 06	**ELEMENTS OF AEROELASTICITY** Concepts, Coupling, Aero elastic instabilities and their prevention, Basic ideas on wing divergence, Loss and reversal of aileron control, Flutter and its prevention.	6

Text Books

01 R.W. Clough and Penzien, Dynamics of Structures, McGraw Hill 2nd Edition.
02 Singiresu. S. Rao, Mechanical Vibrations, Pearson Education LPE.
03 Fung Y.C., An Introduction to the Theory of Aero elasticity, John Wiley and Sons, New York
04 Bisplinghoff R. L., Ashley H and Hoffman R.L., Aero elasticity, Addision Wesley Publication, New York.
05 Tse. F.S., Morse, I.F., Hinkle, R.T., Mechanical Vibrations, Prentice Hall,New York
06 Scanlan R.H. and Rosenbaum R., Introduction to the study of Aircraft Vibration and Flutter, John Wiley and Sons. New York

Course: Aero Engine Maintenance **Code: AET308C**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Explain**^{2} the Components and Maintenance of Piston Engine.
CO2	**Explain**^{2} the Jet Engine Components and their Maintenance
CO3	**Explain**^{2} the overhauling procedure of various Engines
CO4	**Apply**^{3} various inspection procedures for jet engine maintenance
CO5	**Explain**^{2} inspection and overhauling procedure of Gas turbine Engine

Unit No.	Contents	Lecture Hrs
Unit 01	**Classification of piston engine components** Types of piston engines – Principles of operation – Function of components – Materials used – Details of starting the engines – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plug details – Engine operating conditions at various altitudes – Maintenance and inspection check to be carried out.	7
Unit 02	**Inspections of piston engines** 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	7
Unit 03	**Overhauling of Piston Engines** Symptoms of failure – Fault diagnostics – Case studies of different engine systems – l:Tools and equipment 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 part and their repair. Engine	7

	testing: Engine testing procedures and schedule preparation – Online Maintenance.	
Unit 04	**Classification of jet engine components** Types of jet engines – Principles of operation – Functions of components – Materials used – Details of starting and operating procedures – Gas turbine engine inspection & checks – Use of instruments for online maintenance – Special inspection procedures : Foreign Object Damage – Blade damage	7
Unit 05	**Jet Engine Maintenance** Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures. Gas turbine testing procedures – test schedule preparation – Storage of Engines –Preservation and de-preservation procedures	6
Unit 06	**Overhaul Procedures** Engine Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components. Trouble Shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods	6

Text Books

01 Kroes and Wild, Aircraft Power plants, 7th Edition, McGraw Hill, New York, 1994

02 Turbomeca, Gas Turbine Engines, The English Book Store, New Delhi, 1993

03 United technologies pratt & whitney, The Aircraft Gas turbine Engine and its Operation", (latest edition), The English Book Store, New Delhi

Course: Airframe Maintenance **Code AET308D**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	CAT -I	CAT- II	ESE
	3	-	-	3		20	15	15	50
						Minimum pass marks- 20			Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Differentiate**^{2} the joining techniques used in aircraft industry
CO2	**Explain**^{2} the sheet metal repair procedures in the aircraft maintenance process
CO3	**Compare**^{3} repair procedure in plastic and composite material component of aircraft
CO4	**Explain**^{2} the procedure of basic aircraft maintenance and safety Procedure
CO5	**Explain**^{2} safety practices in terms of hazardous materials

Unit No. **Contents** **Lecture Hrs**

Unit 01 **Welding Equipment and Techniques** 7
Fundamentals of Welding , Oxyacetylene Welding , Gas Welding Techniques, Electric-Arc Welding , Inert-Gas Welding, Aircraft Tubing Repair , Special Welding Repairs , Soldering and Brazing

Unit 02 **Sheet-Metal** 7
Design Philosophies , Factors Affecting Sheet-Metal Part and Joint Design
Hand Tools for Sheet-Metal Work , Fabrication of Sheet-Metal Parts
Sheet-Metal Inspection , Sheet-Metal Repair , Repair Practices

Unit 03 **Plastics and Composites** 7
Fundamentals of Plastic Materials, Working with Plastic Materials, Installation, Maintenance, and Repair of Plastic Materials, Introduction to Composites, Laminated Structures, Major Components of a Laminate, Strength Characteristics, Description of Sandwich Structures, Inspection and Repair of Composites

Unit 04 **Assembly and Rigging** 7
Aircraft Assembly, Aircraft Rigging , Fixed-Surface Alignment ,

	Aircraft Flight Controls, Secondary Flight-Control Surfaces, Control-System, Components, Control Surface Rigging, Balancing Control Surfaces, Inspection and Maintenance, Helicopter Flight Controls	
Unit 05	**Auxiliary Systems** Fire Protection Systems, Ice Protection Systems, Rain-Removal Systems, Water and Waste Systems, Position and Warning Systems, Auxiliary Power Units	6
Unit 06	**Hazardous Materials and Safety Practices** Hazardous Materials, OSHA's Hazardous Communications Standards, Disposal and Accidental Releases of Hazardous Materials, Troubleshooting Process	6

Text Books

01 Kroes, Watkins, Delp, Aircraft Maintenance and Repair, McGraw-Hill, New York, 1992

02 Larry Reithmeir, Aircraft Repair Manual, Palamar Books, Marquette, 1992

Course: Flight Mechanics Lab **Code: AET314**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Write**[3] MATLAB Codes for solve simple Flight Mechanics equation
CO2	**Use**[4] the MATLAB Simulink Toolbox to solve Navigation and Guidance Problems
CO3	**Analyze**[4] lift and drag coefficients at different angle of attack by considering Cessna 172 data
CO4	**Analyze**[4] atmospheric air properties and behavior at different altitudes
CO5	**Develop**[5] atmospheric model using MATLAB Codes

List of Experiments

1. Create a .M file to compute the temperature, pressure and density with respect to altitude less than 68km and plot the respective graphs by using MATLAB.
2. Develop the following MATLAB m- file by considering Cessna 172 data (sea-Level)
   a) C_L vs AoA b)C_L vs C_D
3. Solve the following fourth degree polynomial numerically by using MATLAB to Find Maximum airspeed for a Jet engine aircraft
4. Create a simulink model and an m-file to run a simulation of the motion of the aircraft. The result of the model should be the state vector X and output vector Y and the forces and moments as function of time show the structure of your model in a few graphs.
5. Create a simulink model and an m-file to run a simulation of the motion of the airship. The result of the model should be the state vector X and output vector Y is function of time. Assume that the centre of mass is placed on x-axis and the air density remains constant.
6. Conduct Wind Analysis using MATLAB
7. To check Flight Instruments using MATLAB
8. Perform Flight Simulator Interface using MATLAB
9. Flight Actuators using MATLAB

Course: Aircraft Design Lab **Code: AET316**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Select**[3] different design parameters for the complete aircraft
CO2	**Calculate**[3] aircraft performance using weight and drag estimation
CO3	**Develop**[4] aircraft model
CO4	**Evaluate**[5] designed aircraft model
CO5	**Analyze**[4] the Stability of designed aircraft

List of Experiments

1. Comparative studies of different types of airplanes and their specifications and performance details with reference to the design work under taken.
2. Calculate Preliminary weight estimation, Selection of design parameters, power plant selection, aerofoil selection, fixing the geometry of Wing, tail, control surfaces Landing gear selection.
3. Preparation of layout drawing,
4. Construction of balance and three view diagrams of the airplane under consideration.
5. To conduct experiment using windtunnel to determine drag coefficient
6. Conduct test on aircraft model with different parameters
7. Conduct Stability analysis of the developed aircraft
8. Conduct structural analyze of the aircraft model using Nastran patran
9. Analyze variation in lift and drag with different control surface size
10. Draw the Three View Diagram of designed aircraft

Course: Finite Elements Analysis Lab **Code: AET318A**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Analyze[4]** structural behavior on Bars with constant and tapered cross section area and Beams using Software
CO2	**Analyze[4]** deflection of SSB with point load and UDL
CO3	**Analyze[4]** deflection of cantilever beams with point load and UDL
CO4	**Perform[3]** thermal analysis using Software
CO5	**Perform[3]** Modal analysis of Bar and Beams

List of Experiments

1. Demonstration of ansys software
2. Calculate strain in Bars of Constant Cross-section Area
3. Calculate strain in Bars of Tapered Cross section Area
4. Determine deflection in Simply Supported Beam with point load
5. Determine deflection in Simply Supported Beam with Uniformly varying load
6. Determine deflection in Simply Supported Beam with Uniformly distributed load
7. Determine deflection in Cantilever Beam with Uniformly distributed load
8. Determine heat transfer coefficient using thermal analysis of Beams
9. Determination of natural frequency of Cantilever beam using Modal Analysis

Course: Vibrations and Aero Elasticity Lab **Code: AET318B**
Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Determine**[3] logarithmic decrement for damped system
CO2	**Conduct**[3] experiment on torsional vibration of two rotors
CO3	**Perform**[3] experiment on free and forced Vibrations with different types of exciters and vibration instruments
CO4	**Measure**[3] different parameters using vibration instruments
CO5	**Calculate**[3] natural frequencies of different dynamic systems

List of Experiments

1. Demonstration of equivalent spring mass system.
2. Experiment to determine forced vibration characteristics
3. Determination of logarithmic decrement for single DOF damped system
4. Determine natural frequency due to torsional vibration of two rotors without damping
5. Determine natural frequency due to free vibration of a coupled pendulum and double pendulum
6. Demonstrate different types of exciters for vibration analysis
7. Determine vibration parameters using vibration instruments
8. Determine natural frequency by Holzer method.
9. Determine natural frequency by Raleigh‟s or Matrix Iteration Method.

Course: Aero Engine and Maintenance Lab **Code: AET318C**
Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Perform**[3] the general maintenance activity on aircraft piston engine
CO2	**Perform**[3] the general maintenance activity on aircraft Jet engine
CO3	**Analyze**[4] the Propeller performance
CO4	**Analyze**[4] aircraft engine health monitoring system
CO5	**Demonstrate**[3] aircraft engine instruments

List of Experiments

1. Assemble and disassemble of aircraft piston engine, and the assembly of sub systems.
2. Demonstration of aircraft piston engines components, functions, operating principles.
3. Assemble subsystems of aircraft jet engine
4. Demonstration of Aircraft jet engines components, functions, operating principles.
5. To determine thrust developed by propeller.
6. Demonstrate the functioning of aircraft gas turbine engines.
7. Visualizing Aircraft Engine Health Monitoring System
8. Demonstration Aircraft Engine Instruments

Course: Airframe Maintenance Lab **Code: AET318D**

Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET	ESE
	-	-	2	1		50	50
						Minimum pass marks- 20	Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Perform**[3] the general maintenance activity on trainer aircraft using the maintenance manual.
CO2	**Apply**[3] the safety practices in maintenance and repair of aircraft
CO3	**Select**[2] the special tool to maintain the aircraft
CO4	**Perform**[3] aircraft break system inspection
CO5	**Conduct**[3] cockpit overview inspection

List of Experiments

1) Demonstration of Various Aircraft Manuals
2) Demonstration of Aircraft Cowling and components
3) Perform Inspection of aircraft fuel primer line
4) Remove and clean aircraft spark plug
5) Perform Fuel loading of Aircraft
6) Conduct Inspection and maintenance of carburetor
7) Conduct Inspection and repairing of aircraft lighting System
8) Demonstrate Systems of Aircraft
9) Inspect Aircraft Break system
10) Inspection Cockpit Overview

Course: Mini Project **Code: AET320**
Course Prerequisites: (If Any)

Teaching Scheme	L	T	P	C	Evaluation Scheme	FET
	-	-	2	1		50
						Minimum pass marks - 20

Course Outcomes: After the completion of this course, the student will able to,

CO1	**Identify**[3] problem through detailed literature survey
CO2	**Formulate**[3] identified problem
CO3	**Apply**[3] appropriate method to solve the identified problem
CO4	**Develop**[5] a model (working model / virtual model)
CO5	**Analyze**[4] the results obtained

Contents

Student can do project in industry / university

Project could be completed in 8 to 10 weeks using current technology under a industry supervisor or a faculty from department

Students have to come out with a model or prototype or product or process or simulation with detailed analysis and a type written report in a standard format

After joining the university, they have to present the same before the department committee for its final evaluation