B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2019
Curriculum and Syllabi

(Amendments updated upto June 2020)

M.Tech.
(Avionics)

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2019
CURRICULUM AND SYLLABI
(Amendments updated upto June 2020)

M.TECH.
AVIONICS

VISION AND MISSION OF THE INSTITUTION

VISION

B.S.Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

DEPARTMENT OF AEROSPACE ENGINEERING
VISION AND MISSION

VISION

Department of Aerospace Engineering aspires to be a premier hub in Aerospace Engineering Education, Training and Research and contribute to the development of Aerospace Technology.

MISSION

- To provide quality education and training in Aerospace Engineering to bring out motivated and capable aerospace engineers.
- To create stimulating environment and supportive infrastructure for knowledge development in Aerospace and related areas.
- To develop analytical skills and undertake collaborative research in Aerospace and related industries.
- To provide leadership qualities and team spirit through a balanced curriculum along with co-curricular, extra-curricular and professional society activities.

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M.Tech. (AVIONICS)

PROGRAMME EDUCATIONAL OBJECTIVES

I. **PEO 1:**To impart adequate knowledge in practical and theoretical domains in the field of Avionics Engineering through rigorous post graduate education.
II. **PEO 2:**To provide skills required to have successful technical and managerial careers in Avionics industries and Aviation Engineering Management.
III. **PEO 3:**To develop creativity, ability, and potential, to generate innovative ideas and contribute to development and other needs of Aviation industries.
IV. **PEO 4:**To develop sustained interest in learning and adapting new technology developments to meet the needs of changing industrial scenarios.

PROGRAMME OUTCOMES

I. **PO1:**Ability to design, analyze, and conduct experimentsto interpret data in the field of Avionics Engineering.
II. **PO2:**Ability to design a system or a component tomeet design requirements with constraints exclusively meant for Avionics Engineering.
III. **PO3:** Familiarity with modern engineering tools and skills required to analyze problems in Avionics Engineering as a member ofmultidisciplinaryteams.
IV. **PO4:**Understanding of professional and ethical responsibilities withreference to a career in the field of Avionics Engineering and other professional fields.
V. **PO5:**Understandthe importance of designanddevelopment of Flight Control System, Navigation System, and System Simulation, from a systems integration point of view.
VI. **PO6:**Ability to communicate effectively both in verbal and non-verbal forms.
VII. **PO7:**Capability to understand the value of lifelong learning.
VIII. **PO8:**Development ofa firm scientific, technological, and communications base that helps find placement in the Aircraft industry and R & D organizations related to Avionics Engineering and other professional fields.
IX. **PO9:** Acquire skills and knowledge required for undertaking doctoral studies and research in inter- and multidisciplinary areas.

B.S.ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY,CHENNAI – 600 048.

REGULATIONS -2019 FOR

M.Tech. / MCA / M.Sc. DEGREE PROGRAMMES

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires **"Programme"** means Post Graduate Degree Programme (M.Tech. / MCA/ M.Sc.)

"Course" means a theory / practical / laboratory integrated theory / mini project / seminar / internship / Project and any other subject that is normally studied in asemester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting,Analytical Chemistry, etc.,

"Institution" means B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Academic Council" means the Academic Council, which is the apex body on all academic matters of B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Dean (Academic Affairs)" means Dean (Academic Affairs) ofB.S. Abdur Rahman Crescent Institute of Science & Technology who administers the academic matters.

"Dean (Student Affairs)" means Dean (Student Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology, who looks after the welfare and discipline of the students.

"Controller of Examinations" means the Controller of Examinations of B.S. Abdur Rahman Crescent Institute of Science & Technology who is responsible for the conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

2.1 Programmes Offered

The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	

2.2 ADMISSION REQUIREMENTS

2.2.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this Institution as specified in the clause 3.2 [Eligible entry qualifications for admission to P.G. programmes] or any other degree examination of any University or authority accepted by this Institution as equivalent thereto.

2.2.2 Eligibility conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by the Institution from time to time.

3.0DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

3.1. The minimum and maximum period for completion of the Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech.	4	8
MCA (3 years)	6	12
MCA (Lateral Entry)	4	8
MCA (2 years)	4	8
M.Sc.	4	8

3.1.1 Each academic semester shall normally comprise of 90 working days. Semester End Examinations shall follow within 10 days of the last Instructional day.

3.1.2 Medium of instruction, examinations and project report shall be in English.

3.2 ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

Sl. No.	Name of the Department	Programmes offered	Qualifications for admission
1.	Aeronautical Engineering	M.Tech. (Avionics)	B.E. / B. Tech. (Aeronautical Engineering)
2.	Civil Engineering	M.Tech. (Structural Engineering)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering)

		M. Tech. (Construction Engineering and Project Management)	B.E. / B. Tech. (Civil Engineering) / (Structural Engineering) / B. Arch.
3.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M.Tech. (CAD/CAM)	
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg.)	B.E. /B.Tech. (EEE/ECE/E&I/I&C / Electronics / Instrumentation)
		M.Tech. (Power Electronics and Drives)	
5.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E. / B.Tech. (EEE/ ECE / E&I / CSE IT / I&C / Electronics / Instrumentation)
		M.Tech. (VLSI and Embedded Systems)	B.E./ B.Tech. (ECE / E&I / I&C / EEE / CSE / IT)
6.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E./ B.Tech. (EIE/ICE/Electronics/ECE/EEE)
7.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
8.	Information Technology	M.Tech. (Information Technology)	B.E. / B.Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics / MCA)

9.	Computer Applications	MCA (3 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		MCA – (Lateral Entry)	B.Sc. Computer Science / B.Sc. Information Technology / BCA
		MCA (2 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level or B.Sc. Computer Science / B.Sc. Information Technology / BCA
10.	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study
11.	Physics	M.Sc.(Physics)	B.Sc. (Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
12.	Chemistry	M.Sc.(Chemistry)	B.Sc. (Chemistry / Applied Science)
13.	Life Sciences	M.Sc. Molecular Biology &Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Tech. Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

3.3.STRUCTURE OF THE PROGRAMME

3.3.1 The PG. programmes consist of the following components as prescribed in

the respective curriculum

i. Core courses
ii. Elective courses
iii. Laboratory oriented core courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Seminars
vii. Mini Project
viii. Industrial Internship
ix. Value Added Courses
x. MOOC Courses (NPTEL, SWAYAM, etc.,)

3.3.2 The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

3.3.3 For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

3.3.4 The curriculum ofprogrammes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Range of credits
M.Tech.	74-80
MCA (3 years)	118 - 126
MCA(Lateral Entry)	80 - 85
MCA (2 years)	85 - 90
M.Sc.	77- 82

3.3.5 Credits will be assigned to the courses for all programmes as given below:

- ❖ Onecredit for one lecture period per week or 15 periods of lecture per semester
- ❖ One credit for one tutorial period per week or 15 periods per semester
- ❖ One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester
- ❖ One credit for four weeks of industrial internship or 160 hours per semester.

3.3.6 The number of credits the student shall enroll in a non-project semester and

project semester is as specified below to facilitate implementation of Choice Based Credit System.

Programme	Non-project semester	Project semester
M.Tech.	9 to 28	18 to 26
MCA	12 to 33	12 to 26
M.Sc.	9 to 32	10 to 26

3.3.7 The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

3.3.8 The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

3.3.9 Apart from the various elective courses listed in the curriculum for each specialization ofprogramme, the student can choose a maximum of two electives from any other similar programmes across departments, during the entire period of study, with the approval of the Head of the department offering the course and parent department.

3.4.ONLINE COURSES

3.4.1 Students are permitted to undergo department approved online courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

3.4.2 Students shall undergo project related online course on their own with the mentoring of the faculty member.

3.5PROJECT WORK/DISSERTATION

3.5.1 Project work / Dissertation shall be carried out by the student under the supervision of a Faculty member in the department with similar specialization.

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research Organization, with the approval of the Head of the Department/ Dean of School. In such cases, the project work shall be jointly

supervised by a faculty of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the faculty periodically and to attend the review meetings for evaluating the progress.

3.5.3 The timeline for submission of final project report / dissertation is within 30 calendar days from the last Instructional day of the semester in which Project / Dissertation is done.

3.5.4 If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work / dissertation and shall re-register in the subsequent semester.

4.0CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD/ Dean of School as Class Advisor for the whole class. He/she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

4.2 FACULTY ADVISOR

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department / Dean of School of the students shall attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters, and guide the students in taking up courses for registration and enrolment in every semester.

5.0CLASS COMMITTEE

5.1 A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted in every semester:

5.2 The composition of the class committee will be as follows:

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

ii) Faculty members of all courses of the semester

iii) All the students of the class

iv) Faculty advisor and class advisor

v) Head of the Department – Ex officio member

5.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

5.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabus.

5.5 The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

6.0COURSE COMMITTEE

6.1 Each common theory / laboratorycourse offered to more than one group of students shall have a “Course Committee” comprising all the teachers handling the common course with one of them nominated as course coordinator. The nomination of the course coordinator shall be made by the Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

7.0REGISTRATION AND ENROLLMENT

7.1 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

7.2 For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

7.3 A student can withdraw from an enrolled course at any time before the first assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.4 A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

8.0TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

8.1 A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. A student can avail the break of study before the start of first assessment test of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only in the subsequent year. The student availing break of study is permitted to write arrear examinations by paying the prescribed fees.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / DISSERTATION

9.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum no. of credits to be earned to enroll for project semester
M.Tech.	18
MCA (3 years)	45
MCA (Lateral Entry)	22
MCA (2 years)	22
M.Sc.	18

9.2 If the student has not earned minimum number of creditsspecified, he/she has

to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

10.0ATTENDANCE

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds, representing for the institution in approved events, etc.) to become eligible to appear for the semester end examination in that course, failing which the student shall be awarded "I" grade in that course. The courses in which the student is awarded "I" grade, shall register and redo the course when it is offered next.

10.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.

10.3 A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall redo all the courses of the semester in the subsequent academic year.However he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

10.4 A student shall register to redo a core course wherein "I" or "W" grade is awarded. If the student is awarded, "I" or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be chosen with the approval of Head of the Department / Dean of School.

11.0REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester in the evening after regular working hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters, without affecting the regular academic schedule

and not exceeding prescribed maximum credits.

11.2 The Head of the Department with the approval of Dean (Academic Affairs) may arrange for the conduct of a few courses in the evening after regular working hours, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

11.3 The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

12.0ASSESSMENTS AND EXAMINATIONS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Weightageof Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

12.2 Appearing for semester end theory examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However a student should have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.3 For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory component shall have a total of three assessments with two continuous assessments having 25% weightage each and semester end examination having50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination for the award of pass grade. The evaluation of practical component shall be through continuous assessment.

12.4 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

12.5 In the case of Industrial training, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research organisation. The weightage for Industry internship reportshall be 60% and 40% for viva voce examination.

12.6 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva voce) shall beconducted as semester end examination by an external examiner approved by Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the Viva Voce examination.

12.7 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be considered for grading along with the marks scored in the semester end arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination to award grades and the internal assessment marks secured during the course of study shall not be considered.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end arrear examination for theory component. There shall be no arrear or improvement examination for lab component.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc.

by a committee constituted by the Head of the Department / Dean of School for that purpose. However there is no substitute examination for semester end examination.

13.2 A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However the substitute examination will be conducted only after the last working day of the semester and before the semester end examination.

14.0 SUPPLEMENTARY EXAMINATION

14.1 Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise students with less credit can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semester.

15. PASSING, DECLARATION OF RESULTS AND GRADE SHEET

15.1 All assessments of a course shall be made on absolute marks basis. However, the Class Committee without the student members shall meet within 5 days after the semester end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	0
I	0
AB	0

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevented from appearing for semester end examination

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

15.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

15.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department/Dean of School and it shall be declared by the Controller of Examinations.

15.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed feeto the Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

15.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the i^{th} course and GP_i is the Grade Point in the i^{th} course

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n}C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

“I” and "W" grades are excluded for calculating GPA.

"U", “I”, "AB" and **"W"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks is as follows:

Percentage Equivalent of Marks = CGPA X 10

15.6 After successful completion of the programme, the Degree shall be awarded upon fulfillment of curriculum requirements and classification based on CGPA as follows:

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the minimum prescribed period.
First Class	6.50 and above and completing the programme within a minimum prescribed period plus two semesters.
Second Class	Others

However, to be eligible for First Class with Distinction, a student should not have obtained ‘U’ or ‘I’ grade in any course during his/her period ofstudy and should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the courses within the specified minimum number of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study is not considered. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall be rounded to two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

16.0DISCIPLINE

16.1 Every student is expected to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which tends

to affect the reputation of the Institution.

16.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

17.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

17.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the stipulated time.
ii. No disciplinary action is pending against him/her.
iii. Enrolled and completed at least one value added course.
iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

17.2 The award of the degree must have been approved by the Institute.

18.0POWER TO MODIFY

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

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B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

M.TECH. Avionics

CURRICULUM & SYLLABUS, REGULATIONS 2019

SEMESTER – I

Code No.	Course Title	L	T	P	C
MAD6185	Advanced Applied Mathematics	3	1	0	4
AED 6101	Digital Avionics (Lab Integrated)	3	0	1	4
	Bridge Course	3	0	0	3
AED 6181	Aerospace Engineering (for Electrical Stream)				
	(or)				
EED 6181	Advanced Electronics and Control System (for Mechanical Stream)				
ECD 6181	Electro Optic Systems	3	0	0	3
AED 6102	Flight Instrumentation	3	1	0	4
AED 6103	MATLAB and Simulink Lab	0	0	1	1
AED 6104	Audit I	2	0	0	0
	TOTAL				**19**

SEMESTER – II

Code No.	Course Title	L	T	P	C
AED 6201	Aerospace Guidance and Control (Lab Integrated)	3	0	1	4
AED 6202	Navigation Systems	3	0	0	3
E1	Elective I	3	0	0	3
E2	Elective II	3	0	0	3
E3	Elective III	3	0	0	3
ECD 6201	Research Methodology for Engineers	3	1	0	4
AED 6204	Object oriented Programming Lab	0	0	1	1
AED 6205	Audit II	2	0	0	0
	Value Added Course				0
	TOTAL				**21**

SEMESTER – III

Course Code	Course Title	L	T	P	C
AED 7101	Digital Fly-By-Wire Control	3	1	0	4
E4	General Elective	3	0	0	3
E5	Elective IV	3	0	0	3
AED 7201	Project Work – Phase I *	0	0	12	6*
	MOOC Course				0
	TOTAL				**10**

SEMESTER – IV

Course Code	Course Title	L	T	P	C
AED 7201	Project Wok - Phase II *	0	0	24	18*
	TOTAL				**18***

18+6 =24

Total No. of Credits: 74

* Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

LIST OF ELECTIVES

Electives for Odd Semester

Course Code	Course Title	L	T	P	C
AEDY 101	UAV System Design	3	0	0	3
AEDY 102	Active Control Technology	3	0	0	3
AEDY 103	Avionics Network Technology	3	0	0	3
AEDY 104	Fault Tolerant Control	3	0	0	3
AEDY 105	Satellite Communications	3	0	0	3
AEDY 106	Digital Image Processing and Aerial Survey	3	0	0	3
AEDY 107	Airborne Actuators & Sensors	3	0	0	3
AEDY 108	Soft Computing for Avionics Engineers	3	0	0	3
AEDY 109	Missile Technology	3	0	0	3

Electives for Even Semester

Course Code	Course Title	L	T	P	C
AEDY 202	Fault Tolerant Computing	3	0	0	3
AEDY 203	Programming in Ada	3	0	0	3
AEDY 204	Mathematical Modeling and Simulation	3	0	0	3
AEDY 205	Microwaves and Radar	3	0	0	3
AEDY 206	Electronic Warfare	3	0	0	3
AEDY 207	Real time Embedded Programming	3	0	0	3
AEDY 208	Display Engineering	3	0	0	3
AEDY 209	Aircraft Product &System Engineering,Standards & Certification	3	0	0	3
AEDY 210	Flight Mechanics	3	0	0	3

Audit course 1 & 2:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

GENERAL ELECTIVE

Sl. No.	Course Code	Course Title	L	T	P	C
1.	GEDY101	Project Management	3	0	0	3
2.	GEDY102	Society, Technology & Sustainability	3	0	0	3
3.	GEDY103	Artificial Intelligence	3	0	0	3
4.	GEDY104	Green Computing	3	0	0	3
5.	GEDY105	Gaming Design	3	0	0	3
6.	GEDY 106	Social Computing	3	0	0	3
7.	GEDY107	Soft Computing	3	0	0	3
8.	GEDY 108	Embedded System Programming	3	0	0	3
9.	GEDY109	Principles of Sustainable Development	3	0	0	3
10.	GEDY110	Quantitative Techniques in Management	3	0	0	3
11.	GEDY111	Programming using MATLAB & SIMULINK	1	0	2	2
12.	GEDY112	JAVA Programming	3	0	0	3
13.	GEDY 113	PYTHON Programming	3	0	0	3
14.	GEDY114	Intellectual Property Rights	1	0	0	1

SEMESTER – I

		L	T	P	C
MAD 6185	**ADVANCED APPLIED MATHEMATICS**	**3**	**1**	**0**	**4**

OBJECTIVES:

The aim of this course is

- To develop a working knowledge of the central ideas of linear algebra.
- To study and understand the concepts of probability and random variable of the various functions.
- Understand the notion of a Markov chain, and how simple ideas of conditional probability and matrices can be used to give a thorough and effective account of discrete-time Markov chains.
- To formulate and construct a mathematical model for a linear programming problem in real life situation.
- Introduce the Fourier Transform as an extension of Fourier techniques on periodic functions and to solve partial differential equations.

MODULE I LINEAR ALGEBRA 9+3

Vector spaces – norms – Inner Products – Eigenvalues using QR transformations – QR factorization - generalized eigenvectors – Canonical forms – singular value decomposition and applications - pseudo inverse – least square approximations - Toeplitz matrices and some applications.

MODULE II ONE DIMENSIONAL RANDOM VARIABLES 9+3

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

MODULE III RANDOM PROCESSES 9+3

Classification – Auto correlation - Cross correlation - Stationary random process – Markov process –- Markov chain - Poisson process – Gaussian process.

MODULE IV LINEAR PROGRAMMING PROBLEM 9+3

Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models, Sequencing problems.

MODULE V FOURIER TRANSFORM FOR PARTIAL DIFFERENTIAL EQUATIONS 9+3

Fourier transforms: Definitions, properties-Transform of elementary functions, Dirac Delta functions – Convolution theorem – Parseval‘s identity – Solutions to partial differential equations: Heat equations, Wave equations, Laplace and Poison‘s equations.

TOTAL: 45+15:60 PERIODS

TEXT BOOKS:

1. Bronson, R.Matrix Operation, Schaum‘s outline series, McGrawHill, Newyork (1989).
2. Oliver C. Ibe, ―Fundamentals of Applied Probability and Random Processes, Academic Press, (An imprint of Elsevier), 2010.
3. Taha H.A. ―Operations Research : An introduction‖ Ninth Edition, Pearson Education, Asia, New Delhi 2012.
4. Sankara Rao, K. ―Introduction to partial differential equations‖ Prentice Hall of India, pvt, Ltd, New Delhi, 1997.

REFERENCES:

1. Andrews, L.C. and Philips.R.L. ―Mathematical Techniques for engineering and scientists‖, Printice Hall of India,2006.
2. O‘Neil P.V. ―Advanced Engineering Mathematics‖, (Thomson Asia pvt ltd, Singapore) 2007, Cengage learning India private limited.

OUTCOMES:

At the end of the course students will be able to

- understand and solve linear algebra problems
- solve one dimensional random variable problem.
- solve problems in random processes
- deal with linear programming problems.
- apply Fourier transform and PDE techniques to solve general problems in Avionics.

AED 6101 DIGITAL AVIONICS (Lab Integrated)

L	T	P	C
3	0	1	4

OBJECTIVES:

- To introduce role of avionics system and its architecture.
- To understand the avionics system design development and integration using simulation tools.
- To know modular avionics packaging and EMI/EMC requirements in avionics.
- To study system assessment, validation, certification and maintenance of avionics system.
- Upon completion of the course, the students will obtain practical knowledge on the avionic system integration and operation of avionic bus systems.
- The students will also have an experience of installation, working and testing of various avionic bus systems, and controllers for rotary and fixed wing aircrafts and will be able to deploy these skills effectively in understanding of systems in avionics engineering.

MODULE I INTRODUCTION TO AVIONICS 6

Role for Avionics in Civil and Military Aircraft systems, Avionics sub-systems and design, defining avionics System/subsystem requirements-importance of ‗ilities', Avionics system architectures.

MODULE II AVIONICS SYSTEM DATA BUSES, DESIGN AND INTEGRATION 10

MIL-STD-1553B, ARINC-429, ARINC-629, CSDB, AFDX and its Elements, Avionics system design, Development and integration-Use of simulation tools, stand alone and integrated Verification and Validation.

MODULE III AVIONICS SYSTEM ESSENTIALS: DISPLAYS, I/O DEVICES AND POWER 10

Trends in display technology, Alphanumeric displays, character displays etc., Civil and Military aircraft cockpits, MFDs, MFK, HUD, HDD, HMD, DVI, HOTAS, Synthetic and enhanced vision, situation awareness, Panoramic/big picture display, virtual cockpit-Civil and Military Electrical Power requirement standards, comparing the Military and Civil Requirements and Tips for Power System Design.

MODULE IV MAINTENANCE AND PACKAGING 8

BIT and CFDS, Automatic Test Equipment - Speeds maintenance - ATLAS, Remote diagnostics and maintenance support-Life Cycle Costs for Military and Civil Avionics - Modular Avionics Packaging - Trade-off studies - ARINC and DOD types - system cooling - EMI/EMC requirements & standards.

MODULE V SYSTEM ASSESSMENT, VALIDATIONAND CERTIFICATION 11

Fault tolerant systems - Hardware and Software, Evaluating system design and Future architecture - Hardware assessment-FARs guide certification requirements- Fault Tree analysis –Failure mode and effects analysis – Criticality, damaging modes and effects analysis - Software development process models - Integrated Avionics and systems- Security and Integrated Standard (SIL) - Software Assessment and Validation -Civil and Military standards - Certification of Civil Avionics.

Practical Experiments:

1. Testing of installation of MIL –STD-1553, ARINC-49 and ARINC -629 card (Self-test)
2. Configuring MIL –STD-1553, ARINC-429 and ARINC -629 cards in transmitting and receiving mode.
3. Testing of installation and configuring of AFDX card in transmitting and receiving mode.
4. Using the interactive driver to transmit or receive the data
   a) On a single PC by loop back connection.
   b) PC to PC by connecting a shielded pair of wires.
5. Transmit and receive the messages
   a) Using loop back connection with single card.
   b) Using connector (shielded pair of wires).
6. Development of Basic AT mega -8-bit controller for rotary wing and fixed wing

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES:

1. Spitzer, C.R. ―Digital Avionics Systems‖, Prentice Hall, Englewood Cliffs, N.J., U.S.A., 1987.

2. Cary R .Spitzer, —The Avionics Handbook‖, CRC Press, 2000.
3. Collinson R.P.G. —Introduction to Avionics‖, Chapman and Hall, 1996.
4. Middleton, D.H. —Avionics Systems‖, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
5. Jim Curren, —Trend in Advanced Avionics‖, IOWA State University, 1992.

OUTCOMES:

- To impart the basic concepts of Avionics Systems to the engineers.
- To provide the necessary knowledge on working of avionics systems in an aircraft.
- To give an exposure on various topics such as Avionics system architecture, Avionics bus systems, integration, display systems and packaging.
- To deploy these skills effectively in the understanding and analysis of avionics systems.

AED 6181	AEROSPACE ENGINEERING (for Electrical Stream)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge in the basic concepts of aerospace engineering including Aerodynamics, Aircraft performance, stability & control, Aircraft Structures and Propulsion.
- To provide knowledge on analysis of longitudinal/lateral/directional motions.

MODULE I CONFIGURATION OF AIRPLANE AND BASIC AERODYNAMICS **9**

How an Airplane flies - Components of an airplane and their functions - Airfoils and streamlines - Forces acting on an airplane - Lift and drag – Types of Drag– Speed and power – International Standard Atmosphere. Wind Tunnel Testing Techniques for Forces and Moments.

MODULE II AIRCRAFT PERFORMANCE **9**

Straight and level flight– Conditions for minimum Drag and minimum power– Climbing and gliding –Range and Endurance – Take off and Landing – V-n diagram.

MODULE III STABILITY AND CONTROL **9**

Concepts of static and dynamic stability and control– Yaw and sideslip – Dihedral effect – Rudder requirements – Directional and spiral divergence – Dutch roll– Autorotation and spin.

MODULE IV AIRCRAFT STRUCTURES **9**

Introduction to Aircraft structures - Loads - Types of construction - Design feature of Aircraft materials.

MODULE V PROPULSION **9**

Aircraft propulsion, Rocket propulsion, power plant classification, Principles of operation, Areas of their application.

Total Hours:45

TEXT BOOKS:

1. Kermode, A.C, ‗Mechanics of Flight' English Book Store, New Delhi, 1982.
2. Van Sickle Neil, D ‗Modern Airmanship' VanNostr and Reinhol, New York, 1985.
3. Megson T.H. 'Aircraft Structures for Engineering Student's II Edition, Edward Arnold, Kent, U.S.A. 1990.

OUTCOMES:

- The students will explain the available basic concepts of aeronautical engineering to the engineers and the necessary mathematical knowledge that are needed in modeling physical phenomena involved.
- The students will also have an exposure on various topics such as Lift, Drag, aircraft performance, structure and propulsion and will be able to deploy these skills effectively in the understanding of concepts relating to an aircraft.

EED 6181	ADVANCED ELECTRONICS & CONTROL SYSTEM (for Mechanical Stream)	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide knowledge in the basic concepts and applications of electronics systems including Operational Amplifiers, Digital Electronics, Microprocessors and Micro-Controllers.
- To introduce to analysis and design of feedback amplifiers and oscillatory circuits.

MODULE I LINEAR IC's **9**

OP-AMP specifications, applications, voltage comparator, A/D and D/A converter, sample and hold circuit, timer, VCO, PLL, interfacing circuits.

MODULE II DIGITAL SYSTEMS **9**

Review of TTL, ECL, CMOS- Logic gates, Flip Flops, Shift Register, Counter, Multiplexer, Demultiplexer / Decoder, Encoder, Adder, Arithmetic functions, analysis and design of clocked sequential circuits, Asynchronous sequential circuits.

MODULE III MICROPROCESSOR and MICROCONTROLLER based System **9**

16 bit microprocessor - interfacing with Alpha numeric displays, LCD panels, Stepper motor controller, Analog interfacing and industrial control - 8031 / 8051 Micro controllers – Architecture- Assembly language Programming-Timer and Counter Programming- D/A and A/D conversions - Introduction to 16 bit Microcontrollers. Programming Environment - DSP processor.

MODULE IV SYSTEM AND THEIR RESPONSES **11**

Introduction on the systems Basic elements of control system – Open and closed loop system – transfer function- transfer function – block diagram reduction - Mathematical model of Physical systems: Thermal system, Pneumatic system, Hydraulic system, Flight Control system -Time response-test signals –response of first and second order systems for unit step input – Time domain Specification - Frequency response: Root locus, Bode plot - Specification: Gain margin and Phase margin.

MODULE V CONTROLLERS AND STATE SPACE MODELS 7

Controllers introduction - P, PI, PID types - Examples of controllers modelling - State space models introduction - Example for sate space modelling.

TOTAL HOURS: 45

REFERENCES:

1. Jacob Millman, Christos C Halkias, SatyabrataJit, Millman's, ―Electronic Devices and Circuits‖, Second Edition, Tata McGraw Hill,New Delhi, 2007.
2. Donald P Leach, Albert Paul Malvino, GoutamSaha, ―Digital Principles and Applications‖, 6th Edition Tata McGraw Hill, New Delhi,2006.
3. John Crisp, ―Inroduction to Microprocessor and Microcontroller‖, Newnes Publication, London. 2004.
4. William Kleitz, ―Microprocessor and Microcontroller Fundamentals: The 8085 and 8051 Hardware and Software‖, Prentice Hall Inc, New York, 1997
5. Nagrath& Gopal, “Control System Engineering”, 3rd Edition, New Age International Edition, 2002.

OUTCOMES:

Students will be able to

- Gain knowledge about basic avionic system using various Linear semiconductor devices.
- Keep abreast of the latest digital technology and design of various digital logic
- circuits.
- Gain knowledge of the operation of the microprocessor & microcontroller and its interfacing devices.
- Apply the programming techniques in developing the assembly language program for microprocessor application.
- Differentiate between the open loop and closed loop of a control system.
- Analyze the stability of the control systems using time and frequency domain analysis.

ECD 6181 ELECTRO OPTIC SYSTEMS

L	T	P	C
3	0	0	3

Objective:

- To describe the advanced concepts of Opto-electronics
- To utilize the applications of Opto-electronics in aviation systems.
- To provide exposure on various optical phenomena.
- To justify the advantages of Laser optics in the domain of avionics.
- To explain the various imaging system.
- To compare various image compression standards.

Prerequisites

- Circuit theory fundamentals
- Electrical and Electronic device working principle and its application
- Basics of Opto electronics
- Characteristics of RF optical spectrum

MODULE I INTRODUCTION TO OPTICAL RADIATION 9

Electro Magnetic spectrum, Thermal radiation, Laws of Black body radiation, Emissivity and Kickoff's law, Black body sources, Atmospheric propagation characteristics: Scattering effect, Transmission through rain, Scintillations.

MODULE II LASER SYSTEMS 9

Theory of Laser operation, Optical resonators, Temporal and Spatial coherence, Introduction to gas, solid and semiconductor lasers, Modulators: Electro-optic, Magneto-optic and Acousto-optic modulators, Q switching, Mode locking, Cavity dumping, Introduction to Holography, Ring Laser gyro, Laser hazards and Safety measures.

MODULE III INFRARED SYSTEMS 9

Infrared and thermal detectors, Description and design features of typical passive search and detection, Infrared imaging, Forward Looking Infra Red (FLIR), Tracking and Homing systems. Satellite Radiometers.

MODULE IV IMAGING DEVICES AND TRACKING SYSTEMS 9

Imaging tubes: Vidicon, Pyroelectric-vidicon, Image intensifier tubes, CCD, Focal plane arrays (FPA), Optical tracking, Sensor steering and stabilization, Servo Control. Opto mechanical design of camera and systems. Description and design features of laser ranging and guidance system, LIDAR.

MODULE V FIBER OPTIC SYSTEMS 9

Types of Fiber optic cables and their characteristics, fiber optic sources and detectors, Avionics fiber optic data busses: IEEE Std 1393, MIL STD 1773 etc. Multiplexing schemes for onboard avionics, Fiber optic gyro.

Total Hours 45

Text Books:

1. John Wilson, John Hawkes, “Optoelectronics”, 3rd Edition, Pearson Education, 2018.
2. S.C.Gupta, “Optoelectronic Devices and Systems”, 2nd Edition, Prentice Hall of India, 2014.
3. Richard D. Hudson Jr., “Infrared System Engineering”, Wiley-Blackwell Publishing, 2006

Reference Books:

1. Keith Atkins, “Jane's Electro-optic Systems, 2006/2007, 12th Edition, Janes Information Group Ltd, Surrey, 2006.
2. William L. Wolfe, “Introduction to Infrared System Design”, Illustrated Edition, SPIE Press, 1997.
3. “IEEE 1393-1999 - IEEE Standard for Spaceborne Fiber Optic Data Bus”, IEEE Standards Association, 1999.

Outcomes :

- To summarize the emission and propagation characteristics of radiations.
- To contrast the importance of infrared and thermal detection in aviation systems.
- To find solution for Tracking and detection issues using infrared and optical technology.
- To illustrate the principles of various imaging systems
- To relate the properties of LASER to the needs in avionics.
- To comprehend the applications of fiber-optic systems

AED 6102	FLIGHT INSTRUMENTATION	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To learn the concept of measurement, error estimation and classification of aircraft instrumentation and displays
- To study air data instruments and synchronous data transmissions systems
- To study gyroscope and its purposes, aircraft compass system and flight management system
- To study Data acquisition and handling systems
- To impart knowledge about the basic and advanced flight instruments, their construction, characteristics and their operation.

MODULE I MEASUREMENT SCIENCE AND DISPLAYS 12

Instrumentation brief review-Concept of measurement-Errors and error estimation-Functional elements of an instrument system –Transducers - classification - Static and dynamic characteristics- calibration- classification of aircraft instruments-Instrument displays panels and cockpit layout.

MODULE II AIR DATA INSTRUMENTS AND SYNCHRO TRANSMISSION SYSTEMS 12

Air data instruments-airspeed, altitude, Vertical speed indicators. Static Air temperature, Angle of attack measurement, Synchronous data transmission system.

MODULE III GYROSCOPIC INSTRUMENTS 12

Gyroscope and its properties, gyro system, Gyro horizon, Direction gyro-direction indicator, Rate gyro-rate of turn and slip indicator, Turn coordinator, acceleration and turning errors.

MODULE IV AIRCRAFT COMPASS SYSTEMS &FLIGHT MANAGEMENT SYSTEM 12

Direct reading compass, magnetic heading reference system-detector element, monitored gyroscope system, DGU, RMI, deviation compensator. FMS- Flight planning-flight path optimization-operational modes-4D flight management.

MODULE V DATA ACQUISITION SYSTEMS 12

Data acquisition and Handling systems: Introduction-signal conditioners-Instrumentation amplifiers-filters. Data conversion - multiplexers-A/D-D/A

conversion. Telemetry-Airborne and ground system-PC based telemetry system. Introduction to telemetry flight data testing. Application of telemetry in UAVs and Satellites.

Total Hours:60

REFERENCES:

1. Pallet, E.H.J. —Aircraft Instruments & Integrated systems‖, Longman Scientific and
   Technical, McGraw-Hill, 1992.
2. Murthy, D.V.S., —Transducers and Measurements‖, McGraw-Hill, 1995
3. Doeblin.E.O, —Measurement Systems Application and Design‖, McGraw-Hill, New York, 1999.
4. HarryL.Stilz, —Aerospace Telemetry‖, Vol I to IV, Prentice-Hall Space Technology
   Series.

OUTCOMES:

- The learners will able to measure the error and can find the error estimation in the aircraft instruments
- The learners will be able know about the various air data systems and synchronous data transmissions systems
- The learners will be able to know the principle of gyroscope and its property, principle of DGU, RMI, FMS and its operation mode in 4D flight management.
- The students will also have an exposure to various topics such as measurement concepts, air data sensors and measurements, Flight Management Systems, and other instruments pertaining to Gyroscopic measurements and Engine data measurements and will be able to deploy these skills effectively in understanding and analysing the instrumentation methods in avionics engineering.

AED 6103 MATLAB AND SIMULINK LABORATORY

L	T	P	C
0	0	3	1

Objectives: (Minimum of 6 and measurable) (Follow Blooms Taxonomy)

- To introduce MATLAB and Simulink modelling environment.
- To analyze basic communication and instrumentation designs using simulation.
- To design and model aircraft subsystems, using Simulink.

Prerequisites

- Engineering mathematics.
- Basic understanding in signals and communication systems.
- Basic awareness of flight control and instrumentations.

List of Lab Experiments:

- Matrix and Vector, and solving Linear Equations using MATLAB
- Plotting of 2D and 3D Graph using MATLAB
- Image Processing with MATLAB
- Solving Ordinary Differential Equation with MATLAB
- GUI application design using MATLAB
- Spectral Analysis of Real-Time Signal with MATLAB
- Modelling of Communication Systems using Simulink.
- Radar Tracking Using MATLAB Function Block
- Create and Configure Flight Instrument Component and an Animation Object with Simulink.
- Lightweight Airplane Design modelling with MATLAB and Simulink.

Total Hours: 45

Reference Book

1. Amos Gilat, “MATLAB: An Introduction with Applications”, 4th Edition, John Wiley, 2012
2. Shailendra Jain, “Modeling and Simulation using MATLAB – Simulink”, 2nd Edition, Wiley International, 2015.
3. Marcello R. Napolitano, “Aircraft Dynamics: From Modeling to Simulation”,

1st Edition, Wiley, 2011.

4. Raveendranathan K C, “Communication Systems Modelling and Simulation using Matlab and Simulink”, CRC Press, 2011.

Outcomes :

On completion of the course Students will be able to

- To recall the built-in Matlab functions for solving basic mathematical problems
- To demonstrate the properties of functions by graph plotting
- To apply MATLAB tools for image processing and differential equation
- To analyze and interpret the spectrum of real-time communication signals.
- To estimate the performance of communication systems and aircraft instrumentation by modelling and simulating them with Simulink
- To design a lightweight aircraft using Simulink modelling.

SEMESTER – II

		L	T	P	C
AED 6201	**AEROSPACE GUIDANCE AND CONTROL (Lab Integrated)**	**3**	**0**	**1**	**4**

OBJECTIVES:

- To introduce advanced concepts of Guidance and Control of an aircraft needed in modeling the guidance and control methods.
- To give the exposure on various topics such as 6-DOF equations of motion, autopilots and augmentation systems and missile guidance systems

MODULE I INTRODUCTION 4

Introduction to Aircraft equations of motion, longitudinal equations of motion, lateral equations of motion, Historical background

MODULE II AUGMENTATION SYSTEMS 7

Need for automatic flight control systems, Stability augmentation systems, control augmentation systems, Gain scheduling concepts.

MODULE III LONGITUDINAL AUTOPILOT 12

Displacement Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide Slope Coupler and Automatic Flare Control and Flight path stabilization, Longitudinal control law design using back stepping algorithm

MODULE IV LATERAL AUTOPILOT 10

Damping of the Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system, turn compensation, Automatic lateral Beam Guidance. Introduction to Fly-by-wire flight control systems, Lateral control law design using back stepping algorithm

MODULE V MISSILE AND LAUNCH VEHICLE GUIDANCE 12

Operating principles and design of guidance laws, homing guidance laws- short range, Medium range and BVR missiles, Launch Vehicle- Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q guidance schemes

Practical Experiments:

1. Stability analysis using Root locus, Bode plot, Nyquist plot and Polar plot techniques
2. Design of lead, lag and lead-lag compensator for aircraft dynamics

3. Performance Improvement of Aircraft Dynamics By pole placement technique
4. Development of Longitudinal Equations of Motion
5. Design of displacement longitudinal autopilot
6. Design of Automatic Glide Slope Control System and Flare Control System
7. Development of Lateral Equations of Motion
8. Design of Lateral Autopilot

9. Design of Turn Co-ordination system
10. Design of Van-Guard Missile system

NOTE: Implementation using X-plane, Flight-Gear &Aerosim
(experiments from 5 to 10)

L – 45; P – 30; TOTAL HOURS – 75

REFERENCES

1. Blake Lock, J.H 'Automatic control of Aircraft and missiles ', John Wiley Sons, New York,1990.
2. Stevens B.L & Lewis F.L, 'Aircraft control & simulation', John Wiley Sons, New York, 1992.
3. Collinson R.P.G, 'Introduction to Avionics', Chapman and Hall, India, 1996.
4. Garnel.P. &East.D.J, 'Guided Weapon control systems', Pergamon Press, Oxford, 1977.
5. Nelson R.C 'Flight stability & Automatic Control', McGraw Hill, 1989.
6. BernadEtikin,'Dynamic of flight stability and control', John Wiley, 1972.

OUTCOMES

- Students will understand the advanced concepts of Guidance and Control of an aircraft to the engineers and to provide the necessary mathematical knowledge that are needed in modeling the guidance and control methods.
- The students will have an exposure on various topics such as 6-DOF equations of motion, autopilots and augmentation systems and missile guidance systems.
- The students will have an exposure on various topics such as Root locus, analysis of stability through Root locus plots, Bode plot, Lead Lag compensator, PID controller and tuning, controller and autopilot design.
- Students be able to deploy these skills effectively in the solution of problems in Avionics engineering.

AED 6202 **NAVIGATION SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce various types of navigation systems.
- To understand the dead reckoning navigation system and its error correction.
- To know satellite navigation and hybrid navigation system integration.
- To study various radio navigation system and its usage in air traffic regulation and landing of aircrafts
-

MODULE I NAVIGATION SYSTEMS & INERTIAL SENSORS 6

Introduction to navigation – Types – Introduction to Inertial Sensors - Mechanical - Ring Laser - Gyro- Fiber optic gyro – MEMS system

MODULE II INERTIAL NAVIGATION SYSTEMS 9

INS components: transfer function and errors - Earth in inertial space - Coriolis Effect – INS Mechanization. Platform and Strap down – Navigation algorithms - INS system block diagram, Different co-ordinate systems – Transformation Techniques - Schuler Tuning – compensation errors - Gimbal lock - Initial calibration and Alignment Algorithms

MODULE III RADIO NAVIGATION 12

Different types of radio navigation- ADF, VOR, DME - Doppler – Hyperbolic Navigations -LORAN, DECCA and Omega – TACAN

MODULE IV APPROACH AND LANDING AIDS 6

ILS, MLS, GLS - Ground controlled approach system - surveillance systems-radio altimeter, gyro compassing

MODULE V SATELLITE NAVIGATION&HYBRID NAVIGATION 12

Introduction to GPS -system description -basic principles -position and velocity determination signal Structure -DGPS, Introduction to Kalman filtering-Estimation and mixed mode navigation Integration of GPS and INS-utilization of navigation systems in aircraft.

Total Hours:45

REFERENCES:

1. Myron Kyton, Walfred Fried, 'Avionics Navigation Systems', John Wiley & Sons,2 edition,1997.
2. Nagaraja, N.S. "Elements of Electronic Navigation", Tata McGraw-Hill Pub. Co., New Delhi, 2nd edition, 1975.
3. George M Siouris, 'Aerospace Avionics System; A Modern Synthesis', Academic Press Inc., 1993.
4. Albert Helfrick, 'Practical Aircraft Electronic Systems', Prentice Hall Education, Career & Technology, 1995.
5. Albert D. Helfrick, 'Modern Aviation Electronics', Second Edition, Prentice Hall Career & Technology, 1994.
6. Sen, A.K. & Bhattacharya, A.B. "Radar System and Radar Aids to Navigation", Khanna Publishers, 1988.
7. Slater, J.M. Donnel, C.F.O and others, "Inertial Navigation Analysis and Design", McGraw-Hill Book Company, New York, 1964.

OUTCOMES:

Upon completion of the course,

- Students will understand the advanced concepts of Aircraft Navigation
- To provide the necessary mathematical knowledge that are needed in modeling the navigation process and methods.
- The students will have an exposure on various Navigation systems such as Inertial Measurement systems, Radio Navigation Systems, Satellite Navigation – GPS.
- Landing aids and will be able to deploy these skills effectively in the analysis and understanding of navigation systems in an aircraft.

ECD 6201 RESEARCH METHODOLOGY FORENGINEERS

L	T	P	C
4	0	0	4

OBJECTIVES:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding.

MODULE I RESEARCH PROBLEM FORMULATION 7

The research problem – Sources of research problem – Information, how to deal with it – Criteria / characteristics of a good research problem – Errors in selecting a good research problem – Types of research – Nature and use of arguments.

MODULE II HYPOTHESIS FORMULATION 8

Research design – meaning and need – basic concepts, Different research designs, experimental design – principle – important experimental designs, Design of experimental setup, mathematical modeling, simulation – validation and experimentation, dimensional analysis and similitude

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –hypothesis testing- sample design- design of experiments – factorial designs – orthogonal arrays- ANOM - ANOVA - Multivariate analysis - use of optimization techniques –traditional methods – evolutionary optimization techniques –transportation model.

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 8

Purpose of written report – audience, synopsis writing, preparing papers for International journals, thesis writing – organization of contents – style of writing – graphs and charts – referencing, oral presentation and defence, ethics in research, Patenting, Intellectual Property Rights.

Total Hours:45

REFERENCES:

- Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
- Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting,
- McGraw Hill International edition, 1995.
- George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
- Madhav S. Phadke, Quality Engineering using Robust Design, Prentice Hall,
- Englewood Cliffs, New Jersey, 1989.
- Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
- Kalyanmoy Deb., “Genetic Algorithms for optimization”, Kangal report, No.2001002.
- Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
- Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
- University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
- Shannon. R.E., System Simulation: the art and science, Prentice Hall Inc, Englewood Cliffs, N.J.1995.
- Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

OUTOMES:

Students who complete this course will be able to

- Identify the research problem.
- Become capable of analyzing the data using mathematical techniques.
- Learn to apply the statistical concepts in research.
- Demonstrate the different research methods applicable to a specificproblem.

AED 6204 OBJECT ORIENTED PROGRAMMING LAB

L	T	P	C
0	0	2	1

OBJECTIVES:

- To introduce object oriented concepts in C++ and Ada 95.
- To implement and understand the object oriented concepts and application
- To design real time problems and find the way to implement the solution.
- To make familiar with the object oriented concepts.
- To implement File handling and Exception handling.
- To strengthen their problem solving ability by applying the characteristics of an object- oriented approach and developments using C++ and Ada 95.

SOFTWARE REQUIRED

- C++
- Gnat

List of Lab Experiments:

1. Classes and Objects
2. Friend function and Inline function
3. Constructor and Destructor
4. Function Overloading and Operator Overloading
5. Inheritance
6. Virtual Function and Dynamic binding
7. File handling and Exception handling.
8. Simple Ada programs (Integer Type variable, Logical compares and precedence)
9. Control Structures.
10. Derived Types
11. Subprograms
12. Arrays.
13. Records
14. The Character & String Type
15. The Access Type Variable
16. Input /Output
17. Packages
18. Advanced concepts in Ada (Exception, Tasking)

Total Hours:45

OUTCOMES:

Students who complete this course will be able to

- Explain what constitutes an object-oriented approach to programming.
- Analysis of the application problem and identify the efficient solution for it
- Apply an object-oriented approach to develop applications of varying complexities.
- Identify the exception for the specific problem.
- Use object oriented concepts to solve the complex problems.
- Potential benefits of object-oriented programming over other approaches

SEMESTER - III

		L	T	P	C
AED 7101	**DIGITAL FLY-BY WIRE CONTROL**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To introduce the advanced concepts of Fly-by-wire that are needed in understanding modern aircraft control strategies.

MODULE I INTRODUCTION TO FLY-BY-WIRE CONTROL 7

Need for FBW systems, Historical perspectives in design Programs-Douglas Long Beach Programs, WPAFB B 47 In House Program, LTV IAP, Sperry Phoenix Programs, CAS and SAS, CCV and ACT concepts.

MODULE II ELEMENTS OF DFBW CONTROL 9

Description of various elements of DFBW systems - Concept of redundancy and reliability, Fault coverage and redundant architecture

MODULE III DFBW ARCHITECTURES 9

Need for redundant architecture, discussion on triplex vs. quadruplex architecture for DFBW system, Concept of cross-strapping, Actuator command voting and servo force voting etc.

MODULE IV SOME REQUIREMENTS FOR DFBW SYSTEM DESIGN 9

Survivable Flight control System programs, ADP Phases-Simplex package Evaluation -FBW without Mechanical Backup-Survivable Stabilator Actuator package, Reliability requirements and their relevance to DFBW system design, redundant power supply requirements, Environmental and weight, volume constraints

MODULE V DESIGN ISSUES IN DFBW SYSTEM DESIGN 9

Thermal consideration, Built-in-test features, reliable software development, Redundancy management (voting, monitoring), Failure and maintenance philosophies, Implementation, Issues of digital control laws, Generic failures in Hardware and software. Advanced concepts in DFBW System Design

Total Hours:45

REFERENCES:

1. Vernon R Schmitt, James W Morris and Gavin D Jenny, “Fly By Wire-A Historical Perspective”, SAE International, 1998.

2. AGARD-CP-137, “Advances in Control systems”, (Chap.10, 17,21, 22, 23, 24)
3. AGARD-CP-384, “Active Control Systems Review”, Evaluations and Projections.
4. AGARD-CP-260, “Stability and Control” (Chap.15)
5. ‘Modern Air Combat’, Salamander Books Ltd, 2001.

OUTOMES:

Upon completion of this course,

- Students will understand the advanced concepts of Fly-by-wire to the engineers
- To provide the necessary mathematical knowledge that are needed in understanding modern aircraft control strategies.
- The students will have an exposure on various topics such as evolution of FBW, Elements, architecture, design and design issues of DFBW
- Students will be able to deploy these skills effectively in the analyzing and understanding modern control methods.

AED 7201 **PROJECT WORK - PHASE I**

L	T	P	C
0	0	12	6

OBJECTIVES:

- To improve the professional competency and research aptitude
- Aims to develop the work practice of students to apply theoretical and practical tools/techniques
- To solve real life problems related to industry and current research
- To improve the skills towards report/documentation preparation

GUIDELINES

Project work can be a design project/experimental project and/or computer simulation project on any of the topics of communication systems. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential (Industry oriented Projects), they may be permitted to continue their project outside the parent institute. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4^{th} semester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, Objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4^{th} semester. The Evaluation committee consists of at least four faculty members of which internal guide and other experts in the specified area of the project shall be two essential members.

OUTCOMES:

- At the end of the project work phase I the student will be able to learn the tool required for the design, analysis of their preliminary work
- Select the specific devices for different application along with justification
- Apply the practical knowledge while solving real time problems
- Incorporate cost effective and efficient project models
- Conclude the subject knowledge through proto type models
- Prepare an appropriate documentation

SEMESTER - IV

		L	T	P	C
AED 7202	**PROJECT WORK - PHASE II**	**0**	**0**	**36**	**18**

OBJECTIVES:

- To improve the professional competency and research aptitude
- Aims to develop the work practice of students to apply theoretical and practical tools/techniques
- To solve real life problems related to industry and current research
- To improve the skills towards report/documentation preparation

GUIDELINES

Project work can be a design project/experimental project and/or computer simulation project on any of the topics of communication systems. The project work is allotted individually on different topics. The students shall be encouraged to do their project work in the parent institute itself. If found essential (Industry oriented Projects), they may be permitted to continue their project outside the parent institute. Department will constitute an Evaluation Committee to review the project work. The Evaluation committee consists of at least three faculty members of which internal guide and another expert in the specified area of the project shall be two essential members.

The student is required to undertake the master research project phase 1 during the third semester and the same is continued in the 4^{th} semester (Phase 2). Phase 1 consist of preliminary thesis work, two reviews of the work and the submission of preliminary report. First review would highlight the topic, Objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4^{th} semester. The Evaluation committee consists of at least four faculty members of which internal guide and other experts in the specified area of the project shall be two essential members.

OUTCOMES:

- At the end of the project work phase I the student will be able to learn the tool required for the design, analysis of their preliminary work
- Select the specific devices for different application along with justification
- Apply the practical knowledge while solving real time problems
- Incorporate cost effective and efficient project models
- Conclude the subject knowledge through proto type models
- Prepare an appropriate documentation

VALUE ADDED COURSE	L	T	P	C
	0	0	0	0

OBJECTIVES:

- To expose the latest technology / tools used in the industry and enable the students acquire knowledge and skill set in the same.

GENERAL GUIDELINES:

- Students should undergo any relevant certification course offered by the institution or other institutions / universities / IIT / IISc etc. for a minimum of 40 hours.
- Selection and completion of value added course by the students shall be endorsed by Head of the Department.

OUTCOMES:

- Students should be exposed and gained knowledge in any one latest technology used in the industry

MOOC COURSE

L	T	P	C
0	0	0	0

OBJECTIVES:

- To learn the basics principles and concepts of the topic in which a project work is undertaken by the student.

GENERAL GUIDELINES:

- Students shall identify a MOOC course related to his/her project topic in consultation with the project supervisor.
- Student shall register for a MOOC course with minimum two credit offered by any recognized organization during the project phase I.
- Selection and completion of MOOC course by the students shall be endorsed by Head of the Department.

OUTCOMES:

Students will be able to

- Familiarize the basic principles and concepts related to the topic of his/her project work.
- Utilize the knowledge gained in the field of study to perform literature review with ease.
- Formulate the experimental / analytical methodology required for the project work

ELECTIVE SYLLABUS

ELECTIVES FOR ODD SEMESTER

AEDY 101 UAV SYSTEM DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic knowledge of UAV types, mathematical calculation involved in the design of UAV, airframe, sensor and autopilot integration involved in path planning
-

MODULE I INTRODUCTION TO UAV 9

History of UAV –classification –basic terminology-models and prototypes –applications

MODULE II BASICS OF AIRFRAME 9

Airframe –dynamics –modeling- structures –wing design- engines types-equipment maintenanceand management-control surfaces-specifications

MODULE III AVIONICS HARDWARE 9

Autopilot –AGL-pressure sensors-servos-accelerometer –gyros-actuators- power supply processor, integration, installation, configuration, and testing.

MODULE IV COMMUNICATION PAYLOADS AND CONTROLS 9

Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequencyrange –SAS-flight director-commands and videos-elements of control loops-flight computersensor -displays- parameter settings-modems-memory system-simulation-ground test-analysis trouble shooting.

MODULE V PATH PLANNING AND MAV 9

Waypoints navigation-ground control software-Recent trends in UAV-Case Studies

Total Hours:45

REFERENCES:

1. 1.Jane’s Unmanned Aerial Vehicles and Targets, Jane’s Information Group; ASIN: 0710612575,1999

2. R. Said and H. Chayeb, “Power supply system for UAV”, KTH, 2002.
3. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
4. Skafidas, “Microcontroller Systems for a UAV”, KTH, TRITA-FYS 2002:51 ISSN 0280-316 X.34, 2002
5. Kimon P. Valavanis, “Advances in Unmanned Aerial Vehicles: State of the Art and the Roadto Autonomy”, Springer, 2007
6. Paul G Fahlstrom, Thomas J Gleason, “Introduction to UAV Systems”, UAV Systems, Inc,1998,
7. Dr. Armand J. Chaput, “Design of Unmanned Air Vehicle Systems”, Lockheed MartinAeronautics Company, 2001
8. P.J. Swatton, “Ground studies for pilots’ flight planning”, Sixth edition, 2002.

OUTCOMES:

Upon completion of this course,

- Students will understand the advanced concepts of UAV System Design to the engineers
- Students gains the mathematical knowledge that are needed in modeling and analyzing an unmanned system.
- The students will have an exposure on various topics such as Design and development of UAVs, payloads and design standards.
- Concluding with case studies of different such unmanned systems and will be able to deploy these skills effectively in the solution of problems in avionics engineering

AEDY 102 ACTIVE CONTROL TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce to the concepts of fly-by-wire, active control technology and its functions.
- To provide knowledge on automatic configuration management, active control design considerations.
- To impart knowledge on flying qualities and principles control modes of combat aircraft.

MODULE I ACTIVE CONTROL FUNCTIONS 12

Introduction-active control technology concepts-control configured vehicle-Design Philosophy, Aerodynamics: Relaxed static stability, Automatic Configuration management, side force control. Structures, Manoeuvre load control, Gust load alleviation, Ride smoothing, fatigue alleviation, Flutter-mode control, Propulsion and Flight Control Integration Technology (PROFIT)

MODULE II ACTIVE CONTROL DESIGN CONSIDERATIONS 5

Stability augmentation, Command augmentation, Control of aircraft center of gravity, Elastic mode stabilization, and Gust load control, Reliability, redundancy

MODULE III FLY-BY-WIRE TECHNOLOGY 8

Fly-By-Wire concepts. Primary and secondary electrical flight control system, Redundancy and architecture trade studies - analog and digital FBW Systems - Typical fly-by-wire flight control system elements - Application of fly-by-wire technology to civil and military aircraft

MODULE IV FLYING QUALITIES 13

Definition, Cooper - Harper rating scale - flying qualities requirements - Relaxed static stability flying qualities requirements - Lower order equivalent systems criteria Neal - Smith criteria.

MODULE V CONTROL MODES OF COMBAT AIRCRAFT 7

Pitch rate Command - Attitude hold system - Carefree maneuvering - spin-stall

prevention and similar limiting concepts - Combat maneuvers.

Total Hours:45

REFERENCES

1. AGARD-AG-234, Active controls aircraft Design ‘, 1978.
2. AGARD-CP-157,Impact of active control technology in aircraft design‘, 1975.
3. AGARD-CP-260, Stability and control ‘, 1978.
4. AGARD-CP-137, Advance in Control systems ‘, 1974.
5. AGARD-CP-228, Structural aspects of active Controls ‘, 1977.
6. AGARD-IS-89, Task oriented flight control Systems ‘, 1977.

OUTCOMES:

Upon completion of this course

- Students will understand the advanced concepts in Active Control Technology to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.
- The students will have an exposure on various topics such as Automatic configuration management, design considerations, fly-by-wire concepts, flying qualities and control modes of combat aircraft and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

AEDY 103 AIRCRAFT NETWORK TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Students will understand the advanced concepts of AvionicsNetworking Technology to the engineers and to provide the necessary knowledge that are neededinunderstanding the related processes.

MODULE I OPTICAL NETWORKS 9

Fiber channel- WDM LAN- Fiber channel-RF over fiber- Highly integrated photonics (HIP)-Routingin optics- Amplification in optics.

MODULE II ATN (AERONAUTICAL TELECOMMUNICATION NETWORK) 9

ATN Concepts – ATN functionality – ATN Components – End Systems – ATN physical andadministrative structures – ATN planning and implementation process – ATN Router. Military Gigabit type – Ethernet Architecture – Modems - Wideband mobile routers – Smart router– IP Address in cockpit

MODULE III WIRELESS SENSOR NETWORK 9

Introduction-Challenges for wireless sensor networks-Comparison of sensor network with ad hoc network-single node architecture-Hardware components-energy consumption of sensor nodes-Network architecture-sensor network scenarios-types of sources and sinks-single hop versus multi-hop-networks-multiple sinks and sources-Design principles-Development of wireless sensornetworks-Application-military-Target detection tracking-Habitat monitoring-Environmental disastermonitoring.

MODULE IV WIDEBAND WIRELESS COMMUNICATION AND NETWORKS FORMILITARY AVIONICS 9

Communication data link (CDL) - IP based routing in FBW-Smart antenna networking.

MODULE V REAL TIME INTEGRATED AVIONICS NETWORK 9

Inter networking- Multimedia- Pilot vehicles-other defense and aerospace application-ScalablCoherent interface-SCI/RI-Integrated modulator avionics.

Total Hours:45

REFERENCES:

1. Jian-Guozhang, A.Pervez, A.B.Sharma, “Avionics Data Buses: Overview”, IEEE AESSMagazine, Feb 2003.

2. Carry A spitzer, “Avionics Data Buses”, Fifty edition 2005.
3. Frank Gross, “Smart Antennas for Wireless Communication” Wisely Publications, second edition 2004.
4. Hamed Al-Raweshidy, Shozo Komaki. “Radio Over Fiber Technology, for Mobile Communication Network”, 2002.
5. Clifford Headuey, Govind P Agarwal, “Raman Amplification in Fiber Opical Communication Systems”, Tara-McGrall publications, 2002.
6. Feng zhao, Leonidas guibas, “Wiresess Sensor Networks: An Information Processing Approach”, Elsevier publication, 2004.

OUTCOMES:

Upon completion of this course,

- Students will understand the advanced concepts of Avionics Networking Technology to the engineers and to provide the necessary knowledge that are neededin understanding the related processes.
- The students will have an exposure on various networks in an aircraft ranging from optical, telecommunication, wireless sensor network and military avionicsnetwork
- Students will be able to deploy these skills effectively in the solution of problems in avionics engineering.

AEDY 104 **FAULT TOLERANT CONTROL**

L	T	P	C
3	0	0	3

OBJECTIVES:

To introduce the advanced concepts of fault tolerant control system modeling for the physical processes and estimation the errors using various advanced concepts

MODULE I INTRODUCTION 9

Scope of -Approaches to fault detection and diagnosis: -Model free methods and Model basedmethods - Introduction to Random Variables-Distribution-Bivariate distribution- Multivariate Distribution-Normal Distribution-Maximum likelihood distribution-Hypothesis testing

MODULE II ANALYTICAL REDUNDANCY CONCEPT 9

Additive faults and disturbance-Multiplicative faults and disturbance Residual generation-Detection Property-Isolation Property-Computational Property-Design of Residual generation-Specification and implementation

MODULE III PARITY EQUATION FORMULATION 9

Implementation of single residual-Implementation with input output relation-Fault system matrixDesign for structure residual-Structural Definition-Canonical Structures-Handling disturbance-Residual structure for multiple faults

MODULE IV DESIGN FOR DIRECTIONAL RESIDUAL 9

Directional specifications-Parity Equation-Linearly dependent columns Residual generation forparametric faults-Representation of parametric fault-Design for parametric fault and model errors-Robustness in residual generation-Perfect decoupling from disturbance

MODULE V ADVANCE TOPICS 9

Fault diagnosis using Kalman filtering-Fault diagnosis using principle component analysis –Faultdiagnosis using ANN and Fuzzy clustering, Case study: Aircraft fault detection

Total Hours:45

REFERENCES:

1. Janos.J.Gertler, “Fault detection and diagnosis in engineering systems”, second edition,Marcel Dekker, 1998.
2. Rami S.Mangoubi, “Robust Estimation and Failure detection”, Springer-Verlag London, 1998

OUTCOMES

Upon completion of this course,

- students will understand the advanced concepts of Fault Tolerant Control to the engineers
- Students will gain the necessary mathematical knowledge that are needed in modeling physical processes.
- The students will have an exposure on various topics such as Multivariate distribution, likelihood distribution, analytical redundancy concept, parity equation and directional residual.
- Students will be able to deploy these skills effectively in the solution of problems in avionics engineering.

AEDY 105 SATELLITE COMMUNICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Students will able to understand the advanced concepts of Spacecraft communication systems to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the physical processes.

MODULE I ELEMENTS OF SATELLITE COMMUNICATION 9

Satellite Systems, Orbital description and Orbital mechanics of LEO, MEO and GSO, Placement ofa Satellite in a GSO, Satellite – description of different Communication subsystems, Bandwidthallocation.

MODULE II TRANSMISSION, MULTIPLEXING, MULTIPLE ACCESS AND CODING 9

Different modulation and Multiplexing Schemes, Multiple Access Techniques FDMA, TDMA,CDMA, and DAMA, Coding Schemes, Satellite Packet Communications.

MODULE III SATELLITE LINK DESIGN 9

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionosphericcharacteristics, Link Design with and without frequency reuse.

MODULE IV SATELLITE TELEMETRY, TRACKING AND TELECOMMAND 9

Introduction to telemetry systems - Aerospace transducer - signal conditioning – multiplexingmethods - Analog and digital telemetry - Command line and remote control system - Application oftelemetry in spacecraft systems - Base Band Telemetry system - Computer command & Datahandling , Satellite command system-Issues

MODULE V APPLICATIONS 9

VSAT-VSAT Technologies, Networks MSS-AMSS, MMSS

Total Hours:45

REFERENCES:

1. Wilbur L. Pritchard and Joseph A.Sciulli, Satellite Communication Systems Engineering, Prentice Hall, New Jersey, 1986.
2. Timothy Pratt and Charles W.Bostain, Satellite Communications, John Wiley and

Sons, 1986.
3. Tri T Ha, Digital Satellite Communication, Macmillan Publishing Company, 1986.
4. Kadish, Jules E, Satellite Communications Fundamentals, Artech House, Boston 2000
5. Lida,Takashied.,Satellitecommunications:System and its design technology, Ohmsha Tokyo2000
6. Maral, Gerard,Satellite communications systems: Systems, techniques and technology, John Wiley, Newyork 2002.

OUTCOMES:

Upon completion of this course,

- Students will understand the advanced concepts of Spacecraft communication systems to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the physical processes.
- The students will have an exposure on various topics such as Orbital mechanics,elements of satellite communication system, links and multiplexing, multiple access, telemetry ,tracking and telecommand
- Studemts will be able to deploy these skills effectively in the solution of problems in avionics engineering.

AEDY 106 DIGITAL IMAGE PROCESSING AND AERIAL SURVEY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Students will get the understandingof advanced concepts of Image processing for aerospace applications to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.

MODULE I FUNDAMENTALS OF IMAGE PROCESSING 9

Introduction – Elements of visual perception, Steps in Image Processing Systems – ImageAcquisition – Sampling and Quantization – Pixel Relationships – Colour Fundamentals andModels, File Formats Introduction to the Mathematical tools

MODULE II IMAGE ENHANCEMENT 9

Spatial Domain Gray level Transformations Histogram Processing Spatial Filtering – Smoothingand Sharpening. Frequency Domain: Filtering in Frequency Domain – DFT, FFT, DCT, Smoothingand Sharpening filters – Homomorphic Filtering.

MODULE III IMAGE SEGMENTATION AND FEATURE ANALYSIS 9

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection –Thresholding – Region Based Segmentation – Motion Segmentation, Feature Analysis andExtraction.

MODULE IV MULTI RESOLUTION ANALYSIS 9

Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet TransforFast Wavelet transforms, Wavelet Packets.

MODULE V AEROSPACE APPLICATIONS 9

Principles of digital aerial photography- Sensors for aerial photography - Aerial Image Exploration- Photo-interpretation, objective analysis and image quality - Image Recognition - ImageClassification – Image Fusion – Colour Image Processing - Video Motion Analysis – Case studies– vision based navigation and control.

Total Hours:45

REFERENCES:

1. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2008.

2. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis and Machine Vision”, Third Edition, Third Edition, Brooks Cole, 2008.
3. Anil K.Jain, “Fundamentals of Digital Image Processing”, Prentice-Hall India, 2007.
4. Madhuri A. Joshi, ‘Digital Image Processing: An Algorithmic Approach”, Prentice-Hall India, 2006.
5. Rafael C.Gonzalez , Richard E.Woods and Steven L. Eddins, “Digital Image Processing Using MATLAB”, First Edition, Pearson Education, 2004.
6. Ron Graham, Alexander Koh,”Digital Aerial Survey: Theory and Practice”, Whittles Publishing; First edition,2002.

OUTCOMES:

Upon completion of this course,

- Students will understand the advanced concepts of Image processing for aerospace applications to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.
- The students will have an exposure on various topics such as Image enhancement, Wavelet transforms, multi-resolution analysis and vision based navigation and control
- Students will be able to deploy these skills effectively in the solutionof problems in avionics engineering.

AEDY 107 AIRBORNE ACTUATORS & SENSORS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understanding basic laws and phenomena on which operation of sensors and actuators transformation of energy is based.
- To describe development and application of sensors and actuator and basic laws and phenomena that define behavior of sensors and actuators

MODULE I AIRCRAFT ACTUATION SYSTEMS 6

Introduction -Principles of actuation systems, Types of actuation systems

MODULE II SERVO COMPONENTS 9

Actuators, Valves, Servo amplifiers pick-offs.

MODULE III MODELING, DESIGN, AND TESTING 9

Linear and non-linear actuation system, modeling of actuation systems, Servo-loop analysis actuator design - testing methodologies, Performance testing test equipment's for actuation systems.

MODULE IV INERTIAL SENSORS 9

Gyroscope- Principles, Gyro equations, Rate Gyros - Rate integration and free Gyro, Vertical and Directional Gyros, Laser Gyroscopes - Inertial navigation - Basic principles, theory and applications. Accelerometers-- Principles & Theory, Spring mass, force balance and piezo-electric accelerometers, MEMS sensors

MODULE V SENSOR TESTING 9

Test philosophies and methodologies, Test equipment, Performance testing of sensor

Total Hours:45

TEXT BOOKS:

- James Ephraim Johnson, Electrohydraulic Servo Systems, Published by Editors of Hydraulics& pneumatics magazine, 1977

REFERENCES

- Neal E. Wood et al, 'Electro-mechanical actuation development AFFDL-TR-150' DEC 1978.
- Pallett, E.H.J. 'Aircraft instruments, principles and applications', Pitman publishing Ltd., London, 1991

OUTCOMES

The course should enable the students to understand and design

- Upon completion of this course, students will understand the advanced concepts of Airborne actuators and sensors to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes
- The students will have an exposure on various topics such as aircraft actuation systems, servo components, inertial sensors, modeling, design and testing of sensors and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

AEDY 108 SOFT COMPUTING FOR AVIONICS ENGINEERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of neural and fuzzy and its optimizing techniques with Neuro fuzzy modeling to the avionics engineers.

MODULE I NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptron's – Adaline – Back propagation MultilayerPerceptron – Radial Basis Function Networks – Unsupervised Learning Neutral Networks –Competitive Learning Networks – Kohonen Self-Organizing Networks – Counter PropagationNetworks- Advances in Neural Networks

.

MODULE II FUZZY SET THEORY 9

Fuzzy Sets – Basic Definition and Terminology – Set Theoretic Operations – Member FunctionFormulation and Parameterization – Fuzzy Rules and Reasoning – Extension Principle and FuzzyRelations – Fuzzy IF-THEN Rules – Fuzzy Reasoning – Fuzzy Inference Systems – MamdaniFuzzy Model – Sugeno Fuzzy Model – Tsukamoto Fuzzy Model – Input Space Partitioning andFuzzy Modeling.

MODULE III OPTIMIZATION METHODS 9

Derivative Based Optimization – Derivative free Optimization - Genetic Algorithm – Design Issues in Genetic Algorithm, Genetic Modeling – Optimization of Membership Function and Rule Base using GA – Fuzzy Logic Controlled GA.

MODULE IV NEURAL AND FUZZY CONTROL SCHEMES 9

Direct and Indirect Neuro Control Schemes – Fuzzy Logic Controller – Familiarization of NeuralNetwork and Fuzzy Logic Toolbox - Case Studies

MODULE V NEURO FUZZY MODELLING 9

Fuzzification and Rule Base using ANN – Fuzzy Neuron – Adaptive Neuro-fuzzy Inference System– Architecture – Hybrid Learning Algorithm – Learning Methods that Cross fertilize ANFIS andRBFN – Coactive Neuro Fuzzy Modeling.

Total Hours:45

REFERENCES:

1. Neural Networks: Algorithms, Applications and Programming Techniques", Freeman J.A. &D.M. Skapura, Addison Wesley,2000.

2. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004, Pearson Education 2004.
3. Anderson J.A “An Introduction to Neural Networks”,PHI, 2001.
4. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
5. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 2000
6. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.

OUTCOME:

Upon completion of this course,

- Students will understand the advanced concepts of soft computing to the engineers
- Students will gain the necessary mathematical knowledge that are needed in modeling the related processes.
- The students will have an exposure on various topics such as Neural Networks, Fuzzy logic and Neuro-fuzzy modeling
- Students will be able to deploy these skills effectively in the solution of problems in avionics engineering

AEDY 109 **MISSILE TECHNOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

MODULE I MISSILE SYSTEMS 9

Introduction - history - classification - missile system elements, missile ground systems - radars – launchers, coordinate frames, basics of trajectory dynamics.

MODULE II AERODYNAMICS 9

Missile aerodynamics- design methodology, aerodynamic prediction method, aerodynamic loads & performance analysis, wind tunnel and flight testing of missile models and missile prototypes.

MODULE III PROPULSION 9

Principles of jet propulsion and rocketry, nozzle theory and performance parameters of solid rockets and ramjet and compound jet engines – evaluation of flight performance - forces acting on vehicle - basic relations of motion - multi stage vehicles

MODULE IV NAVIGATION, GUIDANCE & CONTROL 9

Navigation - types - inertial - GPS - radar based terrain mapping, guidance - explicit - PN –APN - beam riding – CLOS, control – autopilot, and actuation - hydraulic - pneumatic - electromechanical - RCS

MODULE V MISSILE TRAJECTORY CALCULATIONS 9

Vertical, inclined and gravity turn trajectories – determination of range and altitude-numerical computation of ballistic trajectories.

Total Hours:45

REFERENCES

1. G. Merrill, “Dictionary of Guided Missiles and Space Craft”, D. Van Nostrand and Company, Inc, 1959.
2. S. S. Chin, “Missile Configuration Design”, McGraw Hill, 1961.
3. P. Garnel, “Guided Weapon Control Systems”, 2nd Edition, Pergamon Press, 1980.
4. J. Frederick White, “Flight Performance Handbook for Powered Flight Operations”, John Wiley & Sons, Inc., 1963.

OUTCOMES:

Upon completion of this course

- Students will understand the advanced concepts of Missile Technology to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.
- The students will have an exposure on various topics such as classification, aerodynamics, propulsion, navigation, guidance and control of missile systems, and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

ELECTIVES FOR EVEN SEMESTER

		L	T	P	C
AEDY 202	**FAULT TOLERANT COMPUTING**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To provide knowledge on the Fault-tolerant systems, fault diagnosis, adaptive control,robust control, and redundancy control and study future issues.
- To learn design of parametric faults and decoupling from disturbance.
- To understand the principles of fault diagnosis

MODULE I FAULT TOLERANCE 10

Principles of fault tolerance – redundancy – quantitative reliability – evaluation – exception handling. Application of fault tolerant systems in aircraft – reliability strategies – Fault Tolerant Processor – Hardware and software

MODULE II ERROR DETECTION 12

Measure for error detection – Mechanisms for error detection – Measures for damage confinement and damage assessment – Protection mechanisms – Protection in multi-level systems

MODULE III ERROR RECOVERY 12

Measures for error recovery – mechanisms for error recovery – check points and audit trials – the recovery cache – Concurrent processes – recovery for competing process – recovery for cooperating process – distributed systems – fault treatment – location and repair.

MODULE IV SOFTWARE FAULT TOLERANCE 4

The recovery block scheme – Implementation of recovery block – Acceptance – tests – run-time overheads

MODULE V SYSTEMS STRUCTURE AND RELIABILITY 7

System structure – systems model – Software / Hardware interaction and multi-level systems – atomic actions – systems reliability – systems specification - Erroneous transitions and states – component / design failure – errors and faults

Total Hours:45

REFERENCES

1. Anderson and Lee, Fault tolerant principles and practice, Prentice – Hall, 1981
2. Siewiorek, C.P. and Swartz, R.S Theory and practice of reliable system design, McGraw – Hill, 1983.
3. John D. Musa, Anthony Jannino, Kzuhira, Okunito, Software reliability measurement, prediction and application, McGraw – Hill, 1989.

OUTCOMES

Upon completion of this course,

- Students will understand the advanced concepts of Fault Tolerance to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the necessary procedures involved.
- The students will have an exposure on various topics such as Redundancy, Fault Tolerant system architecture and design, error handling and recovery and will be able to deploy these skills effectively in the solution of problems in avionics engineering

AEDY 203 **PROGRAMMING IN ADA**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the concept of object-oriented programming
- To learn about the ADA data types
- To study about the ADA packages
- To study about the parallel programming
- To study the interface with other languages

MODULE I OBJECT ORIENTED PROGRAMMING 9

Overview- History of Ada -Inheritance, dynamic dispatching (polymorphism)-Encapsulation.

MODULE II ADA DATA TYPES 9

Basic Ada structures, program units, Ada structures, lexical elements, identifiers, numeric literals,character literals, Basic types- integer , float, Boolean, user defined types & rule types-Enumeration. Array, records, limited and private limited types, control structure- if, case, loop, loopiteration schemes, subprograms-declaration, parameter passing- local and global variables.

MODULE III ADA PACKAGES 9

Declaration and bodies-packages-compilation units, I/O capabilities, Text file I/o, various text file,package command line options, child packages, exceptions - declarations, handling, generics definitions, formal parameters, visibility rules.

MODULE IV PARALLEL PROGRAMMING 9

Access types-declaration -unbounded types, unchecked deal location-task and protected types multitasking.

MODULE V INTERFACING WITH OTHER LANGUAGES 9

Interfacing with C, Java vs. Ada, Ada applets, Java interfaces and aliased components- flightsafety and Ada, recursion and efficiency, software inspection, debugging, Ada bindings, other Adacapabilities.

Total Hours:45

REFERENCES:

1. Ada for experienced programmers-Habermann AN, Peary DE-Addison Wiley, 1983.
2. Ada in industry- Heibrunner s- Cambridge UniversityPress-1988.
3. Ada: Introduction & Ada reference manual- HegardH-Springer Verlag
4. Ada: Reference manual, Programming language-Spamgerverlag
5. Ada as a second language, Norman H.Cohen, McGraw Hill II edition, 1995.
6. Ada 95: Problem solving and program design, Michael B. Feildman, Elliot B. Koffman, Addison – Wesley, 1999.
7. Ada 95: The Craft of object oriented programming, John English I edition, Prentice Hall, 1996.
8. Herbert schildt, " Java 2 The Complete Reference", McGraw Hill, 2007.

OUTCOMES

Upon completion of this course,

- students will understand the advanced concepts of programming using the ADA language to the engineers
- Students will gain the necessary programming knowledge that are needed in modeling physical processes.
- The students will have an exposure on various topics such as Object oriented programming concepts, packages, parallel programming and interfaces to JAVA and other languages
- Students will be able to deploy these skills effectively in the solution of problems in avionics engineering.

AEDY 204 MATHEMATICAL MODELING AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- Students will understand the advanced concepts of MathematicalModeling and Simulation to the engineers and to provide the necessary mathematical knowledgethat are needed in modeling physical processes.

MODULE I SYSTEM MODELS AND SIMULATION 7

Continuous and discrete systems, System modeling, Static models, Dynamic models, Principlesused in modeling the techniques of simulation, Numerical computation techniques for models,Distributed lag models, Cobweb models.

MODULE II PROBABILITY, CONCEPTS IN SIMULATION 8

Stochastic Variables, Discrete probability functions, continuous probability function, Measure ofprobability functions, Continuous uniformly distributed random number, Congestion in systems,Arrival patterns, Various types of distribution.

MODULE III SYSTEM SIMULATION 10

Discrete events, Representation of time, Generation of arrival patterns, Simulation programmingtasks, Gathering statistics, Counters and summary statistics, Simulation language. ContinuousSystem models, Differential equation, Analog methods, digital analog simulators, Continuoussystem simulation language (CSSLs), Hybrid simulation, Simulation of an autopilot, Interactivesystems.

MODULE IV SYSTEM DYNAMICS AND MATHEMATICAL MODELS FOR FLIGHT SIMULATION 12

Historical background growth and decay models, System dynamics diagrams, Multi – segmentmodels, Representation of time delays, The Dynamo Language Elements of Mathematical models,Equation of motion, Representation of aerodynamics data, Aircraft systems, Structure and cockpitsystems, Motion system, Visual system, Instructor's facilities.

MODULE V FLIGHT SIMULATOR AS A TRAINING DEVICE AND RESEARCH TOOL 8

Introduction, advantage of simulator, the effectiveness of Simulator, The user's role, SimulatorCertification, Data sources, Validation, in- flight simulators

Total Hours:45

REFERENCES:

1. Gordon. G., “System Simulation” , Prentice – Hall Inc., 1992.
2. Stables, K.J. and Rolfe, J.M. “Flight Simulation”, Cambridge University Press, 1986.

OUTCOMES:

Upon completion of this course,

- students will understand the advanced concepts of Mathematical Modeling and Simulation to the engineers and to provide the necessary mathematical knowledgethat are needed in modeling physical processes.
- The students will have an exposure on various topics such as System Models, probability concepts in simulation and flight simulators
- Students will be able to deploy these skills effectively in the understanding the concepts and working of a flight simulator.

AEDY 205 MICROWAVES AND RADAR

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the various Microwave sources and their working.
- To become familiar with radar equation and range.
- To provide an understanding of the basic concepts, operation of modern radar systems.
- To develop the knowledge and techniques necessary to analyze the performance of radar systems.
- To give an overview of radar applications.

MODULE I MICROWAVE SOURCES 10

Passive waveguide components, Microstrip line structure and components, Simple theory and operating characteristics of Reflex klystrons, Two cavity Klystrons, Magnetrons, and TWTS - solid state source – Gunn Diode and Tunnel diode.

MODULE II RADAR PRINCIPLES 8

Introduction to Radar – Radar range equation – Receiver noise and signal to noise ratio- Radar cross section (RCS) – Radar system – Radar Antennas

MODULE III TYPES OF RADARS 10

CW and FMCW radars-Tracking radars-MTI radar -Principles of coherent MTI radars - Digital MTI, Synthetic Aperture radar, Principles of Pulsed Doppler Radar, Low-, High-, and medium-PRF Mode.

MODULE IV TRACKING RADAR 10

Radar signal processing - Tracking with radar – Monopulse Tracking – conical scan and sequential lobing – limitations to tracking Accuracy- Kalman Tracker - Fundamentals of Airborne radar

MODULE V APPLICATIONS OF RADAR 7

Distance measuring equipment (DME) – Tactical air navigation systems (TACAN) - Microwave Landing System (MLS) - Global Positioning System (GPS) - Air traffic services, Primary surveillance and secondary aerodrome surveillance.

Total Hours:45

REFERENCES:

1. Fred E.Nathanson " Radar design Principles " Signal processing and the environment, Prentice Hall, 2004.
2. Y. Liao, Microwave Devices and Circuits, Prentice Hall, 1980.
3. M.I. Skolnik, Introduction to Radar System (Second Edition) McGraw Hill, 1980.
4. M.I. Skolnik, Radar Handbook (Second Edition) McGraw Hill, 1990.
5. Guy V. Morris, Linda L. Harkness, Airborne Pulsed Doppler radar, Second Edition, Artech House Publishers, 1996.
6. Blackman S.S., "Multiple target tracking with radar applications" Artech House 1986.
7. Byron Edde, "Radar Principles, Technology, Applications", Pearson Education India, 2009

OUTCOMES

Upon completion of this course, students will be able to

- Study the various Microwave sources and their working
- Describe the Principle of Radar.
- Explain the concepts of different types of Radars.
- Study the relevant signal processing.
- Discuss the application of Radar including Navigational systems.

AEDY 206 ELECTRONIC WARFARE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce principles of electronic warfare, electronic support measure and electronic counter measures
- To understand the Radar Warning Receivers trends in display technology
- To understand the Radar detection performance low RCS aircraft
- To know EM sensor subsystem, Mile parameter tracking

MODULE I ELECTRONIC WARFARE (EW) PRINCIPLES AND OVERVIEW **3**

Electronic Warfare taxonomy-EW Mission and scenarios

MODULE II ELECTRONIC SUPPORT MEASURE (ESM) RECEIVERS - ELECTRONIC COUNTER MEASURES (ECM) **12**

Radar Warning Receivers (RWR) - Passive direction finding and emitter - location - noise jamming - Deception Electronic Counter Measures (DECM) - Modern ECM systems.

MODULE III RADAR AND ECM PERFORMANCE ANALYSIS **9**

Radar detection performance low RCS aircraft - ECM - Jamming equations - EW receiver sensitivity

MODULE IV EW SIGNAL PROCESSING **9**

Signal environment - EM sensor subsystem - The receiver subsystem - The pre-processor the data servo loop - Mile parameter tracking - Advanced pulley power - Managed Jamming.

MODULE V ELECTRONIC COUNTER - COUNTER MEASURES (ECCM) **9**

Radar applications in weapon systems - Radar types and characteristics, EW Technology and Future Trends - Antenna Technology - ECM transmitter power source technology - EW receiver technology - EW at millimeter Wavelength - Low Observability EW technology.

Total Hours:45

REFERENCES

1. Curtis Schleher. D. “Introduction to Electronic Warfare’, Artech House Inc.,

U.S.A., 1986
2. Mario De Archnaelis, “Electronic War from Battle of Osushima to the Falklands and Lebanon Conflicts”, Ritana Books, New Delhi, 1990.
3. Sen, A.K. Bhattacharya, A.B. “Radar Systems & Radar Aids to Navigation”, Khanna Publishers, 1988

OUTCOMES:

Upon completion of this course,

- Students will understand the advanced concepts of Electronic Warfare to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the same.
- The students will have an exposure on various topics such as principles of electronic warfare system, ESM Receivers and signal processing, Jamming equations and ECCM and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

AEDY 207 REAL TIME EMBEDDED PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of embedded system, architecture of PIC microcontroller andARM processor.
- To understand the RTOS concepts like scheduling and memory management related to theembedded system.
- To learn the protocols of embedded wireless application.
- To understand concepts involved in the design of hardware and software components foran embedded system.

MODULE I INTRODUCTION 12

Real Time System – Embedded Systems – Architecture of Embedded System - Simple Programming for Embedded System – Process of Embedded System Development - Pervasive Computing – Information Access Devices – Smart Cards – PIC Microcontroller – ARM Processor.

MODULE II EMBEDDED/REAL TIME OPERATING SYSTEM 9

Operating System Concepts: Processes, Threads, Interrupts, Events - Real Time Scheduling Algorithms - Memory Management – Overview of Operating Systems for Embedded, Real Time, Handheld Devices – Target Image Creation – Programming in Linux, RTLinux, VxWorks, uC/Osoverview.

MODULE III C**ONNECTIVITY 9**

Wireless Connectivity - Bluetooth – Other Short-Range Protocols – Wireless Application Environment – Service Discovery – Middleware

MODULE IV REAL TIME UML 6

Requirements Analysis – Object Identification Strategies – Object Behavior – Real Time Design Patterns

MODULE V SOFTWARE DEVELOPMENT AND CASE STUDY 9

Concurrency – Exceptions – Tools – Debugging Techniques – Optimization – Case Studies Interfacing Digital Camera with USB port and Data Compressor

Total Hours:45

REFERENCES

1. R.J.A.Buhr, D.L.Bailey, “An Introduction to Real-Time Systems”, Prentice-Hall International, 1999.
2. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2007. (UNIT– II) C.M.Krishna, Kang G.Shin, “Real Time Systems”, Mc-Graw Hill, 1997. (UNIT- II)
3. B.P.Douglass, “Real Time UML 2nd Edition”, Addison-Wesley 2000. ((UNIT – IV)
4. J.Schiller, “Mobile Communication”, Addison-Wesley, 1999. (UNIT – III)
5. Dr.K.V.K.K.Prasad, “Embedded/Real Time Systems: Concepts, Design and Programming”, DreamTech press, Black Book, 2005. (UNIT – I)
6. R.Barnett, L.O.Cull, S.Cox, “Embedded C Programming and the Microchip PIC”, Thomason Learning 2004. (UNIT – I)
7. Wayne Wolf, “Computers as Components - Principles of Embedded Computer System Design”, Mergen Kaufman Publisher, 2006.
8. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata McGraw Hill, 2004
9.

OUTCOMES:

Upon completion of this course,

- Students will understand the advanced concepts of Real-time embedded systems to the engineers and to provide the necessary knowledge for their design and development.
- The students will have an exposure on various topics such as architecture of embedded systems, connectivity, RTOS, Real time UML and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

AEDY 208 **DISPLAY ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide basic knowledge on the type's pf displays, their operation and characteristics.
- To impart knowledge on the different cockpit displays, their characteristics, displayprocessor, and its requirements & architecture.
- To provide knowledge on different technologies involved in computer graphics.

MODULE I DISPLAY DEVICES 9

Trends in display technology – Alphanumeric displays, character display etc. Basic components of display systems. CRT displays, Plasma display, LCDs, Solid state displays, etc. and their characteristics

MODULE II COCKPIT DISPLAYS 10

Head up displays – Basic principles – Holographic HUDs - HUD electronics – HUD design and display generation. Helmet mounted displays – Helmet design factor – Helmet mounted sights – Head tracking system. Head down displays – Raster overlay display generation – Digitally generated color map displays. Multifunction displays – control and data entry – Multifunction keyboards- voice interactive systems

MODULE III DISPLAY PROCESSOR REQUIREMENTS & ARCHITECTURE 8

Concepts – Role of display processor – Design steps – Hardware architecture and Building blocks – Software Architecture – Symbol Generator –Display drive circuits – Display management Processor

MODULE IV COCKPIT EVALUATOR 8

Generation of display symbologies with facilities for quick modification and evaluation Cockpit Information and Display Controls Organization and Optimization

MODULE V COMPUTER GRAPHICS 10

2D Graphics: Line, Curve and elipse Algorithms – Attributes – 2D" transformation – viewing, 3D Graphics: 3 D Concepts – Object Representation – Transformation – Viewing – Color models – Animation – Multimedia technologies – Compression and decompression – Data and file format standards – Full motion video – Storage and

retrieval technologies

Total Hours:45

REFERENCES

1. Donald Hearn & Pauline Baker, “Computer Graphics”, Second edition, 1996
2. Prabath K. Andleigh& Kiran Thakrar, “Multimedia Systems & Design”. First Deition, Prentice Hall O India, 1995.
3. Judith Jeffcoate, “Multimedia In Practice Technology And Applications”, First Edition, Prentice Hall of India, 1995.
4. Foley, Vandam, Feiner, Huges, “Computer Graphics: Principles and Practice”, Second Edition, Pearson Education, 2003.
5. Cooly,”Essence of Computer Graphics”, First Edition. Pearson Education, 2004.
6. Goloi W.K. “Interactive Computer Graphics, Data structures, Algorithms, Languages” Prentice –Hall, 1988.
7. Davis, Computer Displays, Prentice – Hall, 1982.
8. R.B.G. Collinson – Introduction to Avionics, Chapman & Hall, 1996.
9. Spitzer, Digital Avionics System, Prentice Hall, New Jersey, 1987.
10. Cary R. Spitzer, The Avionics Handbook, CRC Press, 2000.

OUTCOMES

Upon completion of this course

- Students will understand the advanced concepts of Display systems to the engineers and to provide the necessary domain knowledge that are needed in understanding display systems.
- The students will have an exposure on various display systems, cockpit display, display architecture and graphics pertaining to aircraft display systems and will be able to deploy these skills effectively in the design and development of display systems for aircrafts

AEDY 209 AIRCRAFT PRODUCT &SYSTEM ENGINEERING,STANDARDS & CERTIFICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide exposure to advanced concepts of Aircraft product and system engineering,standards, and certification.
- To provide the necessary knowledge to design and development of new aircraft systems.
- To provide exposure on Avionic system engineering design life cycle, design standardsand certification, DO-178B and DO 254 standards

MODULE I AVIONICS SYSTEM ENGINEERING DEVELOPMENT CYCLE 8

Establishing the Avionics System Requirements by Mission Scenario Analysis, Functional Analysis, Physical Partitioning, Avionics Architectural Design, Specification of HW/ SW of Subsystems, Development / Procurement of HW/ SW of Subsystems, SW Integration, HW/SW Integration, Standalone testing of subsystems, Avionics System Integration in Ground based Integration Lab, Integration of Avionics System in Aircraft, Flight Testing, Operational Test and Evaluation by user, Deployment, SW updates, Avionics Upgrades

MODULE II SYSTEMS ENGINEERING MANAGEMENT AND CERTIFICATION OF AVIONICSSYSTEMS 12

The Systems Engineering Process - Overview, Requirements Analysis, Functional Analysis and Allocation, Design Synthesis, Verification, Systems Engineering Process Outputs System Analysis and Control - Work Breakdown Structure, Configuration Management, Technical Reviews and Audits, Trade Studies, Modeling and Simulation, Metrics, Risk Management Planning, Organizing, And Managing - Systems Engineering Planning, Product Improvement Strategies, Organizing and Integrating, System Development, Contractual Considerations, Management Considerations Certification, Civil Aviation Authorities, Regulatory and Advisory Agencies, Type Certification, Certification Process, Delegation, Product Certification Process Roadmap

MODULE III SOFTWARE CONSIDERATIONS IN AIRBORNE SYSTEMS ANDEQUIPMENT CERTIFICATION (DO-178B) 9

System Aspects Relating to Software Development, Software Life Cycle, Software Planning Process, Software Development Processes, Software Verification Process, Software Configuration Management Process, Software Quality Assurance Process, Certification Liaison Process, Overview of Aircraft And Engine Certification, Software

Life Cycle Data, Additional Considerations -Use of Previously Developed Software, Tool Qualification, SW Reliability Models, Formal Methods

MODULE IV DESIGN ASSURANCE GUIDANCE FOR AIRBORNE ELECTRONICHARDWARE (DO- 254) **8**

System Aspects of Hardware Design Assurance, Hardware Design Life Cycle, Planning Process, Hardware Design Processes, Validation and Verification Process, Configuration Management Process, Process Assurance, Certification Liaison Process, Hardware Design Life Cycle Data

MODULE V CERTIFICATION CONSIDERATIONS FOR HIGHLY-INTEGRATED ORCOMPLEX AIRCRAFT SYSTEMS (SAE ARP4754 **8**

System Development Process Guidelines and Methods, Development Assurance and Safety Directed Development Concept, Certification Process and Coordination, Requirement Determination and Assignment of Development Assurance Level, Safety Assessment Process, Validation of Requirements, Implementation Verification, Configuration Management, Process Assurance

Total Hours:45

REFERENCES

1. IEEE Std 1220-1998, IEEE Standard for Application and Management of the Systems Engineering Process, 2005.
2. Systems Engineering Fundamentals, Supplementary Text Prepared By The Defense Acquisition University Press Fort Belvoir, Virginia 22060-5565, 2001
3. NASA Systems Engineering Handbook, SP-610S, June 1995
4. INCOSE, Systems Engineering Handbook, A “What To” Guide For All SE Practitioners, INCOSE-TP-2003-016-02, Version 2a, 1 June 2004
5. RTCA DO-178B/EUROCAE ED-12B, Software Considerations in Airborne Systems and Equipment Certification, RTCA Inc.,Washington, D.C, 1992.
6. DO-254/EUROCAE ED-80, Design Assurance Guidance For Airborne Electronic Hardware, RTCA Inc.,Washington, D.C, April 19, 2000
7. SAE ARP4754, Certification Considerations for Highly-Integrated or Complex Aircraft Systems, SAE, Warrendale, PA, 1996.
8. SAE ARP4761, Guidelines and Methods for Conducting the Safety AssessmentProcess on Civil Aircraft Airborne Systems and Equipment, Warrendale, PA, 1996

OUTCOMES:

Upon completion of this courses

- Students will understand the advanced concepts of Aircraft product and system engineering, standards and certification to the engineers and to provide the necessary knowledge that are needed in design and development of new aircraft systems
- The students will have an exposure on various topics such Avionic system engineering design life cycle, design standards and certification, DO-178B and DO 254 standards and will be able to deploy these skills effectively in the solution of problems in avionics engineering

AEDY 210 FLIGHT MECHANICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the knowledge to students on aircraft performance in level, climbing, gliding and accelerated flight modes and also various aspects of stability and control in longitudinal,lateral and directional modes.

MODULE I PRINCIPLES OF FLIGHT 7

Physical properties and structure of the atmosphere, International Standard Atmosphere, temperature, pressure and altitude relationship, Measurement of speed – True, Indicated and Equivalent air speed, Streamlined and bluff bodies, Various Types of drag in airplanes, Drag polar, methods of drag reduction of airplanes.

MODULE II AIRCRAFT PERFORMANCE IN LEVEL, CLIMBING AND GLIDING FLIGHTS 8

Straight and level flight, Thrust required and available, Power required and available, Effect of altitude on thrust and power, Conditions for minimum drag and minimum power required, Gliding and Climbing flight, Range and Endurance.

MODULE III ACCELECRATED FLIGHT 7

Take-off and landing performance, Turning performance, horizontal and vertical turn, Pull up and pull down, maximum turn rate, V-n diagram. Effect of load factor.

MODULE IV LONGITUDINAL STABILITY AND CONTROL 8

Types of stability, static and dynamic stability, static longitudinal stability, Contribution of individual components, neutral point, static margin, Hinge moment, Elevator control effectiveness, Power effects, elevator angle to trim, elevator angle per ‘g’, maneuver point, stick force gradient, aerodynamic balancing.

MODULE V LATERAL, DIRECTIONAL STABILITY AND DYNAMIC STABILITY 10

Dihedral effect, estimation of airplane dihedral effect–effects of wing sweeps, flaps, power on dihedral effect, lateral control–Aileron control forces, and aileron levers. Directional control, –crosswind during takeoff and landing, spinning, Anti symmetric power. Equation of longitudinal motion –Evaluation of stability derivatives –solution of equation of motion (stick fixed case), solution of equation of motion (stick free case).

Total Hours:45

REFERENCES:

1. Houghton, E.L., and Caruthers, N.B., Aerodynamics for engineering students, Edward ArnoldPublishers, 1988.
2. Perkins C.D., &Hage, R.E. Airplane performance, stability and control, Wiley Toppan, 1974.
3. Kuethe, A.M., and Chow, C.Y., Foundations of Aerodynamics, John Wiley & Sons, 1982.
4. Clancey,L.J. Aerodynamics, Pitman, 1986.
5. Babister, A.W. Aircraft stability and response, Pergamon Press, 1980.
6. Nelson, R.C. Flight Stability & Automatic Control, McGraw-Hill, 1989.
7. McCormic, B.W., Aerodynamics, Aeronautics & Flight Mechanics John Wiley, 1995.

OUTCOMES:

Students will be able to

- Understand the various layers of atmosphere and its importance also procedure for obtain drag polar of the aircraft.
- Calculate the performance parameters of the aircraft during steady level flight, climb, cruise, descent, range and endurance.
- Construct the V-n diagram for aircraft.
- Obtain the longitudinal static stability condition for an aircraft
- Gain knowledge about directional and lateral stability of an aircraft
- Acquire knowledge of dynamic stability of the aircraft

GENERAL ELECTIVES

GEDY101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

- Learn to evaluate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GEDY102 SOCIETY, TECHNOLOGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life –Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology-sustainable design- sustainable manufacturing-Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

OUTCOMES:

At the end of this course, the students will be able to

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GEDY103	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game/Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GEDY104 GREEN COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression - Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.

- Address design issues needed to achieve an organizations' green computing objectives.
- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GEDY105 GAMING DESIGN L T P C
3 0 0 3

OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words–What Skills Does a Game Designer Need? –The Most Important Skill - The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice - Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy –Imagination –Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down –The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance –The Twelve Most Common Types of Game Balance –Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie SalenTekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GEDY106 SOCIAL COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition,SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GEDY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization – Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

OUTCOMES:

At the end of the course the students will be able to

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GEDY108 EMBEDDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing –characteristics and challenges –embedded system design process –Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging –Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation,Twos complement, Fixed point and Floating Point Number Formats,Manipulating Bits in -Memory, I/O Ports, Low level programming in C,Primitive data types, Arrays, Functions,Recursive Functions, Pointers, Structures &Unions,Dynamic Memory Allocation,Filehandling,Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program -Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W.Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GEDY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution –Global and Local environmental issues –Resource Degradation- Greenhouse gases –Desertification-industrialization –Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability –Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment– Biodiversity– Natural – Resources– Ecosystem integrity– Clean air and water– Carrying capacity– Equity, Quality of Life, Prevention, Precaution–Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines– interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry–Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism– Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development –Strategies for implementing eco-development programmes Sustainable development through trade –Economic growth –Action plan for implementing sustainable development –Urbanization and sustainable Cities –Sustainable Energy

and Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries– international summits–Stockholm to Johannesburg –Rio principles–Agenda-Conventions–Agreements– Tokyo Declaration –Doubling statement–Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London,1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

OUTCOMES:

At the end of the course the student will be able to

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GEDY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming –Graphical and Simplex Methods, Duality and Post-Optimality Analysis –Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock– Replacement Theory – PERT and CPM – Simulation Models –Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management–Compound Interest and Present Value methods– Discounted Cash Flow Techniques–Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory–Decision Rules–Decision making under conditions of certainty, risk and uncertainty–Decision trees–Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts–Breakeven Analysis–Pricing techniques–Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.

3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.
4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOMES:

At the end of the course, the students will be able to

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GEDY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation-Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression - Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta)- Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta)- Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule

b. Euler method

2. Solution of fourth order non-linear differential equations using
    a. Modified Euler method
    b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. LaureneFausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.

- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GEDY 112 JAVA PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods with ability handle abnormal conditions.
- To learn to work with various string methods and collection framework.
- To establish a connection to database from java application.
- To understand why Java is useful for the designing web applications.
- To design a graphical user interface (GUI) with Java Swing.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 06

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 08

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

MODULE III STRING HANDLING AND COLLECTIONS 07

String Handling - Special String Operations - String Literals- String Conversion - Collections Overview - The Collection Interfaces -The Collection Classes - Accessing a collection Via an Iterator - Working With Maps, Comparators.

MODULE IV DATABASE CONNECTIVITY 08

JDBC - JDBC Driver Types - JDBC Packages - Database Connection - Associating the JDBC/ODBC Bridge with the Database - Statement Objects – Result Set - Transaction Processing – Metadata - Exceptions.

MODULE V SERVER PROGRAMMING 09

The Life Cycle of a Servlet - Using Tomcat for Servlet Development -The Servlet API - Handling HTTP Requests and Responses - Using Cookies - Session Tracking - Java Server Pages (JSP)-Session Objects

MODULE VI SWING PROGRAMMING 07

Concepts of Swing - Java Foundation Class (JFC) - Swing Packages and Classes - Working with Swing - Swing Components

L – 45; TOTAL HOURS-45

REFERENCES :

1. Herbert Schildt, “Java The Complete Reference”, 11th Edition, McGraw Hill, 2018, ISBN: 9781260440249.
2. Joshua Bloch , “Effective Java Paperback”,3rd Edition, Addison Wesley,2017,ISBN: 978-0134685991.
3. E Balagurusamy, “Programming with Java”, 6th Edition, Tata Mcgraw Hill, 2019,ISBN: 978-9353162344.

OUTCOMES:

Students who complete this course will be able to

- Understand the fundamentals java programming language
- Use the Java programming language for various programming technologies.
- Perform various string operations on any given text from user.
- Connect any database with java program and manipulate the contents.
- Write a server side programming which can evaluate the input and respond to user request
- Develop user interface using java swings.

GEDY 113 PYTHON PROGRAMMING L T P C
3 0 0 3

OBJECTIVES :

- To study the control statements and string functions of python.
- To practice python data structures - lists, tuples, dictionaries.
- To organize input/output with files in Python.
- To learn the python tools as well as Unicode process.
- To explore advance python including decorators and metaclasses.
- To integrate python with embedded systems.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 07

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - recursion - GUI basics.

MODULE II LISTS, TUPLES AND DICTIONARIES 08

Lists - list operations - list slices - list methods - list loop – mutability- aliasing - cloning lists - list parameters - Tuples: tuple assignment- tuple as return value- Dictionaries- operations and methods- advanced list processing - list comprehension- selection sort - insertion sort- merge sort- histogram.

MODULE III FILES, MODULES AND PACKAGES 08

Files and exception - text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - word count- copy file.

MODULE IV UNICODE AND BYTE STRINGS 07

String basics - coding basic strings –coding Unicode strings- 3.X bytes objects- 3.X/2.6+ byte array object- text and binary files – Unicode files

MODULE V DECORATORS AND METACLASS 08

Decorator basics- coding function decorators- coding class decorators – managing functions and classes –the metaclass model- declaring metaclasses-coding metaclasses-inheritance and instance-metaclass methods

MODULE VI EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L – 45; Total Hours : 45

REFERENCES :

1. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016, ISBN-13:978-1491939369.
3. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
4. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
5. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
6. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
7. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES :

Students to complete this course will be able to

- Implement date and time function programming using python.
- Represent compound data using Python lists, tuples, dictionaries
- Read and write data from/to files in Python Programs.
- Instrument the unicode process using python tools
- Build advance python programs using decorators and metaclass.
- Develop embedded system with python programming.

GEDY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

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OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) –IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR– Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology– Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter– Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent– Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement– Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. AjitParulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013

6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013
7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database