INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
(Approved by AICTE | NAAC Accreditation with 'A' Grade | Accredited by NBA | Affiliated to JNTUH)
Dundigal, Hyderabad - 500 043, Telangana

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM

MASTER OF TECHNOLOGY
EMBEDDED SYSTEMS

ACADEMIC REGULATIONS, COURSE STRUCTURE AND SYLLABI UNDER AUTONOMOUS STATUS

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2016 - 17)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

CONTENTS

"Take up one idea.
Make that one idea you're life-think of it, dream of it, and live on that idea.
Let the brain muscles, nerves, every part of your body be full of that idea and just leave every other idea alone.
This is the way to success" **Swami Vivekananda**

PRELIMINARY DEFINITIONS AND NOMENCLATURES

Academic Council: The Academic Council is the highest academic body of the institute and is responsible for the maintenance of standards of instruction, education and examination within the institute. Academic Council is an authority as per UGC regulations and it has the right to take decisions on all academic matters including academic research.

Academic Autonomy: Means freedom to an institute in all aspects of conducting its academic programs, granted by UGC for Promoting Excellence.

Academic Year: It is the period necessary to complete an actual course of study within a year. It comprises two consecutive semesters i.e., Even and Odd semester.

AICTE: Means All India Council for Technical Education, New Delhi.

Autonomous Institute: Means an institute designated as autonomous by University Grants Commission (UGC), New Delhi in concurrence with affiliating University (Jawaharlal Nehru Technological University, Hyderabad) and State Government.

Backlog Course: A course is considered to be a backlog course if the student has obtained a failure grade (F) in that course.

Basic Sciences: The courses offered in the areas of Mathematics, Physics, Chemistry, Biology etc., are considered to be foundational in nature.

Betterment: Betterment is a way that contributes towards improvement of the students' grade in any course(s). It can be done by either (a) re-appearing or (b) re-registering for the course.

Board of Studies (BOS): BOS is an authority as defined in UGC regulations, constituted by Head of the Organization for each of the departments separately. They are responsible for curriculum design and updation in respect of all the programs offered by a department.

Certificate course: It is a course that makes a student gain hands-on experience and skill required for holistic development in a specific area/field.

Choice Based Credit System: The credit based semester system is one which provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching along with provision of choice for the student in the course selection.

Compulsory course: Course required to be undertaken for the award of the degree as per the program.

Commission: Means University Grants Commission (UGC), New Delhi.

Continuous Internal Examination: It is an examination conducted towards internal assessment.

Course: A course is a subject offered by the University for learning in a particular semester.

Course Outcomes: The essential skills that need to be acquired by every student through a course.

Credit: A credit is a unit that gives weight to the value, level or time requirements of an academic course. The number of 'Contact Hours' in a week of a particular course determines its credit value. One credit is equivalent to one lecture hour per week.

Credit point: It is the product of grade point and number of credits for a course.

Cumulative Grade Point Average (CGPA): It is a measure of cumulative performance of a student over all the completed semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed upto two decimal places.

Curriculum: Curriculum incorporates the planned interaction of students with instructional content, materials, resources and processes for evaluating the attainment of Program Educational Objectives.

Degree with Specialization: A student who fulfills all the program requirements of her/his discipline and successfully completes a specified set of professional elective courses in a specialized area is eligible to receive a degree with specialization like Structural Engineering, Embedded Systems, CSE, etc.

Department: An academic entity that conducts relevant curricular and co-curricular activities, involving both teaching and non-teaching staff and other resources in the process of study for a degree.

Detention in a course: Student who does not obtain minimum prescribed attendance in a course shall be detained in that particular course.

Dropping from the Semester: A student who doesn't want to register for any semester can apply in writing in prescribed format before commencement of that semester.

Elective Course: A course that can be chosen from a set of courses. An elective can be Professional Elective and/or Open Elective.

Evaluation: Evaluation is the process of judging the academic performance of the student in her/his courses. It is done through a combination of continuous internal assessment and semester end examinations.

Grade: It is an index of the performance of the students in a said course. Grades are indicated by alphabets.

Grade Point: It is a numerical weight allotted to each letter grade on a 10 point scale.

Institute: Means Institute of Aeronautical Engineering, Hyderabad unless indicated otherwise by the context.

Massive Open Online Course (MOOC): MOOC courses inculcate the habit of self learning. MOOC courses would be additional choices in all the elective group courses.

Pre-requisite: A course, the knowledge of which is required for registration into higher level course.

Core: The courses that are essential constituents of each engineering discipline are categorized as professional core courses for that discipline.

Professional Elective: A course that is discipline centric. An appropriate choice of minimum number of such electives as specified in the program will lead to a degree with specialization.

Program: Means, Master of Technology (M.Tech) degree program / UG degree program: B.Tech.

Program Educational Objectives: The broad career, professional and personal goals that every student will achieve through a strategic and sequential action plan.

Project work: It is a design or research based work to be taken up by a student during his/her second year to achieve a particular aim. It is a credit based course and is to be planned carefully by the student.

Re-Appearing: A student can reappear only in the semester end examination for the theory component of a course, subject to the regulations contained herein.

Registration: Process of enrolling into a set of courses in a semester of a Program.

Regulations: The regulations, common to all M.Tech programs offered by Institute are designated as "IARE-R16" and are binding on all the stakeholders.

Semester: It is a period of study consisting of 15 to 18 weeks of academic work equivalent to normally 90 working days. The odd semester starts usually in July and even semester in December.

Semester End Examinations: It is an examination conducted for all courses offered in a semester at the end of the semester.

S/he: Means "she" and "he" both.

Student Outcomes: The essential skill sets that need to be acquired by every student during her/his program of study. These skill sets are in the areas of employability, entrepreneurial, social and behavioral.

University: Means the Jawaharlal Nehru Technological University Hyderabad, Hyderabad.

Withdraw from a Course: Withdrawing from a course means that a student can drop from a course within the first two weeks of the odd or even semester (deadlines are different for summer sessions). However s/he can choose a substitute course in place of it by exercising the option within 5 working days from the date of withdrawal.

Words 'he', 'him', 'his', occur, they imply 'she', 'her', 'hers' also.

FOREWORD

The autonomy is conferred to Institute of Aeronautical Engineering (IARE), Hyderabad by University Grants Commission (UGC), New Delhi based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like J N T University Hyderabad (JNTUH), Hyderabad and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system** and **monitoring mechanism**, independent of the affiliating University but under its observance.

IARE is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the institute and recommendations of the JNTUH to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the institute to order to produce a quality engineering graduate to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

ACADEMIC REGULATIONS

M.Tech. Regular Two Year Degree Program
(for the batches admitted from the academic year 2016 - 17)

For pursuing two year postgraduate Master Degree program of study in Engineering (M.Tech) offered by Institute of Aeronautical Engineering under Autonomous status and herein after referred to as IARE.

1.0 CHOICE BASED CREDIT SYSTEM

The Indian Higher Education Institutions (HEI's) are changing from the conventional course structure to Choice Based Credit System (CBCS) along with introduction to semester system at first year itself. The semester system helps in accelerating the teaching learning process and enables vertical and horizontal mobility in learning.

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

Choice Based Credit System (CBCS) is a flexible system of learning and provides choice for students to select from the prescribed elective courses. A course defines learning objectives and learning outcomes and comprises of lectures / tutorials / laboratory work / field work / project work / comprehensive examination / viva / seminars / assignments / presentations / self-study etc. or a combination of some of these.

Under the CBCS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

The CBCS permits students to:

1. Choose electives from a wide range of elective courses offered by the departments of the Institute.
2. Undergo additional courses of interest.
3. Adopt an inter-disciplinary approach in learning.
4. Make the best use of expertise of the available faculty.

2.0 MEDIUM OF INSTRUCTION

The medium of instruction shall be English for all courses, examinations, seminar presentations and project work. The curriculum will comprise courses of study as given in course curriculum in accordance with the prescribed syllabi.

3.0 ELIGIBILITY FOR ADMISSION

The admissions for category A and B seats shall be as per the guidelines of Telangana State Council for Higher Education (TSCHE) in consonance with government reservation policy.
a) Under Category A: 70% of the seats are filled based on GATE/PGECET ranks.
b) Under Category B: 30% seats are filled on merit basis as per guidelines of TSCHE.

4.0 UNIQUE COURSE IDENTIFICATION CODE

Every specialization of the M. Tech programme will be placed in one of the seven groups as listed in the Table 1.

Table 1: Group of Courses

S. No	Specialization	Offering Department	Code
1	Structural Engineering	Civil Engineering	ST
2	Power Electronics and Electrical Drives	Electrical and Electronics Engineering	PE
3	CAD / CAM	Mechanical Engineering	CC
4	Embedded Systems	Electronics and Communication Engineering	ES
5	Computer Science and Engineering	Computer Science and Engineering	CS
6	Software Engineering	Information Technology	SE
7	Aerospace Engineering	Aeronautical Engineering	AE

5.0 TYPES OF COURSES

Courses in a programme may be of two kinds: **Core and Elective.**

5.1 Core Course:

There may be a core course in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in said discipline of study.

5.2 Elective Course:

Electives provide breadth of experience in respective branch and applications areas. Elective course is a course which can be chosen from a pool of courses. It may be:

- Supportive to the discipline of study
- Providing an expanded scope
- Enabling an exposure to some other discipline/domain
- Nurturing student's proficiency/skill.

An elective may be discipline centric (Professional Elective) focusing on those courses which add generic proficiency to the students or may be chosen from supportive/general discipline called as "Open Elective".

There shall be four professional elective groups out of which students can choose not more than two courses from each group. Overall, students can opt for four professional elective courses

which suit their project work in consultation with the faculty advisor/mentor. In addition, one course from each of the two open electives has to be selected. A student may also opt for more elective courses in his/her area of interest.

6.0 SEMESTER STRUCTURE

The institute shall follow semester pattern. An academic year shall consist of a first semester and a second semester and the summer term. Each semester shall be of 23 weeks (Table 2) duration and this period includes time for course work, examination preparation and conduct of examinations. Each main semester shall have a minimum of 90 working days; out of which number of contact days for teaching / practical shall be 75 and 15 days shall be for examination preparation. The duration for each semester shall be a minimum of 17 weeks of instruction. The Academic Calendar is declared at the beginning of the academic year as given in Table 2.

Table 2: Academic Calendar

FIRST SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation and Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
SECOND SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 Week	
	Preparation & Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Summer Vacation			4 weeks
THIRD SEMESTER	Project Work Phase - I		18 weeks
FOURTH SEMESTER	Project Work Phase - II		18 weeks

7.0 PROGRAM DURATION

A student shall be declared eligible for the award of M.Tech degree, if s/he pursues a course of study and completes it successfully in not less than two academic years and not more than four academic years. A student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the year of his/her admission, shall forfeit his/her seat in M.Tech course.

a) A student will be eligible for the award of M.Tech degree on securing a minimum of 5.0/10.0 CGPA.

b) In the event of non-completion of project work and/or non-submission of the project report by the end of the fourth semester, the candidate shall re-register by paying the semester fee for the

project. In such a case, the candidate will not be permitted to submit the report earlier than three months and not later than six months from the date of registration.

8.0 CURRICULUM AND COURSE STRUCTURE

The curriculum shall comprise Core Courses, Elective Courses, Laboratory Course, Comprehensive Examination, Internship and Project Work. The list of elective courses may include subjects from allied disciplines also.

Each Theory and Laboratory course carries credits based on the number of hours/week as follows:

- **Lecture Hours (Theory):** 1 credit per lecture hour per week.
- **Laboratory Hours (Practical):** 1 credit for 2 practical hours, 2 credits for 3 or 4 practical hours per week.
- **Project Work:** 1 credit for 4 hours of project work per week.

8.1 Credit distribution for courses offered is shown in Table 3.

Table 3: Credit distribution

S. No	Course	Hours	Credits
1	Core Courses	3	3
2	Elective Courses	3	3
3	MOOC Courses	-	2
4	Laboratory Courses	3	2
5	Seminar and Technical Writing	3	2
6	Comprehensive Examination	-	2
7	Project Work	128	30

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (06) + Professional Electives (04) + Open Electives (02)	06 @ 3 credits + 06 @ 3 credits	36
Total Laboratory Courses (03)	03 @ 2 credits	06
MOOC Courses (02)	02 @ 2 credits	04
Seminar and Technical Writing (01)	1 @ 2 credits	02
Comprehensive Examination (01)	1 @ 2 credits	02
Project Work	1 @ 30 credits	30
TOTAL CREDITS		**80**

9.0 EVALUATION METHODOLOGY

9.1 Theory Course:

Each theory course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIE during the semester, marks are awarded by taking average of two sessional examinations.

9.1.1 Semester End Examination (SEE):

The SEE shall be conducted for 70 marks of 3 hours duration. The syllabus for the theory courses shall be divided into FIVE units and each unit carries equal weightage in terms of marks distribution. The question paper pattern shall be as defined below. Two full questions with 'either' 'or' choice will be drawn from each unit. Each question carries 14 marks. There could be a maximum of three sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept
30 %	To test the analytical skill of the concept
20 %	To test the application skill of the concept

9.1.2 Continuous Internal Assessment (CIA):

For each theory course the CIA shall be conducted by the faculty/teacher handling the course as given in Table 4. CIA is conducted for a total of 30 marks, with 25 marks for Continuous Internal Examination (CIE) and 05 marks for Technical Seminar and Term Paper.

Table 4: Assessment pattern for Theory Courses

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	CIE Exam (Sessional)	Technical Seminar and Term Paper	
Max. CIA	25	5	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration, consisting of 5 one mark compulsory questions in part-A and 4 questions in part-B. The student has to answer any 4 questions out of five questions, each carrying 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Technical Seminar and Term Paper:

Two seminar presentations are conducted during I year I semester and II semester. For seminar, a student under the supervision of a concerned faculty member, shall identify a topic in each course and prepare the term paper with overview of topic. The evaluation of Technical seminar and term paper is for maximum of 5 marks. Marks are awarded by taking average of marks scored in two Seminar Evaluations.

9.2 Laboratory Course:

9.2.1 Each lab will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment. The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being a internal examiner and another is external examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

9.2.2 All the drawing related courses are evaluated in line with lab courses. The distribution shall be 30 marks for internal evaluation (20 marks for day–to–day work, and 10 marks for internal tests) and 70 marks for semester end lab examination. There shall be ONE internal test for 10 marks each in a semester.

9.3 MOOC Courses:

Meeting with the global requirements, to inculcate the habit of self learning and in compliance with UGC guidelines, MOOC (Massive Open Online Course) courses have been introduced as electives.

9.3.1 The proposed MOOC Courses would be additional choices in all the elective groups subject to the availability during the respective semesters and respective departments will declare the list of the courses at the beginning of the semester. Course content for the selected MOOC Courses shall be drawn from respective MOOCs links or shall be supplied by the department. Course will be mentored by faculty members and Assessment and evaluation of the courses shall be done by the department.

9.3.2 There shall be one Mid Sessional Examination (Quiz exam for 30 marks) after 8 weeks of the commencement of the course and semester end evaluation (Descriptive exam for 70 marks) shall be done along with other regular courses.

9.3.3 Two credits will be awarded upon successful completion of each MOOC Course.

9.3.4 Students interested in doing MOOC Courses shall register the course title at their department office at the start of the semester against the courses that are announced by the department.

9.4 Project work

Normally, the project work should be carried out at Host Institute (Institute of Aeronautical Engineering). However, it can also be carried out in any of the recognized Educational Institutions, National Laboratories, Research Institutions, Industrial Organizations, Service Organizations or Government Organizations with the prior permission from the guide and concerned Head of the Department. A student shall submit the outcome of the project work in the form of a dissertation.

9.4.1 The student shall submit the project work synopsis at the end of III semester for Phase-I of project evaluation. The Phase-I of project work shall be evaluated by Project Review Committee (PRC) at the end of the third semester for a maximum of 100 marks. Head of the Department (HOD) shall constitute a PRC comprising of senior faculty of the specialization, Guide and Head of the Department.

9.4.2 The first phase of project work is to be carried out in IV semester for Phase –II of Project work. The student will be allowed to appear for final viva voce examination at the end of IV semester only if s/he has submitted s/he project work in the form of paper for presentation / publication in a conference/journal and produce the proof of acceptance of the paper from the organizers/publishers.

9.4.3 The student shall submit the project work in the form of dissertation at least four weeks ahead of the completion of the program. Head of the Department shall constitute an Internal Evaluation Committee (IEC) comprising of the Chairman BOS (PG), HOD and Guide. As per convenes of all meeting for open pre-submission seminar evaluation of the student. If the open pre-submission seminar by a student is not satisfactory, another seminar shall be scheduled within two weeks.

The evaluation of the project work and the marks allotted are as under:

S.No	Project Phases	Mode	Evaluation Committee	Marks
1	Phase - I	Continuous evaluation at the end of III Semester	Guide	30
2		Evaluation at the end of III Semester	Project Review Committee (PRC) comprising of senior faculty of the specialization, guide and HOD.	70
Total(Phase – I)				**100**
3	Phase - II	An open pre-submission seminar by the student	The Internal Evaluation Committee (IEC) comprising of the Chairman, BOS (PG), HOD and guide wherein the HOD convenes its meeting.	30
4		End Semester Examination (An open seminar followed by viva-voce)	The External Evaluation Committee (EEC) comprising of External Examiner, HOD and guide wherein the HOD shall be the chairman of the committee.	70
Total(Phase-II)				**100**

9.4.4 As soon as a student submits his project work, Principal shall appoint the External Examiner among the panel of examiners recommended by the Chairman, BOS (PG).

9.4.5 The Principal shall schedule the End Semester Examination in project work soon after the completion of the study of program and a student can appear for the same provided s/he has earned successfully all the requisite credits. The student shall produce the dissertation duly certified by the guide and HOD during the Examination.

9.4.6 The project reports of M. Tech students who have not completed their course work successfully will be evaluated in that semester itself and the result sent confidentially to the Controller of Examinations. The results of the project work evaluation will be declared by the Controller of Examinations only after the successful completion of the courses by those students.

9.5 Comprehensive Examination

The comprehensive examination is aimed at assessing the student's understanding of various Foundation, Skill and Core courses studied by the end of II semester and is intended to test the student's grasp of the chosen field of study. The comprehensive examination is an online test evaluated for 100 marks.

10.0 ATTENDANCE REQUIREMENTS AND DETENTION POLICY

10.1 It is desirable for a candidate to put on 100% attendance in each course. In every course (theory/laboratory), student has to maintain a minimum of 80% attendance including the days of attendance in sports, games, NCC and NSS activities to be eligible for appearing in Semester End Examination of the course.

10.2 For cases of medical issues, deficiency of attendance in each course to the extent of 15% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the Department if his/her attendance is between 80% to 65% in every course, subjected to submission of medical certificate and other needful documents to the concerned department.

10.3 The basis for the calculation of the attendance shall be the period prescribed by the institute by its calendar of events. For late admission, attendance is reckoned from the date of admission to the program.

10.3 However, in case of a student having less than 65% attendance in any course, s/he shall be detained in the course and in no case such process will be relaxed.

10.4 Students whose shortage of attendance is not condoned in any subject are not eligible to write their semester end examination of that courses and their registration shall stand cancelled.

10.5 A prescribed fee shall be payable towards Condonation of shortage of attendance.

10.6 A candidate shall put in a minimum required attendance at least in three (3) theory courses for getting promoted to next higher class / semester. Otherwise, s/he shall be declared detained and has to repeat semester.

10.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, s/he shall not be eligible for readmission into the same class.

11.0 CONDUCT OF SEMESTER END EXAMINATIONS AND EVALUATION

11.1 Semester end examination shall be conducted by the Controller of Examinations (COE) by inviting Question Papers from the External Examiners.

11.2 Question papers may be moderated for the coverage of syllabus, pattern of questions by Semester End Examination Committee chaired by Head of the Department one day before the commencement of semester end examinations.

11.3 Internal Examiner shall prepare a detailed scheme of valuation.

11.4 The answer papers of semester end examination should be evaluated by the internal examiner immediately after the completion of exam and the award sheet should be submitted to COE in a sealed cover before the same papers are kept for second evaluation by external examiner.

11.5 In case of difference is more than 15% of marks, the answer paper shall be re-evaluated by a third examiner appointed by the Examination Committee and marks awarded by him shall be taken as final.

11.6 HOD shall invite 3-9 external examiners to evaluate all the end semester answer scripts on a prescribed date(s). Practical laboratory exams are conducted involving external examiners.

11.7 Examination Control Committee shall consolidate the marks awarded by internal and external examiners to award grades.

12.0 SCHEME FOR THE AWARD OF GRADE

12.1 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each theory course, if s/he secures:

i. Not less than 40% marks for each theory course in the semester end examination, and

ii. A minimum of 50% marks for each theory course considering both CIA and SEE

12.2 A student shall be deemed to have satisfied the minimum academic requirements and earn the credits for each Laboratory / Seminar and Technical Writing / Project, if s/he secures

i. Not less than 40% marks for each Laboratory / Seminar and Technical Writing / Project course in the semester end examination,

ii. A minimum of 50% marks for each Laboratory / Seminar and Technical Writing / Project course considering both internal and semester end examination.

12.3 If a candidate fails to secure a pass in a particular course, it is mandatory that s/he shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that s/he should continue to register and reappear for the examination till s/he secures a pass.

13.0 LETTER GRADES AND GRADE POINTS

13.1 Performances of students in each course are expressed in terms of marks as well as in Letter Grades based on absolute grading system. The UGC recommends a 10 point grading system with the following letter grades as given below:

Range of Marks	Grade Point	Letter Grade
100 - 80	10	S (Superior)
70 – 79	9	A+ (Excellent)
60 – 69	8	A (Very Good)
55 – 59	7	B+ (Good)
50 – 54	6	B (Average)
Below 50	0	F (Fail)
Absent	0	Ab (Absent)
Authorized Break of Study	0	ABS

13.2 A student is deemed to have passed and acquired to correspondent credits in particular course if s/he obtains any one of the following grades: “S”, “A+”, “A”, “B+”, “B”.

13.3 A student obtaining Grade “F” shall be considered Failed and will be required to reappear in the examination.

13.4 "SA" denotes shortage of attendance (as per item 10) and hence prevention from writing Semester End Examination.

13.5 At the end of each semester, the institute issues grade sheet indicating the SGPA and CGPA of the student. However, grade sheet will not be issued to the student if s/he has any outstanding dues.

14.0 COMPUTATION OF SGPA AND CGPA

The UGC recommends to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). The credit points earned by a student are used for calculating the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA), both of which are important performance indices of the student. SGPA is equal to the sum of all the total points earned by the student in a given semester divided by the number of credits registered by the student in that semester. CGPA gives the sum of all the total points earned in all the previous semesters and the current semester divided by the number of credits registered in all these semesters. Thus,

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and n represent the number of courses in which a students is registered in the concerned semester.

$$CGPA = \sum_{j=1}^{m} (C_j S_j) / \sum_{j=1}^{m} C_j$$

Where, S_j is the SGPA of the j^{th} semester and C_j is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 x 8 = 24
Course 2	4	B+	7	4 x 7 = 28
Course 3	3	B	6	3 x 6 = 18
Course 4	3	O	10	3 x 10 = 30
Course 5	3	C	5	3 x 5 = 15
Course 6	4	B	6	4 x 6 = 24
	20			**139**

$Thus, SGPA = 139 / 20 = 6.95$

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit: 20 SGPA: 6.9	Credit: 22 SGPA: 7.8	Credit: 25 SGPA: 5.6	Credit: 26 SGPA: 6.0

$$Thus,\ CGPA = \frac{20x6.9 + 22x7.8 + 25x5.6 + 26x6.0}{93} = 6.51$$

16.0 PHOTOCOPY / REVALUATION

A student, who seeks the revaluation of the answer script, is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s) within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation with prescribed fee. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses.

17.0 GRADUATION REQUIREMENTS

The following academic requirements shall be met for the award of M .Tech degree.

17.1 Student shall register and acquire minimum attendance in all courses and secure 80 credits.

17.2 A student who fails to earn 80 credits within four consecutive academic years from the year of his/her admission with a minimum CGPA of 5.0, shall forfeit his/her degree and his/her admission stands cancelled.

18.0 AWARD OF DEGREE

Classification of degree will be as follows:

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

a) In case a student takes more than one attempt in clearing a course, the final marks secured shall be indicated by * mark in the marks memo.

b) All the candidates who register for the semester end examination will be issued grade sheet by the Institute. Apart from the semester wise marks memos, the institute will issue the provisional certificate subject to the fulfillment of all the academic requirements.

19.0 IMPROVEMENT OF GRADE:

A candidate, after becoming eligible for the award of the degree, may reappear for the final examination in any of the theory courses as and when conducted for the purpose of improving the aggregate and the grade. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the degree.

However, this facility shall not be availed of by a candidate who has taken the Original Degree Certificate. Candidates shall not be permitted to reappear either for CIE in any course or for Semester End Examination (SEE) in laboratory courses (including Project Viva-voce) for the purpose of improvement.

20.0 TERMINATION FROM THE PROGRAM

The admission of a student to the program may be terminated and the student may be asked to leave the institute in the following circumstances:

a) The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.

b) The student fails to satisfy the norms of discipline specified by the institute from time to time.

21.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the college / if any case of indiscipline / malpractice is pending against him/her, the results of the candidate will be withheld. The issue of the degree is liable to be withheld in such cases.

22.0 GRADUATION DAY

The institute shall have its own annual Graduation Day for the award of Degrees to students completing the prescribed academic requirements in each case, in consultation with the University and by following the provisions in the Statute.

The college shall institute prizes and medals to meritorious students annually on Graduation Day. This will greatly encourage the students to strive for excellence in their academic work.

23.0 DISCIPLINE

Every student is required to observe discipline and decorum both inside and outside the institute and not to indulge in any activity which will tend to bring down the honor of the institute. If a student indulges in malpractice in any of the theory / practical examination, continuous assessment examinations he/she shall be liable for punitive action as prescribed by the Institute from time to time.

24.0 GRIEVANCE REDRESSAL COMMITTEE

The institute shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD as the members. This Committee shall solve all grievances related to the course under consideration.

25.0 TRANSITORY REGULATIONS

25.1 A student who has been detained in any semester of previous regulations for not satisfying the attendance requirements shall be permitted to join in the corresponding semester of this regulation.

25.2 Semester End Examination in each course under the regulations that precede immediately these regulations shall be conducted three times after the conduct of last regular examination under those regulations. Thereafter, the failed students, if any, shall take examination in the equivalent papers of these regulations as suggested by the Chairman, BOS concerned.

26.0 REVISION OF REGULATIONS AND CURRICULUM

The Institute from time to time may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary and on approval by the Academic Council and the Governing Body shall come into force and shall be binding on the students, faculty, staff, all authorities of the Institute and others concerned.

FAILURE TO READ AND UNDERSTAND THE REGULATIONS IS NOT AN EXCUSE

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

EMBEDDED SYSTEMS

COURSE STRUCTURE

I SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BES001	Embedded C	PC	Core	3	-	-	3	30	70	100
BES002	Wireless LANs and PANs	PC	Core	3	-	-	3	30	70	100
BES003	Computer Architecture	PC	Core	3	-	-	3	30	70	100
	Professional Elective - I	PE	Elective	3	-	-	3	30	70	100
	Professional Elective - II	PE	Elective	3	-	-	3	30	70	100
	Open Elective – I	OE	Elective	3	-	-	3	30	70	100
BES301	MOOC – I (Massive Open Online Course)	PE	Elective	-	-	3	2	30	70	100
PRACTICAL										
BES101	Embedded Programming Laboratory	PC	Core	-	-	3	2	30	70	100
TOTAL				**18**	**00**	**06**	**22**	**240**	**560**	**800**

II SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BES004	Embedded System Architecture	PC	Core	3	-	-	3	30	70	100
BES005	FPGA Architecture and Applications	PC	Core	3	-	-	3	30	70	100
BES006	Internet of Things	PC	Core	3	-	-	3	30	70	100
	Professional Elective -III	PE	Elective	3	-	-	3	30	70	100
	Professional Elective -IV	PE	Elective	3	-	-	3	30	70	100
	Open Elective -II	OE	Elective	3	-	-	3	30	70	100
PRACTICAL										
BES102	Embedded System Laboratory	PC	Core	-	-	3	2	30	70	100
BES103	Application Development Mini Project Laboratory	-	Core	-	-	3	2	30	70	100
TOTAL				**18**	**00**	**06**	**22**	**240**	**560**	**800**

III SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
THEORY										
BES401	Seminar and Technical Writing	PC	Core	-	-	3	2	30	70	100
BES302	MOOC – II (Massive Open Online Course)	PC	Core	3	-	-	2	30	70	100
PRACTICAL										
BES501	Comprehensive Examination	-	Core	-	-	-	2	30	70	100
BES601	Project Work(Phase -I)	-	Core	-	-	-	10	30	70	100
TOTAL				**03**	**00**	**03**	**16**	**120**	**280**	**400**

IV SEMESTER

Course Code	Course Name	Subject Area	Category	Periods per week			Credits	Scheme of Examination Max. Marks		
				L	T	P		CIA	SEE	Total
BES602	Project Work(Phase -II)	-	Core	-	-	-	20	30	70	100
TOTAL				**00**	**00**	**00**	**20**	**30**	**70**	**100**

PROFESSIONAL ELECTIVES

GROUP 1: EMBEDDED SYSTEMS

Course Code	Course Title
BES201	Design of Embedded systems
BES202	Real Time Systems
BES203	Embedded Computing
BES204	Hardware Software Co-Design

GROUP 2: DISTRIBUTED EMBEDDED SYSTEMS AND CONTROL SYSTEMS

Course Code	Course Title
BES205	Principles of Distributed Embedded Systems
BES206	Embedded Control Systems
BES207	Intelligent Embedded Systems
BES208	Robotics and Controls

GROUP 3: EMBEDDED NETWORKING AND APPLICATIONS

Course Code	Course Title
BES209	Embedded Networking
BES210	Embedded Wireless Sensor Networks
BES211	Wireless and Mobile Communications
BES212	Image and Video Processing

GROUP 4: OPERATING SYSTEMS AND EMBEDDED SYSTEM PROGRAMMING

Course Code	Course Title
BES213	Advanced Operating Systems
BES214	Embedded Real Time Operating Systems
BES215	RISC Processor Architecture and programming
BES216	Embedded Linux

OPEN ELECTIVES-I

Course Code	Course Title
BST701	Disaster Management
BPE701	Renewable Energy Systems
BCC701	Automotive Design
BES001	Embedded C *
BCS701	Advanced JAVA Programming and Web Services
BAE701	Introduction to Aerospace Engineering
Note: * indicates that subject not offered to the students of Electronics and Communication Engineering Department.	

OPEN ELECTIVES-II

Course Code	Course Title
BST702	Geo Spatial Techniques
BPE702	Solar Photo Voltaic Energy Conversion
BCC702	Computer Graphics
BES702	Microcontrollers for Embedded System Design*
BCS702	Linux Programming
BCS703	Research Methodology
BAE702	Industrial Aerodynamics and Wind Energy
Note: * indicates that subject not offered to the students of Electronics and Communication Engineering Department.	

SYLLABI

EMBEDDED C

I Semester: ES | Open Elective – I : CSE / SE / AE /(CAD /CAM) / PE/ST

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES001	Core/Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand embedded C and use it for programming embedded system.
II. Apply techniques for data transfer between I/O ports and memory.
III. Apply object oriented programming for designing embedded system.
IV. Use timers to generate time delays.

UNIT-I	PROGRAMMING EMBEDDED SYSTEMS IN C	Classes: 09

Introduction, what is an embedded system, which processor should you use, which programming language should you use, which operating system should you use, how do you develop embedded software, conclusions; Introduction, what's in a name, the external interface of the standard 8051, reset requirements, clock frequency and performance, memory issues, I/O pins, timers, interrupts, serial interface, power consumption ,conclusions.

UNIT-II	SWITCHES	Classes: 09

Introduction, basic techniques for reading from port pins; Example: Reading and writing bytes, example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), example: counting goats, conclusions.

UNIT-III	ADDING STRUCTURE TO THE CODE	Classes: 09

Introduction, object oriented programming with C, the project header (MAIN.H), the port header (PORT.H);

Example: Restructuring the 'Hello Embedded World' example, Example: Restructuring the goat-counting example, further examples and conclusions.

UNIT-IV	MEETING REAL-TIME CONSTRAINTS	Classes: 09

Introduction, creating hardware delays using Timer 0 and Timer 1, example: Generating a precise 50 ms delay, example: Creating a portable hardware delay, Why not use Timer 2? The need for timeout mechanisms, creating loop timeouts and example: Testing loop timeouts, example: A more reliable switch interface, Creating hardware timeouts, example: Testing a hardware timeout, conclusions.

UNIT-V	CASE STUDY: INTRUDER ALARM SYSTEM	Classes: 09
Introduction, The software architecture, key software components used in this example, running the program, the software, conclusions.		
Text Books:		
1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.		
Reference Books:		
1. Nigel Gardner, "The Microchip PIC in CCS C", Ccs Inc, 2nd Revision Edition, 2002.		
Web References:		
1. http://www.keil.com/forum/5973/ 2. http://nptel.ac.in/courses/Webcourse,contents/IIT%20Kharagpur/Embedded%20systems/New_index1.html 3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm 4. http://freevideolectures.com/Course/2999/Embedded-Systems-I/5		
E-Text Books:		
1. http://teachers.teicm.gr/kalomiros/Mtptx/ebooks/eBook%20%20PIC%20Programming%20with%20C.pdf 2. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf 3. http://dsp-book.narod.ru/CPES.pdf 4. http://staff.ustc.edu.cn/~shizhu/WinCE/winCE6%20Fundamentals.pdf 5. http://read.pudn.com/downloads167/ebook/769402/Wrox.Professional.Microsoft.Windows.Embedded.CE.6.0.Nov.2008.eBook-DDU.pdf 6. https://syhpullpdf.files.wordpress.com/2015/05/embedded-systems-textbook-pdf.pdf		

WIRELESS LANS AND PANS

I Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES002	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand different WLAN topologies and transmission techniques
II. Interpret Bluetooth and Zigbee technologies
III. Enhance the understanding of 3G systems and 4G networks.

UNIT-I	WIRELESS SYSTEM & RANDOM ACCESS PROTOCOLS	Classes: 09

Introduction, First and Second Generation Cellular Systems, Cellular Communications from 1G to 3G, Wireless 4G systems, The Wireless Spectrum; Random Access Methods: Pure ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

UNIT-II	WIRELESS LANS	Classes: 09

Introduction, importance of Wireless LANs, WLAN Topologies, Transmission Techniques: Wired Networks, Wireless Networks, comparison of wired and Wireless LANs; WLAN Technologies: Infrared technology, UHF narrowband technology, Spread Spectrum technology

UNIT-III	THE IEEE 802.11 STANDARD FOR WIRELESS LANS	Classes: 09

Network Architecture, Physical layer, The Medium Access Control Layer.

MAC Layer issues: Hidden Terminal Problem, Reliability, Collision avoidance, Congestion avoidance, Congestion control, Security, The IEEE 802.11e MAC protocol

UNIT-IV	WIRELESS PANS	Classes: 09

Introduction, importance of Wireless PANs, The Bluetooth technology: history and applications, technical overview, the Bluetooth specifications, piconet synchronization and Bluetooth clocks, Master-Slave Switch; Bluetooth security; Enhancements to Bluetooth: Bluetooth interference issues, Intra and Inter Piconet scheduling, Bridge selection, Traffic Engineering, QoS and Dynamics Slot Assigment, Scatternet formation

UNIT-V	THE IEEE 802.15 WORKING GROUP FOR WPANS	Classes: 09

The IEEE 802.15.3, The IEEE 802.15.4, ZigBee Technology, ZigBee components and network topologies, The IEEE 802.15.4 LR-WPAN Device architecture: Physical Layer, Data Link Layer, The Network Layer, Applications; IEEE 802.15.3a Ultra wideband.

Text Books:

1. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks", World Scientific, 2nd Edition, 2011.
2. Vijay K.Garg, "Wireless Communications and Networking", Morgan Kaufmann Publishers, 1st Edition, 2009.

Reference Books:

1. Kaveh Pahlaram, Prashant Krishnamurthy, "Wireless Networks", PHI,1st Edition, 2002.
2. Marks Ciampor, Jeorge Olenewa, "Wireless Communication", Cengage Learning, 1st Edition, 2007.

Web References:

1. nptel.ac.in/courses/106105080/pdf/M5L7.pdf
2. https://www.iith.ac.in/~tbr/teaching/docs/wireless_lans.pdf
3. textofvideo.nptel.iitm.ac.in/117102062/lec2.pdf

E-Text Books:

1. http://as.wiley.com/WileyCDA/WileyTitle/productCd-0471720690.html
2. www.ece.rochester.edu/courses/ECE586/lectures/WLANs_WPANs.pdf
3. http://www.freebookcentre.net/Networking/WirelessLanBooks.html

COMPUTER ARCHITECTURE

I Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES003	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the principles of instruction set for use in compiler design.
II. Understand data hazards and limitations of instruction level parallelism.
III. Use memory hierarchy in distributed shared memory processing.

UNIT-I	**FUNDAMENTALS OF COMPUTER DESIGN**	**Classes: 09**

Technology trends, cost measuring and reporting performance quantitative principles of computer design, classifying instruction set, memory addressing, type and size of operands, addressing modes for signal processing, operations in the instruction set, instructions for control flow, encoding an instruction set, the role of compiler.

UNIT-II	**INSTRUCTION LEVEL PARALLELISM**	**Classes: 09**

overcoming data hazards, reducing branch costs, high performance instruction delivery, hardware based speculation, limitation of ILP; Compiler techniques, static branch protection, VLIW approach, hardware support for more ILP at compile time: hardware verses software solutions.

UNIT-III	**MEMORY HIERARCHY DESIGN**	**Classes: 09**

Cache performance, reducing cache misses penalty and miss rate, virtual memory, protection and examples of VM.

Symmetric shared memory architectures, distributed shared memory, synchronization, multi threading.

UNIT-IV	**STORAGE SYSTEMS**	**Classes: 09**

Types, Buses, RAID, errors and failures, bench marking a storage device, designing an I/O system.

UNIT-V	**INTER CONNECTION NETWORKS AND CLUSTERS**	**Classes: 09**

Interconnection network media, practical issues in interconnecting networks, examples, clusters, designing a cluster.

Text Books:

1. John. Hennessy, David A. Patterson Morgan Kufmann, "Computer Architecture a Quantitative Approach", Elsevier, 4th Edition, 2007.

Reference Books:

1. Kai Hwang, A. Briggs, "Computer Architecture and Parallel Processing", Mc Graw Hill, International Edition, 1986.
2. Dezso Sima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architectures", Pearson Education, 2nd Edition, 2009.

Web References:

1. http://nptel.ac.in/video.php?subjectId=106102062
2. http://nptel.ac.in/courses/106105033/

E-Text Books:

1. http://chandansingh.co.in/download/Computer%20Architecture%20A%20Quantitative%20Approach,%204th%20Edition.pdf
2. http://www.studynama.com/community/threads/194-Advanced-Computer-Architecture-Ebook-Notes-PDF-Download-for-CS-IT-Engineers
3. http://googleforgenius.blogspot.in/2014/02/advanced-computer-architecture-by-kai.html
4. http://www.freebookcentre.net/CompuScience/Free-Computer-Architecture-Books-Download.html

EMBEDDED PROGRAMMING LABORATORY

I Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES101	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36			Total Classes: 36			

OBJECTIVES:

The course should enable the students to:

I. Use embedded C for reading data from port pins.
II. Understand the interfacing of data I/O devices with microcontroller.
III. Understand serial communication and port RTOS on microcontroller.

LIST OF EXPERIMENTS

Week-1	**LED BLINKING**
Program to toggle all the bits of port P1 continuously with 250 ms delay.	
Week-2	**INTERFACING OF SWITCH AND BUZZER**
Program to interface a switch and a buzzer to two different pins of a port such that the buzzer should sound as long as the switch is pressed.	
Week-3	**INTERFACING OF LCD**
Program to interface LCD data pins to port P1 and display a message on it	
Week-4	**INTERFACING SEVEN SEGMENT DISPLAY**
Program to interface seven segment display	
Week-5	**INTERFACING OF KEYPAD**
Program to interface keypad. Whenever a key is pressed, it should be displayed on LCD	
Week-6	**SERIAL COMMUNICATION**
Program to transmit message from microcontroller to PC serially using RS232. Program to receive a message from PC to microcontroller serially using RS232	
Week-7	**INTERFACING OF STEPPER MOTOR**
Program to interface Stepper Motor to rotate the motor in clockwise and anticlockwise directions	
Week-8	**INTERFACING TEMPERATURE SENSOR**
Program to read data from temperature sensor and display the temperature value.	

Week-9	**PORTING OF RTOS**
Port RTOS on to 89V51 Microcontroller and verify. Run 2 to 3 tasks simultaneously on 89V51 SDK. Use LCD interface, LED interface, Serial communication.	
Week-10	**INTERFACING OF ADC**
Program to convert analog signal into digital (ADC)	
Week-11	**INTERFACING OF DAC**
Program to convert Digital into Analog (DAC)	
Week-12	**INTERFACING OF ELEVATOR**
Program to interface Elevator.	

Reference Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.
2. Nigel Gardner, "The Microchip PIC in CCS C". Ccs Inc, 2nd Revision Edition, 2002.

SOFTWARE AND HARDWARE REQUIREMENTS FOR 18 STUDENTS

SOFTWARE:

System Software: Microsoft windows/ Linux
Programming Languages: Keil Embedded C.

HARDWARE:

18 numbers of Intel Desktop Computers with 2 GB RAM
Dot matrix Printers: 02

EMBEDDED SYSTEM ARCHITECTURE

II Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES004	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understanding of fundamental embedded systems design paradigms, architectures,
II. Interpret possibilities and challenges, both with respect to software and hardware,
III. Analyze a system both as whole and in the included parts, to understand how these parts interact in the functionality and properties of the system

UNIT-I	**INTRODUCTION TO EMBEDDED SYSTEMS**	**Classes: 09**

Embedded system model, embedded standards, block diagrams, powering the hardware: Embedded board using von Neuman model; EMBEDDED processors: ISA architecture models, application specific ISA models and general purpose ISA models: Instruction level parallelism.

UNIT-II	**PROCESSOR HARDWARE**	**Classes: 09**

Internal processor design: ALU, registers, control unit, clock, on chip memory, processor i/o, interrupts, processor buses, processor performance.

UNIT-III	**SUPPORT HARDWARE**	**Classes: 09**

Board memory: ROM, RAM, cache , auxiliary memory, memory management, memory performance, board buses: Arbitration and timing, PCI bus example, integrating bus with components, bus performance.

UNIT-IV	**SOFTWARE**	**Classes: 09**

Middleware and applications: PPP, IP middleware UDP, Java. Application layer: FTP client, SMTP, HTTP server and client.

UNIT-V	**ENGINEERING ISSUES OF SOFTWARE**	**Classes: 09**

Design and development: architectural patterns and reference models: Creating the architectural structures, documenting the architecture, analyzing and evaluating the architecture, debugging testing, and maintaining.

Text Books:

1. Tammy Noergaard, “Embedded system architecture”, Elsevier, 2006.

Reference Books:
1. Jean J. Labrosse, “Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C”, the publisher Paul Temme, 2011.
Web References:
1. http://www.nptelvideos.in/2012/11/embedded-systems.html 2. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm
E-Text Books:
1. http://www.sciencedirect.com/science/book/9780750677929 2. https://books.google.co.in/books/about/Embedded_systems.html?id=tgLm2g8KnH0C

FPGA ARCHITECURE AND APPLICATIONS

II Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES005	Core	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

I. Understand the architecture of various FPGA and CPLD
II. Design and implementation ASIC targeting to FPGA/CPLD
III. Understand different types of programming technologies and logic devices.

UNIT-I	INTRODUCTION TO PROGRAMMABLE LOGIC DEVICES	Classes: 09

Introduction, simple programmable logic devices: Read only memories; Programmable logic arrays, Programmable array logic, Programmable logic devices/Generic array logic; Complex programmable logic devices: Architecture of Xilinx cool runner XCR3064XL CPLD, CPLD implementation of a parallel adder with accumulation.

UNIT-II	FIELD PROGRAMMABLE GATE ARRAYS	Classes: 09

Organization of FPGAs, FPGA programming technologies and Programmable logic block architectures, programmable interconnects, programmable I/O blocks in FPGAs, dedicated specialized components of FPGAs and applications of FPGAs.

UNIT-III	SRAM PROGRAMMABLE FPGAS	Classes: 09

Introduction, programming technology, device architecture, the Xilinx XC2000, XC3000 and XC4000 architectures.

UNIT-IV	ANTI-FUSE PROGRAMMED FPGAS	Classes: 09

Introduction, programming technology, device architecture, the Actel ACT1, ACT2 and ACT3 architectures.

UNIT-V	DESIGN APPLICATIONS	Classes: 09

General design issues, counter examples, fast video controller and position tracker for a robot manipulator, fast DMA controller, designing counters with ACT devices, designing adders and accumulators with the ACT architecture.

Text Books:

1. Stephen M. Trimberger, "Field Programmable Gate Array Technology", Springer International Edition, 1st Editon, 1994.
2. Charles H. Roth Jr, Lizy Kurian John, "Digital Systems Design", Cengage Learning, 2nd Edition, 2012.

Reference Books:

1. John V. Oldfield, Richard C. Dorf, "Field Programmable Gate Arrays", Wiley India, 1st Edition, 2008.
2. Pak K. Chan/Samiha Mourad, "Digital Design Using Field Programmable Gate Arrays", Pearson Low Price Edition, 1999.
3. Ian Grout, "Digital Systems Design with FPGAs and CPLDs, Elsevier, Newnes, 1st Edition, 2008.
4. Wayne Wolf, "FPGA based System Design", Prentice Hall, Modern Semiconductor Design Series, 2004.

Web References:

1. http://www.slideshare.net/yayavaram/unit-i-programmable-logic
2. http://www.slideshare.net/yayavaram/cpld-fpga-cpld-fpga-architectures-applications
3. https://www.scribd.com/doc/24072222/m-tech-Cpld-Fpga-Architecture-Applications
4. http://nptel.ac.in/syllabus/117108040/

E-Text Books:

1. nptel.ac.in/syllabus/syllabus_pdf/117108040.pdf
2. http://www.nptel.ac.in/courses/108105057/Pdf/Lesson-20.pdf
3. http://nptel.ac.in/courses/117108040/downloads/Introduction.pdf
4. http://nptel.ac.in/courses/117108040/

INTERNET OF THINGS

II Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES006	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Learn the basic issues, policy and challenges in the Internet
II. Understand the components and the protocols in Internet
III. Build a small low cost embedded system with the internet
IV. Understand the various modes of communications with internet
V. Learn to manage the resources in the Internet
VI. Deploy the resources into business
VII. Understand the cloud and internet environment.

UNIT-I	INTRODUCTION	Classes: 09

Definition – phases – Foundations – Policy– Challenges and Issues - identification - security – privacy. Components in internet of things: Control Units – Sensors – Communication modules – Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – Rflinks – Mobile Internet – Wired Communication

UNIT-II	PROGRAMMING THE MICROCONTROLLER FOR IOT	Classes: 09

Ecosystem, embedded communications software, software partitioning, module and task decomposition: Partitioning case study , protocol software, debugging protocols, tables and other data structures, table access routines, buffer and timer management, management software, device and router management: CLI based management and HTTP based management, agent to protocol interface, device to manager communication, system setup, boot and post-boot configuration, saving and restoring the configuration.

UNIT-III	RESOURCE MANAGEMENT IN THE INTERNET OF THINGS	Classes: 09

Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object.

Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.

UNIT-IV	BUSINESS MODELS FOR THE INTERNET OF THINGS	Classes: 09

The Meaning of DiY in the Network Society- Sensor-actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY

Internet of Things Semantic Interoperability as a Requirement for DiY Creation

-Ontology- Value Creation in the Internet of Things-Application of Ontology Engineering in the Internet of Things-Semantic Web-Ontology - The Internet of Things in Context of EURIDICE - Business Impact

UNIT-V	FROM THE INTERNET OF THINGS TO THE WEB OF THINGS	Classes: 09

Resource-oriented Architecture and Best Practices- Designing REST ful Smart Things - Web- enabling Constrained Devices - The Future Web of Things - Set up cloud environment – send data from microcontroller to cloud – Case studies – Open Source e-Health sensor platform – Be Close Elderly monitoring – Other recent projects.

Text Books:

1. Charalampos Doukas , Building Internet of Things with the Arduino, Create space, April 2002
2. Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011

Reference Books:

1. Luigi Atzor et.al, "The Internet of Things: A survey, ", Journal on Networks, Elsevier Publications, October 2010

Web References:

1. http://postscapes.com/
2. http://www.theinternetofthings.eu/what-is-the-internet-of-things

E-Text Books:

1. https://mitpress.mit.edu/books/internet-things
2. http://atkinsapps.uncc.edu/etextbooks
3. https://cloud.oracle.com/iot?tabname=LearnMoreInfo&lmResID=1441186561464

EMBEDDED SYSTEMS LABORATORY

II Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES102	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36			Total Classes: 36			

OBJECTIVES:

The course should enable the students to:

I. Use embedded C for reading data from port pins.
II. Understand the interfacing of data I/O devices with microcontroller.
III. Understand serial communication, port RTOS on microcontroller.

LIST OF EXPERIMENTS

PROGRAMMES ON ARM7 (LPC2148)

Week-1	**LED BLINKING**
Program to toggle all the led to port and with some time delay.	
Week-2	**INTERFACING OF LCD**
Interface LCD to ARM7 and display message on screen.	
Week-3	**INTERFACING OF KEYPAD**
Interface keypad with ARM7.	
Week-4	**INTERFACING OF LED**
Interface LED with ARM7.	
Week-5	**INTERFACING OF STEPPER MOTOR**
Stepper motor interfacing.	
Week-6	**INTERFACING OF DC MOTOR**
DC motor interfacing.	

PROGRAMMES ON PSOC (CY8C29466,24X1)

Week-7	**PROGRAMMABLE GAIN AMPLIFIER**
Study and characterization of the Programmable Gain Amplifier (PGA): Gain Bandwidth Product.	

Week-8	**FILTERS**
Realization of Low pass, High pass and Band pass filters and their characterization.	
Week-9	**ADC AND DAC**
Experiments with on-chip ADC's and DAC's.	
Week-10	**DIGITAL FUNCTION IMPLEMENTATION**
Digital Function Implementation using Digital Blocks. a. Timer experiment b. Counter for blinking LED c. PWM experiment d. Digital buffer and digital inverter.	
Week-11	**ALU OPERATIONS**
Logical/Arithmetic function implementation using Microcontroller.	
Week-12	**TIMER**
Timer operation in different Modes.	

Reference Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.
2. Nigel Gardner, "The Microchip PIC in CCS C". Ccs Inc, 2nd Revision Edition, 2002.

SOFTWARE AND HARDWARE REQUIREMENTS FOR 18 STUDENTS

SOFTWARE:

System Software: Microsoft windows/ Linux.
Programming Languages: Keil Embedded C.

HARDWARE:

20 numbers of Intel Desktop Computers with 2 GB RAM
Dot matrix Printers: 02

DESIGN OF EMBEDDED SYSTEMS

Group I: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES201	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand different development tools like assembler, compiler in the design of embedded systems.
II. Design embedded system using RTOS.
III. Discuss on aspects required in developing a new embedded processor, different phases and modeling of embedded system.

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 09

Introduction to embedded systems, build process for embedded systems, structural units in embedded processor, selection of processor and memory devices; DMA: memory management methods, timer and counting devices, watchdog timer, real time clock, software development tools-idle, assembler, compiler, linker, simulator, debugger, in circuit emulator, target hardware debugging, need for hardware-software partitioning, co-design.

UNIT-II	EMBEDDED NETWORKING	Classes: 09

Embedded networking: introduction, i/o device ports & buses, serial bus communication protocols RS232 standard, RS485, USB, CAN bus, inter integrated circuits (I^2C) , interrupt sources, programmed, I/O busy, wait approach without interrupt service mechanism, ISR concept, multiple interrupts, context and periods for context switching, interrupt latency and deadline, device driver; Introduction to basic concept of parallel port & serial port device drivers.

UNIT-III	RTOS BASED EMBEDDED SYSTEM DESIGN	Classes: 09

Introduction to basic concepts of RTOS: Need, task, process and threads, interrupt routines in RTOS, multiprocessing and multitasking, preemptive and non-preemptive scheduling, task communication, shared memory, message passing.

Inter process Communication: Synchronization between processes, semaphores, mailbox, pipes, priority inversion, priority inheritance, comparison of real time operating systems: VxWorks, OS-II, RT Linux

UNIT-IV	FUNDAMENTALS OF UML	Classes: 09

Overview of UML, scope of UML, conceptual model of UML, architectural, metamodel, unified software development lifecycle, UML diagram: Timing, task diagram modeling techniques: Structural, behavioral, activity diagrams, simple patterns.

UNIT-V	EMBEDDED SYSTEM APPLICATION DEVELOPMENT	Classes: 09

Objective, need, different phases and modeling of the EDLC, choice of target architectures for embedded application development-for control dominated-data dominated systems, case studies on digital camera, adaptive cruise control in a car, mobile phone software for key inputs.

Text Books:

1. Rajkamal, 'Embedded system-Architecture, Programming, Design", Tata Mc Graw Hill, 3rd Edition, 2011.
2. James K. Peckol, "Embedded system Design", John Wiley &Sons, 1st Edition, 2010.
3. Lyla B Das, "Embedded Systems-An Integrated Approach", Pearson, 1st Edition ,2013.
4. Elicia White, "Making Embedded Systems", O'Reilly Series, SPD, 1st Edition, 2011.
5. Bruce Powel Douglass, "Real-Time UML Workshop for Embedded Systems", Elsevier, 1st Edition, 2011.

Reference Books:

1. Michael Blaha and James Rambaugh, "Oriented Modeling and Design with UML", Pearson, 2nd Edition, 2004.
2. Jorgen Staunstrup, Wayne Wolf, "Hardware /Software Co-Design: Principles and Practice", Kluwer Academic Pub, 1st Edition, 1997.
3. Shibu. K. V, "Introduction to Embedded Systems", Tata Mc Graw Hill, 1st Edition, 2009
4. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006
5. Jonathan W. Valvano, "Embedded Microcomputer Systems -Real Time Interfacing", Cengage Learning, 3rd Edition, 2012.

Web References:

1. http://www.materialdownload.in/article/ET7008-Advanced-Embedded-Systems_2/
2. http://nptel.ac.in/courses/108102045/
3. http://freevideolectures.com/Course/2341/Embedded,Systems
4. http://www.nptelvideos.in/2012/11/embedded-systems.html

E-Text Books:

1. http://esd.cs.ucr.edu/
2. http://www.springer.com/us/book/9789400702561
3. https://books.askvenkat.com/2015/08/embedded-systems-textbook-by-rajkamal.html
4. http://www.learningace.com/doc/1171017/687ac7f7f2ead6905a267c765dd835d0/m-e-_embedded-system-technologies_

REAL TIME SYSTEMS

Group I: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES202	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Understand the process of real-time system design.
II. Use different scheduling algorithms for design of real time systems
III. Identify the tools and programming language for development of real time systems.

UNIT-I	INTRODUCTION	Classes: 09

Introduction, issues in real time computing, structure of a real time system, task classes performance measures for real time systems, estimating program run times, characteristics of real time systems, classification of real time systems, applications of real time systems, safety and reliability; Basic concepts of scheduling: Real time applications, basic concepts for real time task scheduling; Scheduling of independent tasks: Basic on-line algorithms for periodic tasks: Hybrid task sets scheduling.

UNIT-II	SCHEDULING IN REAL,TIME SYSTEMS	Classes: 09

Scheduling of dependent tasks: Tasks with precedence relations ships, tasks sharing critical resources, scheduling schemes for handling overload: Scheduling techniques in overload conditions, handling real time tasks with varying timing parameters, handling overload conditions for hybrid task sets. Multiprocessor scheduling: Introduction, first results and comparison with uni processor scheduling, schedulability conditions, scheduling algorithms.

UNIT-III	PROGRAMMING LANGUAGES AND TOOLS	Classes: 09

Structures facilitating hierarchical decomposition, packages, run time (exception) error handling overloading and generics, multitasking.

Low level programming, task scheduling, timing specifications, programming environments, run-time support, taxonomy of real time software architectures.

UNIT-IV	REAL-TIME SYSTEM DESIGN	Classes: 09

General introduction to design of real time systems: Specification document, preliminary design, single program approach, foreground/background system, multi-tasking approach, mutual exclusion, monitors rendezvous; Real time system development methodologies: Yourdon methodology, Ward and Mellor method, Hatley and Pirbhai method; MASCOT: Basic features of MASCOT , General design approach textual representation of MASCOT designs, other features, Paisley System for real time software development. Design analysis: Petri Nets.

UNIT-V	FAULT TOLERANCE AND RELIABILITY EVALUATION TECHNIQUES	Classes: 09

Fault tolerance techniques, fault types, fault detection, fault error containment, redundancy, data diversity, reversal checks, integrated failure handling. Reliability evaluation techniques: Obtaining parameter values, reliability models for hardware redundancy, software error models; Case studies: Advanced control in thermal power plants / current status of microcomputer applications in railway transportation systems.

Text Books:

1. C.M. Krishna, Kang G. Shin, "Real-Time Systems", Mc Graw Hill International Editions, 1997.
2. Stuart Bennett, "Real-time Computer Control", Pearson Education Ltd,2nd Edition, 2012.

Reference Books:

1. Francis Cottet, Joelle Delacroix and Zoubir Mammeri, "Scheduling in Real-Time Systems", John Wiley & Sons Ltd., 2002.
2. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education.
3. Pittsburgh, "The Concise Handbook of Real-Time Systems", Time Sys Corporation, PA, 2002.
4. Spyros G Tzafestas and J K Pal, "Real Time Microcomputer Control of Industrial Processes", Kluwer Academic Publishers, the Netherlands, 1990.

Web References:

1. http://www.materialdownload.in/article/Real-Time-Systems_71/
2. http://nptel.ac.in/courses/106105036/2
3. http://www.nptelvideos.in/2012/11/real-time-systems.html
4. http://iiscs.wssu.edu/drupal/node/4450
5. http://faculty.cs.tamu.edu/bettati/Courses/663/Video/presentation.html

E-Text Books:

1. http://freecomputerbooks.com/Real,Time,Systems,Architecture,Scheduling,and,Application.html
2. http://www.springer.com/us/book/9781441982360
3. http://bookboon.com/en/paulos,part,i,ebook
4. textofvideo.nptel.iitm.ac.in/106105036/lec1.pdf

EMBEDDED COMPUTING

Group I: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES203	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the operating system concepts and inter process communication.
II. Use tools like simulator, assembler and debugger
III. Understand the interrupts and interrupt latency to handle interrupts for design of embedded systems.

UNIT-I	PROGRAMMING ON LINUX PLATFORM	Classes: 09

System calls, scheduling, memory allocation, timers, embedded linux, root file system, busybox; Operating system overview: Processes, tasks, threads, multi-threading, semaphore and message queue.

UNIT-II	INTRODUCTION TO SOFTWARE DEVELOPMENT TOOLS	Classes: 09

GNU GCC, make, gdb, static and dynamic linking, C libraries, compiler options, code optimization switches, lint, code profiling tools.

UNIT-III	INTERFACING MODULES	Classes: 09

Sensor and actuator interface, data transfer and control, GPS.

GSM module interfacing with data processing and display, open CV for machine vision, audio signal processing.

UNIT-IV	NETWORKING BASICS	Classes: 09

Sockets, ports, UDP, TCP/IP, client server model, socket programming, 802.11, Bluetooth, ZigBee, SSH, firewalls, network security.

UNIT-V	IA32 INSTRUCTION SET	Classes: 09

Application binary interface, exception and interrupt handling, interrupt latency, assemblers, assembler directives, macros, simulation and debugging tools.

Text Books:

1. Peter Barry and Patrick Crowley, "Modern Embedded Computing", Elsevier/Morgan Kaufmann, 1st Edition, 2012.
2. Michael K. Johnson, Erik W. Troan, "Linux Application Development", Adission Wesley, 1st Edition, 1998.
3. Kip R. Irvine, "Assembly Language for x86 Processors", Pearson, 7th Edition, 2014.
4. Intel® 64 and IA-32 Architectures Software Developer Manuals

Reference Books:

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, "Operating System Concepts". Wiley, 9th Edition, 2013.
2. Maurice J. Bach Prentice Hall, "The Design of the UNIX Operating System", Prentice Hall, 1st Edition, 1986.
3. W. Richard Stevens, "UNIX Network Programming", Addison-Wesley Professional, 3rd Edition, 2003.

Web References:

1. http://video.tu,clausthal.de/vorlesung/469.html
2. https://chess.eecs.berkeley.edu/eecs149/
3. https://www.coursera.org/learn/iot/lecture/Gah7g/lecture-1-1-what-are-embedded-systems

E-Text Books:

1. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm
2. http://store.elsevier.com/Modern,Embedded,Computing/Peter,Barry/isbn,9780123914903/
3. www.csie.ntu.edu.tw/~b91066/Embedded%20Computing(2005).pdf

HARDWARE SOFTWARE CO-DESIGN

Group I: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES204	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil		Practical Classes: Nil			Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Differentiate the various prototyping and emulation techniques for co-design models.
II. Understand the compilation techniques for embedded processor architecture.
III. Use verification tools for verification of co-design.

UNIT-I	CO-DESIGN ISSUES	Classes: 09

Co-design models, architectures, languages and a generic co-design methodology; Co-synthesis algorithms: hardware software synthesis algorithms: Hardware, software partitioning distributed system co-synthesis.

UNIT-II	PROTOTYPING AND EMULATION	Classes: 09

prototyping and emulation techniques, prototyping and emulation environments, future developments in emulation and prototyping architecture specialization techniques, system communication infrastructure target architectures: Architecture specialization techniques, system communication infrastructure, target architecture and application system classes, architecture for control dominated systems 8051,Architectures for High performance control, architecture for data dominated systems ADSP21060, TMS320C60, mixed systems.

UNIT-III	COMPILATION TECHNIQUES	Classes: 09

Modern embedded architectures, embedded software development needs.

Compilation technologies, practical consideration in a compiler development environment.

UNIT-IV	DESIGN SPECIFICATION AND VERIFICATION	Classes: 09

Design, co-design, the co-design computational model, concurrency coordinating concurrent computations, interfacing components, design verification, implementation verification, verification tools, interface verification.

UNIT-V	LANGUAGES FOR SYSTEM	Classes: 09

Level specification and design-I system, level specification, design representation for system level synthesis, system level specification languages; Level specification and design-II: Heterogeneous specifications and multi language co-simulation, cosyma system and lycos system.

Text Books:

1. Jorgen Staunstrup, Wayne Wolf, "Hardware / Software Co-Design Principles and Practice", Springer, 2nd Edition, 2009.
2. Giovanni De Micheli, Mariagiovanna Sami, "Hardware / Software Co-Design", Kluwer Academic Publishers, 1st Edition, 2012.

Reference Books:

1. Patrick R. Schaumont , "A Practical Introduction to Hardware/Software Co-design," Springer Issues and Practices", Elsevier, 1st Edition, 2005.

Web References:

1. http://www.springer.com/in/book/9781461437369
2. http://www.springer.com/us/book/9781441960009
3. http://rijndael.ece.vt.edu/gezel2/book

E-Text Books:

1. http://www.tik.ee.ethz.ch/education/lectures/hswcd/
2. http://freevideolectures.com/Course/3401/Digital-System-design-with-PLDs-and-FPGAs/8

PRINCIPLES OF DISTRIBUTED EMBEDDED SYSTEMS

Group II: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES205	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the design principles of distributed embedded systems.
II. Design CAN network based systems.
III. Understand RTOS to design embedded system.

UNIT-I	**REAL-TIME ENVIRONMENT**	**Classes: 09**

Real-time computer system requirements, classification of real time systems, simplicity, global time, internal and external clock synchronization, real time model. Real time communication, temporal relations, dependability, power and energy awareness, real time communication, event triggered, rate constrained, time triggered.

UNIT-II	**REAL-TIME OPERATING SYSTEMS**	**Classes: 09**

Inter component communication, task management and dual role of time; Inter task interactions, process input/output, agreement protocols, error detection.

UNIT-III	**SYSTEM DESIGN**	**Classes: 09**

Scheduling problem, static and dynamic scheduling, system design.

Validation, time-triggered architecture.

UNIT-IV	**INTRODUCTION TO CAN**	**Classes: 09**

Introduction to CAN open CAN open standard, object directory, electronic data sheets and devices.

UNIT-V	**CAN STANDARDS**	**Classes: 09**

Configuration files, service data objectives, network management CAN open messages, device profile encoder.

Text Books:

1. Hermann Kopetz, "Real–Time systems-Design Principles for distributed Embedded Applications", Springer, 2nd Edition, 2011.
2. Glaf P. Feiffer, Andrew Ayre and Christian Keyold, "Embedded networking with CAN and CAN open", Copperhill Media Corporation, 1st Edition, 2008.

Reference Books:

1. Rajkamal, 'Embedded system-Architecture-Programming-Design", Tata Mc Graw Hill, 3rd Edition, 2011.
2. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley and sons, 2nd Edition, 2002.
3. Lyla B Das, "Embedded Systems-An Integrated Approach", Pearson, 1st Edition, 2013.
4. David E. Simon, "An Embedded Software Primer", Pearson Education, 1st Edition, 1999.

Web References:

1. https://www.youtube.com/watch?v=Uk9zFrEGguM
2. http://freevideolectures.com/blog/2010/11/130-nptel-iit-online-courses/

E-Text Books:

1. http://esd.cs.ucr.edu/
2. http://dsp-book.narod.ru/ESDUA.pdf
3. www.intel.com/education/highered/Embedded/Syllabus/Embedded_syllabus.pdf
4. dmi.uib.es/~jproenza/SistEncTR/Introduction.pdf

EMBEDDED CONTROL SYSTEMS

Group II: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES206	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Differentiate different I/O devices for design of embedded control system
II. Understand the different types of sensors used in embedded control system
III. Understand how to test the embedded control system.

UNIT-I	**CONTROL SYSTEM BASICS**	**Classes: 09**

Z-transforms, performance requirements, block diagrams, analysis and design, sampling theory, Z-transform method for solving difference equations.

UNIT-II	**CONTROL SYSTEM IMPLEMENTATION**	**Classes: 09**

Discretization method, fixed point mathematics, nonlinear controller elements -gain scheduling, controller implementation and testing in embedded systems; A case study of robotic control system.

UNIT-III	**CONTROL SYSTEM TESTING**	**Classes: 09**

Software implications, controller implementation.

Testing in embedded systems, measuring frequency response.

UNIT-IV	**INPUT DEVICES**	**Classes: 09**

keyboard basics, keyboard scanning algorithm, character LCD modules, LCD module display configuration, time of day clock, timer manager, interrupts, interrupt service routines, interrupt driven pulse width modulation; Triangle waves analog vs. digital values, auto port detect, capturing analog information in the timer interrupt service routine, automatic, multiple channel analog to digital data acquisition.

UNIT-V	**OUTPUT DEVICES AND SENSORS**	**Classes: 09**

H-bridge, relay drives, DC/stepper motor control, optical devices; Linear and angular displacement sensors: Resistance sensor and induction displacement sensor, digital optical displacement sensor, pneumatic sensors; Speed and flow rate sensors: Electromagnetic sensors, fluid flow sensor, thermal flow sensor; Force sensors: Piezo electric sensors , strain gauge sensor, magnetic flux sensor , inductive pressure sensor, capacitive pressure sensor; Temperature sensors: Electrical, thermal expansion, optical case study, examples for sensor, actuator, control circuits with applications.

Text Books:

1. Jim Ledin, "Embedded control systems in C/C++", CMP Books, 1st Edition, 2004.
2. TimWiscott, "Applied control for embedded systems", Elsevier Publications, 1st Edition, 2006.

Reference Books:

1. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", The publisher, Paul Temme, 1st Edition, 2011.
2. Ball S. R., "Embedded microprocessor Systems, Real World Design", Prentice Hall, 2nd Edition,2002.
3. Lewin A. R. W. Edwards, "Open source robotics and process control cookbook", Elsevier Publications, 1st Editon, 2005.
4. Ben- Zion Sandler, "Robotics", Elsevier Publications, 1st Edition, 1999.

Web References:

1. https://www.youtube.com/watch?v=89-7xrtkUZA
2. http://www.idsc.ethz.ch/education/lectures/embedded-control-systems.html
3. http://in.mathworks.com/videos/automatic-code-generation-for-embedded-control-systems-106530.html

E-Text Books:

1. https://books.askvenkat.com/2013/10/embedded-systems-textbook-by-shibu.html
2. web.eecs.umich.edu/~jfr/embeddedctrls/files/embedded_controls_intro_W09.pdf
3. http://www.e,booksdirectory.com/listing.php?category=616
4. https://en.wikibooks.org/wiki/Embedded_Control_Systems_Design

INTELLIGENT EMBEDDED SYSTEMS

Group II: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES207	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Apply fuzzy logic for development of intelligent embedded system.
II. Understand the neural networks and to use for development of embedded system.
III. Design intelligent embedded system using neural network concepts.

UNIT-I	INTRODUCTION AND BASIC CONCEPTS	Classes: 09

Introduction, Humans and Computers, the structure of the brain, learning in machines, the differences; Basic neuron, Introduction, modeling the single neuron, learning in simple neurons and the perception: A vectorial perspective, the perception learning rule, proof, limitations of perceptrons.

UNIT-II	MULTILAYER NETWORKS	Classes: 09

The multi layer perceptron: Introduction, altering the perception model, the new model, the new learning rule and multi layer perception algorithm, XOR problem; Multi layer feed forward networks, error back propagation training algorithm: problems with back propagation, Boltzman training, Cauchy training, combined back propagation, Cauchy training.

UNIT- III	RESONANT NETWORKS AND APPLICATIONS	Classes: 09

Hop field networks: Recurrent and bidirectional associative memories, counter propagation network.

Artificial Resonance Theory (ART) application of neural network: Hand written digit and character recognition, traveling sales man problem, neuro and controller.

UNIT- IV	FUZZY SET THEORY	Classes: 09

Introduction to fuzzy set theory: Fuzzy set vs. Crisp set, properties of fuzzy sets, operations on fuzzy set, fuzzy compliments, fuzzy intersection, T, norms, fuzzy union- t-co-norm, fuzzy relations.

UNIT-V	FUZZY LOGIC AND FUZZY SYSTEMS	Classes: 09

Classical logic, multi valued logic, fuzzy propositions, fuzzy quantifiers, linguistic hedges and their inferences, fuzzy controllers, fuzzy systems and neural networks, fuzzy neural networks, fuzzy automata, fuzzy dynamic system.

Text Books:

1. G.J.Klir & Bo Yuan, "Fuzzy Sets and Fuzzy Logic Theory and Applications", Prentice Hall of India, 2nd Edition, 2009.
2. Timothy S.Ross, "Fuzzy Logic with engineering applications", Weily India Pvt. Ltd., 3rd Edition, 2011.
3. Kosko B, "Neural Networks and Fuzzy Systems: A dynamical system approach to machine intelligence", Prentice Hall of India, 1st Edition, 2009.

Reference Books:

1. R Beale & T Jackson, "Neural Computing, An Introduction", Adam Hilger, 1990.
2. Rao V.B and Rao H.V., "C++, Neural Networks and Fuzzy Logic", BPB Publications, 2003.
3. Simon Kendal, Malcolm Creen, "An Introduction to Knowledge Engineering", Springer-Verlag Limited, 2007.

Web References:

1. http://videolectures.net/acai05_berthold_fl/
2. http://freevideolectures.com/Course/2348/Intelligent-Systems-and-Control/16

E-Text Books:

1. http://as.wiley.com/WileyCDA/WileyTitle/productCd,047074376X.html
2. http://sipi.usc.edu/~mendel/book/
3. iauctb.ac.ir/.../fuzzy%20logic%20with%20engineering%20application-3rdEdition.pdf

ROBOTICS AND CONTROL

Group II: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES208	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand robot terminologies and robotics sensors for controls of robotics.
II. Apply different robot control techniques for control of robotics.
III. Understand the robot dynamics to design robotics.

UNIT-I	**INTRODUCTION AND TERMINOLOGIES**	**Classes: 09**

Definition, Classification, History, Robots components, Degrees of freedom, Robot joints, coordinates, Reference frames, workspace; Robot languages, actuators, sensors: Position, velocity and acceleration sensors, torque sensors, tactile and touch sensors, proximity and range sensors, vision system, social issues.

UNIT-II	**KINEMATICS**	**Classes: 09**

Mechanism, matrix representation, homogenous transformation, DH representation, Inverse kinematics, solution and programming, degeneracy and dexterity.

UNIT-III	**DIFFERENTIAL MOTION AND PATH PLANNING**	**Classes: 09**

Jacobian-differential motion of frames, Interpretation.

Calculation of Jacobian, Inverse Jacobian, Robot Path planning.

UNIT-IV	**DYNAMIC MODELLING**	**Classes: 09**

Lagrangian mechanics, two-DOF manipulator, Lagrange-Euler formulation, Newton- Euler formulation, Inverse dynamics.

UNIT-V	**ROBOT CONTROL SYSTEM**	**Classes: 09**

Linear control schemes, joint actuators, decentralized PID control, computed torque control, force control, hybrid position force control, Impedance/ Torque control.

Text Books:

1. R.K. Mittal and I J Nagrath, " Robotics and Control", Tata Mc Graw Hill, 1st Edition, 2003.
2. Saeed B. Niku ,"Introduction to Robotics ", Pearson Education, 1st Edition, 2002.

Reference Books:

1. K S Fu, Gonzalez, C S Lee, "Robotics: Control, Sensing, Vision and Intelligence ", Mc Graw Hill, international edition, 1987.
2. R.D. Klafter, TA Chmielewski and Michael Negin, "Robotic Engineering- An Integrated approach", Prentice Hall of India, 1st Edition, 2003.
3. Steve heath, "Embedded system design", Elsevier, 2nd Edition, 2004.

Web References:

1. http://www.gettextbooks.com/author/SAEED_B_NIKU
2. http://nptel.ac.in/video.php?subjectId=112101099
3. http://nptel.ac.in/courses/112101099/

E-Text Books:

1. http://www.springer.com/us/book/9781846286414
2. http://www.robotee.com/index.php/download-free-robotic-e-books/
3. http://www.e-booksdirectory.com/listing.php?category=279
4. http://bookboon.com/en/automation-and-robotics-ebook

EMBEDDED NETWORKING

Group III: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES209	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand embedded communication protocols to implement in embedded networking.
II. Design of CAN network based systems
III. Use UDP, TCP and FTP in design of embedded networks.

UNIT-I	EMBEDDED COMMUNICATION PROTOCOLS	Classes: 09

Embedded Networking: Introduction, serial/parallel communication, serial communication protocols,RS232 standard,RS485,synchronous serial protocols, serial peripheral interface ,inter integrated circuits I^2C– pc parallel port programming , ISA/PCI bus protocols, firewire.

UNIT-II	USB AND CAN BUS	Classes: 09

USB bus, introduction, speed identification on the bus, USB states, USB bus communication: Packets ,data flow types, enumeration, descriptors, PIC 18 microcontroller USB interface, C programs; CAN bus: Introduction, frames, bit stuffing, types of errors, nominal bit timing, PIC microcontroller CAN interface, simple application with CAN.

UNIT-III	ETHERNET BASICS	Classes: 09

Elements of a network, inside Ethernet, building a network: Hardware options, cables, connections and network speed.

Design choices: Selecting components, Ethernet controllers, using the internet in local and communications, inside the Internet protocol.

UNIT-IV	EMBEDDED ETHERNET	Classes: 09

Exchanging messages using UDP and TCP: Serving web pages with dynamic data, serving web pages that respond to user Input, email for embedded systems, using FTP, keeping devices and network secure.

UNIT-V	WIRELESS EMBEDDED NETWORKING	Classes: 09

Wireless sensor networks: Introduction, applications, network topology, localization, time synchronization, energy efficient MAC protocols, SMAC, energy efficient and robust routing, data centric routing.

Text Books:

1. Frank Vahid, Tony Givargis, "Embedded Systems Design: A Unified Hardware/Software Introduction" John & Wiley Publications, 1st Edition, 2002
2. Jan Axelson, "Parallel Port Complete: Programming, interfacing and using the PCs parallel printer port", Penram Publications, 1st Edition, 1996.

Reference Books:

1. Dogan Ibrahim, "Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F series" Elsevier, 1st Edition, 2008.
2. Jan Axelson, "Embedded Ethernet and Internet Complete", Penram publications, 2nd Edition, 2003.
3. Bhaskar Krishnamachari, "Networking Wireless Sensors", Cambridge press, 1st Edition, 2005.

Web References:

1. http://nptel.ac.in/courses/108102045/26
2. http://freevideolectures.com/Course/2341/Embedded-Systems/27
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm

E-Text Books:

1. www.nptel.ac.in/courses/108105057/Pdf/Lesson-26.pdf
2. www.nptel.ac.in/courses/108105057/Pdf/Lesson-3.pdf
3. emanager.srmuniv.ac.in/elibrary/temp/CAN_and_CANopen.pdf
4. https://www.crcpress.com/Embedded-and-Networking-Systems-Design-Software-and-Implementation/Khan-Iniewski/p/book/9781466590656

EMBEDDED WIRELESS SENSOR NETWORKS

Group III: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES210	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the concepts of sensor networks to use in embedded wireless sensor networks.
II. Use sensor programming in wireless sensor networks
III. Analyze wireless sensor networks for different applications.

UNIT-I	INTRODUCTION TO WSN	Classes: 09

Introduction to WSN, challenges for WSNs, characteristic requirements, required mechanisms, single node architecture, hardware components, energy consumption of sensor nodes, operating systems and execution environments, some examples of sensor nodes.

UNIT-II	NETWORK ARCHITECTURE	Classes: 09

Sensor network scenarios, optimization goals and figures of merit, design principles for WSNs, service interfaces of WSNs, gateway concepts.

UNIT-III	SENSOR NETWORK IMPLEMENTATION	Classes: 09

Sensor programming, introduction to tiny OS programming and fundamentals of programming sensors using nes C.

Algorithms for WSN: Techniques for protocol programming.

UNIT-IV	PROGRAMMING MODELS	Classes: 09

An introduction to the concept of cooperating objects and sensor networks, system architectures and programming models.

UNIT-V	CASE STUDIES	Classes: 09

Wireless sensor networks for environmental monitoring, wireless sensor networks with mobile nodes, autonomous robotic teams for surveillance and monitoring, Inter-vehicle communication networks.

Text Books:

1. Holger karl, Andreas Willig, "Protocols and architectures for wireless sensor networks", John Wiley, 1st Edition, 2005.
2. Liljana Gavrilovska, Srdjan Krco, Veljko Milutinovic, Ivan Stojmenovic, Roman Trobec, "Application and Multidisciplinary Aspects of Wireless Sensor Networks", Springer, London Limited, 1st Edition, 2011.

Reference Books:

1. Michel Banatre, Pedro Jose Marron, Anibal Ollero, A. Dam Wolisz, "Cooperating Embedded Systems and Wireless Sensor Networks", John Wiley & Sons, 1st Edition, 2008.
2. Seetharaman Iyengar, Nandhan, "Fundamentals of Sensor Network Programming Applications and Technology", John Wiley & Sons, 1st Edition, 2008.

Web References:

1. https://www.youtube.com/watch?v=e_Db58EEeAI
2. https://www.youtube.com/watch?v=LSRMmXCMlbQ

E-Text Books:

1. www.nptel.ac.in/courses/108105057/Pdf/Lesson-27.pdf
2. users.uom.gr/~kpsannis/Book2.pdf

WIRELESS AND MOBILE COMMUNICATIONS

Group III: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES211	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

I. Analyze and design wireless and mobile cellular systems.
II. Understand the routing protocols of wireless networks
III. Understand mobile adhoc networks and tcp over adhoc networks

UNIT-I	INTRODUCTION	Classes: 09

Wireless Transmission-signal propagation-spread spectrum-Satellite Networks-Capacity Allocation-FAMA-DAMA-MAC.

UNIT-II	MOBILE NETWORKS	Classes: 09

Cellular Wireless Networks-GSM-Architecture-Protocols-Connection Establishment-Frequently Allocation-Routing-Handover-Security-GPRA.

UNIT-III	WIRELESS NETWORKS	Classes: 09

Wireless LAN-IEEE 802.11 Standard-Architecture-Services

AdHoc Network- HiperLan - Blue Tooth.

UNIT-IV	ROUTING	Classes: 09

Mobile IP-DHCP- AdHoc Networks-Proactive and Reactive Routing Protocols-Multicast Routing.

UNIT-V	TRANSPORT AND APPLICATION LAYERS	Classes: 09

TCP over Adhoc Networks-WAP-Architecture-WWW Programming Model- WDP-WTLS-WTP-WSP-WAE-WTA Architecture-WML-WML scripts.

Text Books:

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", PHI/Pearson Education, 2003.
2. Jochen Schiller, "Mobile communications", PHI/Pearson Education, Second Edition, 2003.
3. William Stallings, "Wireless communications and Networks", PHI/Pearson Education, 2002.

Reference Books:

1. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile computing", Springer, New york, 2003.
2. C.K.Toh, "AdHoc mobile wireless networks", Prentice Hall, Inc, 2002.
3. Charles E. Perkins, "Adhoc Networking", Addison-Wesly, 2001.

Web References:

1. https://www.vitalsource.com/en-au/textbooks/trades-technology/technology-engineering/mobile-wireless-communications
2. https://books.google.co.in/books/about/Wireless_Communications.html?id=cQJJzA8CCUUC

E-Text Books:

1. http://freecomputerbooks.com/networkWirelessBooks.html
2. https://accessengineeringlibrary.com/browse/wireless-and-cellular-communications-third-edition

IMAGE AND VIDEO PROCESSING

Group III: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES212	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand representation of digital images and video in the spatial (pixel) and frequency domains.
II. Understand principles and methods of motion/optical flow estimation; understand fundamentals of image compression and video compression basics of video transport over the internet.
III. Analyze and interpret the results of image processing methods and algorithms.

UNIT-I	FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS	Classes: 09

Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.

Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

UNIT-II	IMAGE ENHANCEMENT	Classes: 09

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Frequency domain methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.

UNIT-III	IMAGE COMPRESSION	Classes: 09

Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy.

Compression models: Lossy & Lossless, Huffman coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

UNIT-IV	BASIC STEPS OF VIDEO PROCESSING	Classes: 09

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT-V	2-D MOTION ESTIMATION	Classes: 09

Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution

motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Text Books:

1. Gonzaleze and Woods , "Digital Image Processing ", 3rd Edition., Pearson,2007
2. Yao Wang, Joem Ostermann and Ya–quin Zhang , "Video Processing and Communication ", 1st Edition., PH Int

Reference Books:

1. Scotte Umbaugh, "Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools", 2nd Edition, CRC Press, 2011.
2. M. Tekalp, "Digital Video Processing", Prentice Hall International
3. S.Jayaraman, S.Esakkirajan, T.Veera Kumar, "Digital Image Processing", TMH, 2009.
4. John Woods, "Multidimentional Signal, Image and Video Processing and Coding", 2nd Edition, Elsevier.
5. Vipula Singh, "Digital Image Processing with MATLAB and Labview", Elsevier.
   Keith Jack, "Video Demystified – A Hand Book for the Digital Engineer", 5th Edition, Elsevier

Web References:

1. http://nptel.ac.in/courses/117105079/
2. http://nptel.ac.in/video.php?subjectId=117105079
3. http://nptel.ac.in/courses/106105032/

E-Text Books:

1. iitlab.bit.edu.cn/.../Handbook%20of%20Image%20and%20Video%20Processing.pdf
2. www.sciencedirect.com/science/book/9780121197926

ADVANCED OPERATING SYSTEMS

Group IV: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES213	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand and analyze theory and implementation of processes, resource control.
II. Analyze synchronization problems in multiprocessor systems.
III. Understand the concepts of distributed resource management.

UNIT-I	**INTRODUCTION TO OPERATING SYSTEMS**	**Classes: 09**

Overview of computer system hardware, instruction execution, I/O function, interrupts, memory hierarchy, I/O communication techniques, operating system objectives and functions, evaluation of operating system.

UNIT-II	**INTRODUCTION TO UNIX AND LINUX**	**Classes: 09**

Basic commands and command arguments, standard input and output, input/output redirection, filters and editors, shells and operations.

UNIT-III	**SYSTEM CALLS AND INTER PROCESS COMMUNICATION**	**Classes: 09**

System calls and related file structures, Input /output, process creation and termination.

Introduction, file and record locking, client server example, pipes, FIFOs, streams and messages, name spaces, message queues, semaphores, shared memory, sockets and TLI.

UNIT-IV	**COMMUNICATION IN DISTRIBUTED SYSTEMS**	**Classes: 09**

Goals of distributed system, hardware and software concepts, design issues, layered protocols, ATM networks, client, server model, remote procedure call and group communication.

UNIT-V	**SYNCHRONIZATION IN DISTRIBUTED SYSTEMS**	**Classes: 09**

Clock synchronization, mutual exclusion, E-tech algorithms, Bully algorithm and ring algorithm; Atomic transactions; Dead lock in distributed systems, distributed dead lock prevention and distributed dead lock detection.

Text Books:

1. Maurice J. Bach, "The design of the UNIX Operating Systems", PHI, 1st Edition,1986.
2. Andrew. S. Tanenbaum, "Distributed Operating System", PHI, 1st Edition, 1994.
3. Richard Peterson, "The Complete reference LINUX", Mc Graw Hill, 6th Edition, 2007.

Reference Books:

1. Stallings, "Operating Systems: Internal and Design Principles", Pearson Education, 6th Edition, 2011.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson Education, 3rd Edition,
3. Abraham Silberchatz, Peter B. Galvin, Greg Gagne, "Operating System Principles", John Wiley & sons publications, 7th Edition, 2014.
4. Ritchie and Yates, "UNIX User Guide".

Web References:

1. http://nptel.ac.in/syllabus/106106107/
2. http://nptel.ac.in/courses/Webcourse,contents/IISc,BANG/Operating%20Systems/New_index1.html
3. http://nptel.ac.in/downloads/106108101/

E-Text Books:

1. https://www.cs.helsinki.fi/u/ilkkahak/doc/hello2.pdf
2. https://it325blog.files.wordpress.com/2012/.../operating-system-concepts-7th-edition
3. gost.isi.edu/555/fall2012/lectures/usc-csci555-f12-part1.pdf
4. https://www.udacity.com/course/advanced-operating-systems-ud189

EMBEDDED REAL TIME OPERATING SYSTEMS

Group IV: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES214	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand and analyze theory and implementation of tasks.
II. Analyze synchronization problems and to use semaphore operations.
III. Analyze interrupt service routines for interrupts and timers.

UNIT-I	**INTRODUCTION**	**Classes: 09**

Introduction to UNIX/LINUX, overview of commands, file I/O (open, create, close, lseek, read, write), process control (fork, vfork, exit, wait, waitpid, exec).

UNIT-II	**REAL TIME OPERATING SYSTEMS**	**Classes: 10**

Brief history of OS, defining RTOS, Scheduler, objects, services, characteristics of RTOS, defining a task, asks states and scheduling, task operations, structure, synchronization, communication and concurrency, defining semaphores, operations and use, defining message queue, states, content, storage, operations and use.

UNIT-III	**OBJECTS, SERVICES AND I/O**	**Classes: 08**

Pipes, event registers, signals, other building blocks, component configuration.

Basic I/O concepts, I/O subsystem.

UNIT-IV	**EXCEPTIONS, INTERRUPTS AND TIMERS**	**Classes: 10**

Exceptions, interrupts, applications, processing of exceptions and spurious interrupts, real time clocks, programmable timers, timer interrupt service routines, soft timers, operations.

UNIT-V	**CASE STUDIES OF RTOS**	**Classes: 09**

RT linux, Micro C/OS-II, Vx works, embedded linux, tiny OS and basic concepts of android OS.

Text Books:

1. Qing Li, "Real Time Concepts for Embedded Systems", Elsevier, 1st Edition, 2011

Reference Books:

1. Rajkamal, "Embedded Systems, Architecture, Programming and Design", Tata Mc Graw Hill, 2nd Edition, 2003.
2. Richard Stevens, "Advanced UNIX Programming", Addison-Wesley Professional, 3rd Edition, 2013
3. Dr. Craig Hollabaugh, "Embedded Linux: Hardware, Software and Interfacing", Addison Wesley, 1st Edition, 2002.

Web References:

1. http://nptel.ac.in/courses/106105036/
2. https://www.youtube.com/watch?v=rpdygqOI9mM
3. https://www.youtube.com/watch?v=hELr9-7aAG8

E-Text Books:

1. www.nptel.ac.in/courses/108105057/Pdf/Lesson-31.pdf
2. nptel.ac.in/courses/106108101/pdf/Lecture_Notes/Mod%208_LN.pdf

RISC PROCESSOR ARCHITECTURE AND PROGRAMMING

Group IV: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES215	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Describe the programming model of ARM processor and create and test assembly level programming.
II. Understand the processor architecture and organization.
III. Create and test C programming for ARM.

UNIT-I	ARM ARCHITECTURE	Classes: 09

ARM design philosophy, registers, program status register, instruction pipeline, interrupts and vector table, architecture revision, ARM processor families.

UNIT-II	ARM PROGRAMMING MODEL – I	Classes: 09

Instruction set: Data processing instructions, addressing modes and branch, load, store instructions, PSR instructions and conditional instructions.

UNIT-III	ARM PROGRAMMING MODEL – II	Classes: 09

Thumb instruction set: Register usage, other branch instructions and data processing instructions.

Single register and multi register load, store instructions, stack and software interrupt instructions.

UNIT-IV	ARM PROGRAMMING	Classes: 09

Simple C programs using function calls, pointers, structures, integer and floating point arithmetic, assembly code using instruction scheduling, register allocation, conditional execution and loops.

UNIT-V	MEMORY MANAGEMENT	Classes: 09

Cache architecture, polices, flushing and caches, MMU, page tables, translation, access permissions, context switch.

Text Books:

1. Andrew N. Sloss, Dominic Symes, Chris Wright., "ARM Systems Developer's Guides, Designing & Optimizing System Software," Elsevier, 1st Edition, 2008.

Reference Books:

1. Jonathan W. Valvano – Brookes / Cole, "Embedded Microcomputer Systems, Real Time Interfacing", Thomas Learning, 1st Edition, 1998.

Web References:

1. http://nptel.ac.in/courses/106103068/34
2. http://nptel.ac.in/courses/106103068/35
3. http://nptel.ac.in/courses/106103068/
4. http://nptel.ac.in/courses/106108055/5

E-Text Books:

1. nptel.ac.in/courses/Webcourse-contents/IIT.../comp...risc/1_Intro_risc_Suroj.doc
2. nptel.ac.in/reviewed_pdfs/106102062/lec7.pdf

EMBEDDED LINUX

Group IV: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES216	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand fundamentals of Embedded Linux.
II. Use GNU tool chain for Linux programming.
III. Use Linux programming to develop embedded applications.

UNIT-I	**LINUX FUNDAMENTALS**	**Classes: 09**

Introduction, host, target development setup, hardware support , development languages and tools: RT Linux.

UNIT-II	**INITIALIZATION**	**Classes: 09**

Linux kernel and kernel initialization, system initialization – hardware support, boot loaders.

UNIT-III	**DEVICE HANDLING**	**Classes: 09**

Device driver basics, module utilities, file systems, MTD subsystems, busy box.

UNIT-IV	**DEVELOPMENT TOOLS**	**Classes: 09**

Embedded development environment, GNU debugger, tracing and profiling tools, binary utilities, kernel debugging, debugging embedded Linux applications, porting Linux, Linux and real time, SDRAM interface.

UNIT-V	**DEVICE APPLICATIONS**	**Classes: 09**

Asynchronous serial communication interface, parallel port interfacing, USB interfacing, memory I/O interfacing, using interrupts for timing.

Text Books:

1. Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, " Building embedded linux systems", O'Reilly, 2nd Edition, 2008.
2. Christopher Hallinan, "Embedded Linux Primer: A practical real world approach", Prentice Hall, 1st Edition, 2007.

Reference Books:

1. Craig Hollabaugh, "Embedded Linux: Hardware, software and Interfacing", Pearson Education, 1st Edition, 2002.
2. Doug Abbott, "Linux for embedded and real time applications", Elsevier Science, 1st Edition, 2003.

Web References:

1. https://www.youtube.com/playlist?list=PLtVUzTUqnYYq1TsLaU,6Pr,epxYqiR2hM
2. http://www.engineersgarage.com/tutorials/embedded,linux,basics,programming
3. https://training.linuxfoundation.org/free-linux-training/linux-training-videos/introduction-to-embedded-linux
4. http://www.embedded.com/electronics,blogs/open,mike/4420567/Learning-Linux-for-embedded-systems

E-Text Books:

1. https://linuxlink.timesys.com/files/pdf/Timesys-EmbeddedLinuxTutorial.pdf
2. http://www.embeddedcraft.org/elinuxtutorials.html
3. http://www.bogotobogo.com/cplusplus/embeddedSystemsProgramming.php

DISASTER MANAGEMENT

Open Elective I : AE / (CAD/CAM) / CSE / ES / SE /PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The student should enable the students to:

I. Exposure to disasters, their significance and types.
II. Understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
III. Explore on Disaster Risk Reduction (DRR) approaches.
IV. Enhance awareness of institutional processes in the country.
V. Develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live,with due sensitivity.

UNIT-I	INTRODUCTION TO NATURAL AND MANMADE DISASTERS	Classes: 09

Concepts and definitions of Disaster, Hazard, Vulnerability, Resilience, Risks. Impact of drought, review of past disasters and drought in India, its classification and characteristics. Classification of drought, causes, Impacts (including social, economic. political, environmental, health, psychosocial, etc.).

UNIT-II	DISASTER, DIFFERENTIAL IMPACTS, CYCLONES AND FLOODS	Classes: 09

Classifications, Causes, Impacts including social, economic, political, environmental, health, psychosocial etc. Differential Impacts in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, climate change.
Tropical cyclones & Local storms, Destruction by tropical cyclones and local storms, Cumulative atmospheric hazards/ disasters, Cold waves, Heat waves, Causes of floods, Rood hazards in India.

UNIT-III	APPROACHES TO DISASTER RISK REDUCTION	Classes: 09

Disaster cycle, its analysis, phases, culture of safety, prevention, mitigation and preparedness community based Disaster risk reduction.

Structural, nonstructural sources, roles and responsibilities of community, Panchayati raj Institutions, Urban local bodies, states, centre and other stake holders.

UNIT-IV	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	Classes: 09

Factors affecting vulnerabilities, differential impacts, impact of development projects such as darns, embankments, changes in Land-use etc. Climate Change Adaptation, Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-V	DISASTER RISK MANAGEMENT IN INDIA	Classes: 09

Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, OM Act and Policy, other related policies, plans, programmes and legislation).
Field work and case Studies to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the institute is located.

Text Books:

1. Nick, "Disaster Management: A Disaster Manager's Handbook", Asian Development Bank, Manila Philippines, 1991.
2. Kapur, et al., "Disasters in India: Studies of Grim Reality", Rawat Publishers, Jaipur, 2005.
3. Pelling Mark, "The Vulnerability of Cities: Natural Disaster and Social Resilience", Earthscan Publishers, London, 2003.

Reference Books:

1. Sharma, V. K. (1999), "Disaster Management", National Centre for Disaster Management, IIPE, Delhi, 1999.
2. Anil, K. Gupta and Sreeja, S. Nair (2011), "Environmental Knowledge for Disaster Risk Management", NIDM, New Delhi, 2011.

Web References:

1. http://humanityroad.org/
2. http://www.wcpt.org/disaster-management/what-is-disaster-management
3. http://www.ndmindia.nic.in/
4. http://nidm.gov.in/default.asp
5. http://www.unisdr.org/2005/mdgs-drr/national-reports/India-report.pdf

E-Text Books:

1. http://www.ekalavvya.com/disaster-management-in-india-volume-i-free-ebook/
2. http://cbse.nic.in/natural%20hazards%20&%20disaster%20management.pdf
3. http://www.undp.org/content/dam/india/docs/disaster_management_in_india.pdf
4. http://www.digitalbookindex.org/_search/search010emergencydisastera.asp

RENEWABLE ENERGY SYSTEMS

Open Elective I : AE / (CAD / CAM) / CSE / ES / SE / ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPE701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

This course should enable the students to:

I. Illustrate the concept of photo voltaic power generation.
II. Discuss the Magneto hydrodynamic (MHD) and wind energy power conversion systems.
III. Explain tidal and wave energy.
IV. Design energy conversion systems with low impact on environment.
V. Understand the technology of fuel cells.

UNIT-I	PHOTOVOLTAIC POWER GENERATION SYSTEMS	Classes: 09

Photo voltaic power generation: spectral distribution of energy in solar radiation, solar cell configurations, voltage developed by solar cell, photo current and load current, practical solar cell performance, commercial photo voltaic systems, test specifications for PV systems, applications of super conducting materials in electrical equipment systems.

UNIT-II	MHD WIND ENERGY CONVERSION AND WIND POWER GENERATION	Classes:10

Principles of MHD power generation, ideal MHD generator performance, practical MHD generator, MHD technology; Wind Energy conversion: Power from wind, properties of air and wind, types of wind turbines, operating characteristics.

UNIT-III	TIDAL AND WAVE ENERGY CONVERSION	Classes:08

Tides and tidal power stations, modes of operation, tidal project examples, turbines and generators for tidal power generation.

Wave energy conversion: Properties of waves, power content, vertex motion of waves, device applications, types of ocean thermal energy conversion systems application of OTEC systems examples.

UNIT-IV	ENERGY CONVERSION SYSTEMS AND ENVIRONMENTAL EFFECTS	Classes:09

Miscellaneous energy conversion systems: coal gasification and liquefaction, biomass conversion, geothermal energy, thermo electric energy conversion, principles of EMF generation, co generation and energy storage, combined cycle co generation, energy storage; Global energy position and environmental effects: energy units, global energy position.

UNIT-V	FUEL CELLS	Classes:09

Fuel cells: Types of fuel cells, H_2O_2 Fuel cells, application of fuel cells, batteries, description of batteries, battery application for large power, environmental effects of energy conversion systems.

Text Books:

1. Ashok Desai V, Non-Conventional Energy, Wiley Eastern Ltd, 1990.
2. Rakosh das Begamudre, "Energy conversion systems", New age International publishers, New Delhi - 2000.
3. Freris L.L. Prentice Hall1, "Wind energy Conversion Systems", 1990.
4. Spera D.A., "Wind Turbine Technology: Fundamental concepts of wind turbine technology", ASME Press, NY, 1994.

Reference Books:

1. Mittal K.M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, 1997.
2. Ramesh R, Kurnar K.U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 1997.
3. John Twidell, Tony Weir "Renewable Energy Resources", 2nd edition.
4. Kreith, Kreider, "Solar Energy Handbook", McGrawHill

Web References:

1. http://www.nrel.gov/docs/fy13osti/54909.pdf
2. http://www.gisday.com/resources/ebooks/renewable-energy.pdf
3. http://www.geni.org/globalenergy/library/energytrends/currentusage/renewable/Renewable-Energy-Potential-for-India.pdf
4. http://www.cerien.upc.edu/jornades/jiie2005/ponencies/power%20converters%20and%20control%20of%20renewable%20energy%20systems%20paper.pdf
5. https://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-SOLAR_PV.pdf

E-Text Books:

1. http://maxwell.sze.hu/~marcsa/MegujuloEnergiaforrasok/Books/renewable%20energy%20resources.pdf
2. http://lab.fs.uni-lj.si/kes/erasmus/Renewable%20Energy%20Conversion,%20Transmission,%20and%20Storage.pdf
3. http://www.landartgenerator.org/LAGI-FieldGuideRenewableEnergy-ed1.pdf

AUTOMOTIVE DESIGN

Open Elective I : AE / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCC701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand and Specify automotive styling and design principles of automotive exteriors.
II. Analyze automotive exterior design trends.
III. Design automotive exteriors using manual and digital renderings.
IV. Create clay models of automotive exterior design.

UNIT-I	AUTOMOTIVE DESIGN TERMINOLOGY , CLASSIFICATION OF CARS BASED ON BODY STYLE	Classes: 09

Overview, Automotive design terminology, automotive design process and factors influencing automotive design, development and history behind different body styles, micro cars, hatchback and it sub types, sedan and its sub-types, coupe and its variants, convertible and its variants, station wagon, sports utility vehicles, multi utility vehicles.

UNIT-II	PLATFORM TECHNOLOGY, TYPES OF CHASSIS, AND AUTOMOTIVE PACKAGING	Classes: 09

Platform technology, types of chassis, and automotive packaging: Definition, motivation, versions of platform, benefits of platform sharing and downside of platform technology; History of automotive chassis, composite construction, unibody construction, tubular space frame, glass-fibre monocoque chassis, aluminium monocoque construction, carbon fibre monocoque construction, ULSAB type, definition and different layout sectors in packaging, Interior dimensions, exterior dimensions, front end (engine compartment), rear end (luggage space), under-body, major factors influencing automotive packaging, regulatory requirements.

UNIT-III	AUTOMOTIVE FRONT- REAR END DESIGN	Classes: 09

Factors affecting the front end design, front end design for better air cooling, latest design trends, bumper design theme, regulation for bumper design.

Evolution of grille design, grille design as a new brand image, hood design and new trends in exterior design, tail lamp, spoiler, bumper design, overall rear design for aerodynamics.

UNIT-IV	AUTOMOTIVE LIGHTING SYSTEM , AUTOMOTIVE GLASSES	Classes: 09

History and development in automotive lighting, different types of optical system, light sources used in lighting, headlamp design and styling, advanced lighting technology, pedestrian friendly lights, signal lamps, latest trends in automotive lighting, different types of automotive glasses, recent development in automotive glass design, importance of glass in car design, role of glazing for car safety, developments in automotive glass design.

UNIT-V	AUTOMOTIVE EXTERIOR DESIGN, PAINTING , SURFACE PROTECTION	Classes: 09

Design methodology, image boards: lifestyle board, mood board, theme board, design trends, design movements, application of design principles, product aesthetics, different types of corrosion on automotive bodies, corrosion protection methods, automotive body painting procedure, paint components and latest trends in automotive body colors.

Text Books:

1. J.Fenton, "Handbook of Automotive Body and System Design", Professional Engineering Publishing, 1st Edition, 2000.
2. Erik Eckermann, "World History of the Automobile", SAE International, 1st Edition, 2002.

Reference Books:

1. Stephen Newbury, "Car Design Year Book 1 to 5", Marrell, 1st Edition, London, 2007.
2. Tony Lewin, "How to Design Car Like A Pro", Motorbooks International, 1st Edition, 2003

Web References:

1. www.carbodydesign.com
2. www.style4cars.com
3. www.cardesignnews.com

E-Text Books:

1. http://www.sciencedirect.com/science/book/9780750656924
2. http://books.sae.org/r-312/

EMBEDDED C

Open Elective I: AE / (CAD / CAM) / CSE / SE / ST /PEED | I Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES001	Core/Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand embedded C and use it for programming embedded system.
II. Apply techniques for data transfer between I/O ports and memory.
III. Apply object oriented programming for designing embedded system.
IV. Use timers to generate time delays.

UNIT-I	PROGRAMMING EMBEDDED SYSTEMS IN C	Classes: 09

Introduction, what is an embedded system, which processor should you use, which programming language should you use, which operating system should you use, how do you develop embedded software, conclusions; Introduction, what's in a name, the external interface of the standard 8051, reset requirements, clock frequency and performance, memory issues, I/O pins, timers, interrupts, serial interface, power consumption, conclusions.

UNIT-II	SWITCHES	Classes: 09

Introduction, basic techniques for reading from port pins; Example: Reading and writing bytes, example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, Dealing with switch bounce, Example: Reading switch inputs (basic code), example: counting goats, conclusions.

UNIT-III	ADDING STRUCTURE TO THE CODE	Classes: 09

Introduction, object oriented programming with C, the project header (MAIN.H), the port header (PORT.H).

Example: Restructuring the 'Hello Embedded World' example, Example: Restructuring the goat-counting example, further examples and conclusions.

UNIT-IV	MEETING REAL-TIME CONSTRAINTS	Classes: 09

Introduction, creating hardware delays using Timer 0 and Timer 1, example: Generating a precise 50 ms delay, example: Creating a portable hardware delay, Why not use Timer 2? The need for timeout mechanisms, creating loop timeouts and example: Testing loop timeouts, example: A more reliable switch interface, Creating hardware timeouts, example: Testing a hardware timeout, conclusions.

UNIT-V	CASE STUDY: INTRUDER ALARM SYSTEM	Classes: 09

Introduction, The software architecture, key software components used in this example, running the program, the software, conclusions.

Text Books:

1. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.

Reference Books:

1. Nigel Gardner, "The Microchip PIC in CCS C", Ccs Inc, 2nd Revision Edition, 2002.

Web References:

1. http://www.keil.com/forum/5973/
2. http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Embedded%20systems/New_index1.html
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Delhi/Embedded%20Systems%20(Video).htm
4. http://freevideolectures.com/Course/2999/Embedded-Systems-I/5

E-Text Books:

1. http://teachers.teicm.gr/kalomiros/Mtptx/e-books/eBook%20-%20PIC%20Programming%20with%20C.pdf
2. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf
3. http://dsp-book.narod.ru/CPES.pdf
4. http://staff.ustc.edu.cn/~shizhu/WinCE/winCE6%20Fundamentals.pdf
5. http://read.pudn.com/downloads167/ebook/769402/Wrox.Professional.Microsoft.Windows.Embedd
6. ed.CE.6.0.Nov.2008.eBook-DDU.pdf
7. https://syhpullpdf.files.wordpress.com/2015/05/embedded-systems-textbook-pdf.pdf

ADVANCED JAVA PROGRAMMING AND WEB SERVICES

Open Elective I: AE / (CAD/CAM) / ES / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to :

I. Understand OOPS Concepts Describe client side technologies.
II. Implement database connections.
III. Develop the skills to design user interfaces for web Applications.

UNIT-I	INTRODUCTION TO OOPs	Classes: 09

Basic concepts of OOPs: Java History, Java Features, Comparison in Java and C++ ,Java Virtual Machine, Java Environment, Program, Data types, operators, Control Structure, Classes and Objects, Constructors, Interfaces, Exception Handling.

UNIT-II	APPLETS AND SWINGS	Classes: 09

Applets: Introduction to applet, applet vs application, applet class, advantages of applet, applet lifecycle, applet tag, passing parameters to applet, types of applets, examples; swing: introduction to JFC, swing, Swing, Features, JComponent, JApplet, JFrame, JPannel, JButtons, Jcheckboxes and JRadiobuttons, JTextField, JMenu, JMenuBar

UNIT-III	HTML AND XML	Classes: 09

HTML common tags: list, tables, images, forms, frames; cascading style sheets; introduction to java scripts, objects in java script, dynamic HTML with java script.

XML: document type definition, XML schemas, document object model, presenting XML, using XML processors: DOM and SAX.

UNIT-IV	WEB SERVERS,SERVLETS AND JSP	Classes: 09

Web servers: Tomcat server installation and testing, introduction to servelets: lifecycle of a servelet, JSDK, servelet API, javax. servelet package, reading servelet parameters, reading initialization parameters; servlets: javax, servelet HTTP package, handling http request and responses, using cookies session tracking, security issues, JSP: problem with servelet, anatomy of a JSP Page, JSP processing, JSP application design with MVC architecture, AJAX.

UNIT-V	JDBC AND ODBC	Classes: 09

JDBC & ODBC :Java and JDBC , JDBC vs ODBC, JDBC driver model, JDBC driver types, two-tier architecture for data access ,three-tier architecture for data access , types of driver managers, connecting to an ODBC data source, JDBC programs

Text Books:

1. WILEY Dreamtech Chris Bates, "Web Programming, building internet applications", 2nd edition.
2. Patrick Naughton and Herbert Schildt, "The complete Reference Java 2" , TMH, 5th Edition.
3. Hans Bergsten , "Java Server Pages", SPD O"Reilly.

Reference Books:

1. Sebesta, "Programming world wide web", Pearson Core,8th Edition 2008.
2. Marty Hall, Larry Brown, "Servlets and Javaserver Pages", Volume 1: Core Technologies, Pearson 2nd Edition 1998.

Web References:

1. http://engineeringppt.blogspot.in/2010/01/advance-java-web-technology.html
2. http://www.scoopworld.in/2015/02/ajwt-ppt-lab-materials-cse.html
3. http://jntuh.ac.in/new/bulletin_board/WEB_TECHNOLOGIES.pdf

E-Text Books:

1. http://www.freetechbooks.com/advanced-programming-for-the-java-2-platform-t36.html
2. https://www.mkyong.com/featured/top-5-free-java-ebooks/
3. http://www.e-booksdirectory.com/listing.php?category=226

INTRODUCTION TO AEROSPACE ENGINEERING

Open Elective I: (CAD/CAM) / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BAE701	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Outline different aspects of flight vehicles and their operational environment.
II. Description of flow behavior of one-dimensional incompressible and compressible flow, two-dimensional flow and finite wing.
III. Apprise about boundary layer effects, aerodynamic forces on airfoils, wings and high-lift systems.
IV. Analyze airplane performance, stability and control.

UNIT-I	INTRODUCTION TO AERONAUTICS AND ASTRONAUTICS	Classes: 08

Historical perspective of aeronautics and astronautics, anatomy of the airplane, anatomy of a space vehicle, aerodynamic forces; Parameters affecting aerodynamic forces: Dimensional analysis; Theory and experiment, wind tunnels; Atmosphere: Properties of U.S. standard atmosphere, definitions of altitude.

UNIT-II	ONE DIMENSIONAL FLOW IN INCOMPRESSIBLE AND COMPRESSIBLE FLUIDS, TWO DIMENSIONAL FLOW AND FINITE WING	Classes: 10

Continuity equation, Bernoulli's equation; Application of Bernoulli's equation: Airspeed indicators and wind tunnels, one dimensional compressible flow concepts, speed of sound, compressible flow equations in a variable-area stream tube, application to airspeed measurement, applications to channels and wind tunnels; Two dimensional flow and finite wing: Limitations of one dimensional flow equations; Theory of lift: circulation, Airfoil pressure distribution, Helmholtz vortex theorems, Simulating the wing with a vortex Line, downwash, elliptic lift distribution; Lift and drag: Momentum and energy, Slope of finite wing lift curve, verification of Prandtl wing theory, additional effects of wing vortices, search for reduced induced drag.

UNIT-III	VISCOUS EFFECTS, DRAG DETERMINATION, AIRFOILS, WINGS AND HIGH-LIFT SYSTEMS	Classes: 10

Boundary layer, boundary layer on bluff bodies, creation of circulation, laminar and turbulent boundary layers: skin friction, nature of Reynolds number, effect of turbulent boundary layer on separation; Total Incompressible drag: Parasite drag, drag due to lift, importance of aspect ratio; Compressibility drag: Prediction of drag divergence Mach number, sweptback wings, total drag.

Supersonic flow: Shock waves and Mach waves, supersonic wing lift and drag, area rule, supersonic aircraft, airfoils; Wings: early airfoil development, modern airfoils, supersonic airfoils, airfoil pitching moments, effects of sweepback on lift, airfoil characteristics, airfoil selection and wing design; High-lift Devices: Airfoil maximum lift coefficient, leading and trailing edge devices, effect of sweepback, deep stall, effect of Reynolds number, propulsive lift.

UNIT-IV	AIRPLANE PERFORMANCE, STABILITY AND CONTROL, AEROSPACE PROPULSION	Classes: 09
Level flight performance, climb performance, range, endurance, energy-state approach to airplane performance, takeoff performance, landing performance; Static longitudinal stability; Dynamic longitudinal stability; Dynamic lateral stability; Control and maneuverability: Turning performance, control systems, active controls; Aerospace propulsion: Piston engines, gas turbines; Speed limitations of gas turbines: Ramjets, propellers, overall propulsion efficiency, rocket engines, rocket motor performance, propulsion-airframe integration.		
UNIT-V	AIRCRAFT STRUCTURES, HYPERSONIC FLOWS, ROCKET TRAJECTORIES AND ORBITS	Classes: 08
Aircraft structures: Importance of structural weight and integrity, development of aircraft structures, importance of fatigue, materials, loads, weight estimation; Hypersonic flows: temperature effects, Newtonian theory; rocket trajectories, multistage rockets, escape velocity, circular orbital or satellite velocity, elliptical orbits, orbital maneuvers.		

Text Books :

1. Richard S. Shevell, Fundamentals of Flight, Pearson Education Publication, 2nd Edition, 1988.
2. Anderson J. D, "Introduction to Flight", McGraw-Hill, 5th Edition, 1989.
3. Newman D, "Interactive Aerospace Engineering and Design", McGraw-Hill, 1st Edition, 2002.
4. Barnard R.H and Philpot. D.R, "Aircraft Flight", Pearson, 3rd Edition, 2004.

Reference Books:

1. Introduction to Flight, John D. Anderson, Jr., Tata McGraw-Hill Publishing Company, Fifth Edition, Fifth Edition, 2007.
2. Kermode, A. C, "Flight without Formulae", McGraw Hill, 4th Edition, 1997.
3. Swatton P. J, "Flight Planning", Blackwell Publisher, 6th Edition, 2002.

Web References:

1. https://fas.org/irp/doddir/army/fm3-04-203.pdf
2. http://www.aerospaceengineering.es/book/
3. http://www.ne.nasa.gov/education/
4. http://nptel.ac.in

E-Text Books:

1.http://www.e-booksdirectory.com/
2.http://www.adl.gatech.edu/extrovert/Ebooks/ebook_Intro.pdf
3.http://www.academia.edu/7950378/Introduction_to_Flight_-_Anderson_5th_Ed._

GEOSPATIAL TECHNIQUES

Open Elective-II: AE / (CAD/CAM) / CSE / ES / SE /PEED

Course Code	Category	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BST702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. Provide technical skills to use geo-referenced data for the purpose of economic, educational, and social development.
II. Learn the art of image interpretation and mapping.
III. Learn the applications of geospatial technologies.

UNIT-I	INTRODUCTION TO GEOSPATIAL DATA	Classes: 09

Geospatial data, why to study geospatial data, importance of geospatial technology, spatial data infrastructure, three important geospatial technologies, spatial elements., coordinates and coordinate systems, basic electromagnetic radiation.

UNIT-II	PHOTOGRAMMETRY AND REMOTE SENSING	Classes: 10

Definition and scope, history of photogrammetry and remote sensing, principle, remote sensing data acquisition, Remote sensing data analysis methods, advantages and limitations, hardware and software required. Map Vs mosaic, ground control points. Energy interactions with atmosphere and earth surface features.

UNIT-III	MAPPING AND CARTOGRAPHY	Classes: 10

What is map and its importance, map scale and types, elements of map and Indexing, map coordinate systems, visual interpretation of satellite images, and interpretation of terrain evaluation.

Introduction to digital data analysis, cartographic symbolization, classification of symbols, colours in cartography, scale and purpose of a map, cartographic design, thematic cartography, digital cartography.

UNIT-IV	GEOGRAPHIC INFORMATION SYSTEM	Classes:10

Introduction to GIS, definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, theoretical framework for GIS, GIS data structures, data collection and input overview, processing of spatial data, data Input or output, vector data model, raster data model, geometric representation of spatial feature and data structure. Spatial data and modeling, TIN, DTM, overlay, spatial measurement etc.,

UNIT-V	GEOSPATIAL TECHNOLOGIES APPLICATIONS	Classes:09

Visual image analysis for land use / land cover mapping, land use and land cover in water resources, surface water mapping and Inventory, geological and soil mapping, agriculture applications for forestry applications, water resources applications, urban and regional planning, environmental assessment, principles of land form identification and evaluation: sedimentary, igneous and metamorphic rock terrain.

Text Books :

1. John D. Bossler, “Manual of Geospatial Science and Technology” Taylor & Francis.
2. M. Anji Reddy, “Textbook of Remote Sensing and Geographical Information Systems”, BS Publications.

Reference Books:

1. C. P. Lo Albert, K.W. Yonng, “Concepts and Techniques of GIS”, Prentice Hall (India) Publications.
2. Peter A Burragh and Rachael A. Mc Donnell, “Principles of Geo- Physical Information Systems”, Oxford Publishers, 2004.
3. M. Anji Reddy, “Geo-informatics for Environmental Management” BS Publications.

Web References:

1. https://www.aaas.org/content/what-are-geospatial-technologies
2. http://www.istl.org/10-spring/internet2.htmls

E-Text Books:

1. http://www.springer.com/us/book/9781441900494
2. https://www.amazon.com/Introduction-Geospatial-Technologies-Bradley-Shellito/dp/146413345X
3. http://www.springer.com/us/book/9784431555186
4. http://gep.frec.vt.edu/VCCS/materials/2011/Day1/Handouts/1.2-Ch.1_GIS_Intro.pdf
5. http://www.slideshare.net/CuteGirl11/introduction-to-geospatial-technologies-pdf

SOLAR PHOTOVOLTAIC ENERGY CONVERSION

Open Elective II : AE / (CAD / CAM) / CSE / ES / SE / ST

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BPE702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

This course should enable the students to:

I. Illustrate the operation of Photo voltaic power generation.
II. Analyze the characteristics of solar photovoltaic power generation.
III. Design energy conversion systems with low impact on environment.
IV. Understand the technology of fuel cells.

UNIT-I	INTRODUCTION	Classes: 09

Introduction: Highlights, an atomic description of silicon, the effect of light on silicon the potential barrier, the function of the barrier, the potential barrier in action the electric current.

UNIT-II	PHYSICAL ASPECTS OF SOLAR CELL EFFICIENCY	Classes: 09

Physical aspects of solar cell efficiency: Reflection light with too little or too much energy, recombination of electron hole pairs, direct recombination indirect recombination, resistance, self shading, performance degradation at non optimal temperatures, high temperature losses, low temperature losses.

UNIT-III	SINGLE CRYSTAL SILICON SOLAR CELLS AND ARRAYS	Classes: 09

Single Crystal Silicon Solar cells: New fabrication edge, defined film fed growth (dendritic web growth, Ribbon to ribbon (rtr) growth innovative cell designs back surface fields (BSF) and other minority carrier mirrors (MCM). Schottky barrier cells, inversion layer cells, cells for concentrated sun light advances in component technology highlights, PV building blocks, boosting voltage and amperage design requirements for connecting components, the physical connection. placing the cells;

Arrays: Array support, module covers, module cooling, hybrid designs, Brayton cycle, electricity production, the rmo electric generators, intercepting sunlight, arrays with relectors, arrays that follow the sun, controlling intensity, imaging optics, mirrors,
lenses tracking devices, steering mechanisms, tracking device controls, optimizing the use of the spectrum, splitting the spectrum, converting the spectrum to a single color.

UNIT-IV	SOLAR ARRAY CONSTRUCTIONS	Classes: 09

Solar array constructions: Intercepting sunlight, arrays with relectors, arrays that follow the sun, controlling intensity, imaging optics, mirrors, lenses; Tracking devices: steering mechanisms, tracking device controls, optimizing the use of the spectrum, splitting the spectrum, converting the spectrum to a single color.

UNIT-V	PV SUPPORT EQUIPMENT	Classes: 09

PV support equipment: PV vs conventional electricity, storing PV's electricity, batteries, fuel cells, power conditioning equipment the inverter regulators other devices; system analysis, design procedure, design constraints, other considerations.

Text Books:

1. CS Solanki, "Solar photovoltaic's fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., 2011.
2. Rai. G.D, "Solar energy utilization", Khanna publishes, 1993.
3. Rai,G.D., "Non- conventional resources of energy", Khanna publishers, Fourth edition, 2010.

Reference Books:

1. Rai. G.D, "Solar energy utilization", Khanna publishes, 1993.
2. Pai, B. R. and Ram Prasad, "Power Generation through Renewable Sources of Energy", Tata McGraw Hill, New Delhi, 1991.
3. Bansal, Kleeman and Meliss, "Renewable Energy Sources and Conversion Techniques", Tata Mc Graw Hill, 1990.
4. Godfrey Boyl, "Renewable Energy: Power sustainable future", Oxford University Press, Third edition, 2012.
5. B.H.Khan, "Non-Conventional Energy Resources", The McGraw Hills, Second edition, 2009.
6. John W Twidell and Anthony D Weir, "Renewable Energy Resources", Taylor and Francis, 2006.

Web References:

1. http://www.tue.nl/fileadmin/content/faculteiten/tn/PMP/White_papers/Delft2012_-_ALD4PV.pdf
2. http:// www.en.wikipedia.org/wiki/Photovoltaics
3. http://www.desware.net/Sample-Chapters/D06/D10-014.pdf
4. http://www.southampton.ac.uk/~solar/files/Strasbourg.pdf
5. http:// www.science.nasa.gov/science-news/science-at-nasa/2002/solarcells/

E-Text Books:

1. http://www.nrel.gov/docs/legosti/old/1448.pdf
2. http://www.irena.org/DocumentDownloads/Publications/IRENAETSAP%20Tech%20Brief%20E11%20Solar%20PV.pd
3. http://www.opalrt.com/sites/default/files/technical_papers/SOLAR%20PHOTOVOLTAIC%20ENERGY%20GENERATION%20AND%20CONVERSION.pdf

COMPUTER GRAPHICS

Open Elective II: AE / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCC702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the basics of Computer Graphics needed for CAD/ CAM applications.
II. Apply the geometrical modeling for computer graphics.
III. Apply data structures in computer graphics.

UNIT-I	INTRODUCTION TO COMPUTER GRAPHICS	Classes: 09

Introduction: Role of computer graphics in CAD/CAM, configuration of graphic workstations, menu design and graphical user interfaces, customization and parametric programming.

UNIT-II	GEOMETRIC TRANSFORMATIONS, PROJECTIONS AND FUNDAMENTALS OF 2D AND 3D TRANSFORMATIONS	Classes: 09

Geometric transformations and projections: Vector representation of geometric entities, homogeneous coordinate systems; Fundamentals of 2D and 3D transformations: reflection, translation, rotation, scaling, and shearing, various types of projections.

UNIT-III	DEVELOPMENT OF GEOMENTRICAL MODELLING	Classes: 09

Curves: Modeling planar and space curves, analytical and synthetic approaches, non-parametric and parametric equations.

Surfaces: Modeling of bi-parametric freedom surfaces, Coons, Bezier, B-spline, and NURBS surfaces, surface manipulation techniques.

UNIT-IV	GEOMENTRICAL MODELING	Classes: 09

Geometric Modeling: Geometric modeling techniques, wireframe modeling, solid modeling: B Rep CSG, hybrid modelers, feature based, parametric and variation modeling.

UNIT-V	DATA STRUCTURES IN COMPUTER GRAPHICS	Classes: 09

Data Structure in Computer Graphics: Introduction to product data standards and data structures, data-base integration for CIM.

Text Books:

1. D. F. Rogers, J. A. Adams, “Mathematical Elements for Computer Graphics”, Tata McGraw Hill. 1989.
2. I. D. Faux, M. J. Pratt, “Computational Geometry for Design and Manufacture”, Ellis Horwood, 1979.
3. Mortenson, M. E., “Geometric Modeling”, 3rd Ed., Industrial Press. 2006
4. Ibrahim Zeid, “CAD/CAM: Theory and Practice”, Tata McGraw Hill, 1998.
5. B. K. Choi, B. K., “Surface Modeling for CAD/CAM", John Wiley & Sons 1991

Reference Books:
1.C. Pozrikidis, “Introduction to Theoretical and Computational Fluid Dynamics”, Oxford University Press, 2nd Edition, 2013. 2.V. Patankar, Hema shava Suhas , “ Numerical heat transfer and fluid flow”, Tata McGraw Hill
Web References:
1. http://nptel.ac.in/courses/106106090/ 2. http://nptel.ac.in/courses/112102101/
E-Text Books:
1. http://www.freebookcentre.net/CompuScience/Free-Computer-Graphics-Books-Download.html 2.https://docs.google.com/file/d/0B_YZ665nBRhlYmNiOTU5ZDItMmU2OC00YTVmLThiNmMtMjg 3 Y2E3ZTgwZDYw/edit?hl=en_US&pref=2&pli=1

MICROCONTROLLERS FOR EMBEDDED SYSTEM DESIGN

Open Elective II: AE / (CAD / CAM) / CSE / SE / ST /PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BES702	Elective	3	-	-	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

OBJECTIVES:

The course should enable the students to:

I. Understand hardware units and devices for design of embedded systems.
II. Use architectures of embedded RISC processors and system on chip processor design of embedded systems.
III. Analyze interrupt latency, context switching time, for development of device drives for timing devices.

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 09

Overview of embedded systems, processor embedded into a system, embedded hardware units and devices in system, embedded software, complex system design, design process in embedded system, formalization of system design, classification of embedded systems.

UNIT-II	MICROCONTROLLERS	Classes: 09

8051 architecture, input/output ports and circuits, external memory, counters and timers, PIC controllers; Interfacing processor 8051, PIC, memory interfacing, I/O devices, memory controller and memory arbitration schemes.

UNIT-III	EMBEDDED RISC PROCESSORS	Classes: 09

programmable system on chip architectures, continuous timer blocks, switched capacitor blocks, I/O blocks, digital blocks, programming of PSOC;

Embedded RISC processor architecture, ARM processor architecture, registers set, modes of operation and overview of Instructions.

UNIT-IV	INTERRUPTS AND DEVICE DRIVERS	Classes: 09

Exceptions and Interrupt handling Schemes, Context and periods for context switching, deadline and interrupt latency; Device driver using interrupt service routine, serial port device driver and device drivers for internal programmable timing devices.

UNIT-V	NETWORK PROTOCOLS	Classes: 09

Serial communication protocols, Ethernet protocol, SDMA, Channel and IDMA, external bus interface.

Text Books:

1. Raj Kamal, "Embedded Systems, Architecture Programming and Design", Tata Mc Graw Hill, 2nd Edition, 2008.
2. Muhammad Ali Mazidi, Rolin D. Mckinaly, Danny Causy, "PIC Microcontroller and Embedded Systems", Pearson Education, 1st Edition, 2008.

3. Robert Ashpy, “Designers Guide to the Cypress PSOC”, Elsevier, 1st Edition, 2005.

Reference Books:

1. Jonathan W. Valvano – Brookes / Cole, “Embedded Microcomputer Systems, Real Time Interfacing”, Thomas Learning, 1st Edition, 1998.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, “ARM Systems Developers Guides, Design & Optimizing System Software”, Elsevier, 1st Edition, 2004.
3. John B. Peatman, “Designing with PIC Microcontrollers”, PH Inc, 1st Edition, 1998.

Web References:

1. http://nptel.ac.in/syllabus/108102045/
2. http://nptel.ac.in/courses/Webcourse-contents/IIT,KANPUR/microcontrollers/micro/ui/Course_home1_1.Htm

E-Text Books:

1. http://microcontrollershop.com/default.php?cPath=239
2. http://www.sciencedirect.com/science/book/9780750667555
3. https://books.google.co.in/books/about/Embedded_Systems_Design_with_8051_Microc.html?id=YiTa,HChn0UC&redir_esc=y
4. https://books.google.co.in/books/about/Microcontroller_And_Embedded_Systems.html?id=4GrXJeC6HFkC

LINUX PROGRAMMING

Open Elective II: AE / (CAD/CAM) / ES / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to :

I. Understand basic Linux utilities and Shell scripting language (bash) to solve Problems.
II. Explore on implementation of Linux utilities using system calls.
III. Develop the skills necessary for systems programming
IV. Illustrate the basic skills required to write inter process communication programs.

UNIT-I	LINUX UTILITIES	Classes: 09

File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities; Sed-Scripts, Operation, Addresses, Commands, awk-Execution, Fields and Records, Scripts, Operation, Patterns, Actions, Associative Arrays, String and Mathematical functions, System commands in awk, Applications.

UNIT-II	SHELL PROGRAMMING	Classes: 09

Introduction, shell responsibilities, pipes and Redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, debugging shell scripts.

UNIT-III	FILES AND DIRECTORIES	Classes: 09

Files: File types, File System Structure, file metadata: Inodes, kernel support for files, system calls for file I/O operations: open, create, read, write, close, lseek, dup2, file status information: stat family, file and record locking: fcntl function,

File permissions - chmod, fchmod, file ownership, links: soft and hard links: symlink, link, unlink. Directories: Creating, removing and changing Directories, obtaining current working directory: getcwd, Directory contents, Scanning Directories: opendir, readdir, closedir, rewinddir functions.

UNIT-IV	INTERPROCESS COMMUNICATION AND MESSAGE QUEUES	Classes: 09

Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pies-creation, IPC between related processes using unnamed pipes, FIFOs: creation, IPC between unrelated processes using FIFOs(Named pipes), differences between unnamed and named pipes, popen and pclose library functions, Message Queues: Kernel support for messages, APIs for message queues, client/server example. Semaphores-Kernel support for semaphores, APIs for semaphores, file locking with semaphores.

UNIT-V	SHARED MEMORY AND SOCKETS	Classes: 09

Shared Memory: Kernel support for shared memory, APIs for shared memory, shared memory example, Sockets: Introduction to Berkeley Sockets, IPC over a network, Client-Server model, Socket address structures (unix domain and Internet domain), Socket system calls for connection oriented protocol and connectionless protocol.

Text Books:

1. T. Chan , "Unix System Programming using C++", PHI, 2nd Edition,2005.
2. Sumitabha Das, "Unix Concepts and Applications", 4th Edition, TMH, 2011.
3. W. R. Stevens , "Unix Network Programming", PHI, 2nd Edition ,1999.

Reference Books:

1. Mathew, R. Stones, Wrox, "Beginning Linux Programming", Wiley India Edition,4th Edition,2008.
2. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition,Pearson, 2006.
3. Hoover, "SystemProgramming with C and Unix", Pearson, 2nd Edition ,2009.
4. K. A. Robbins, "Unix System Programming, Communication, Concurrency and Threads", Pearson Education, 6th Edition, 2007.

Web References:

1. http://www.fuky.org/abicko/beginning-linux-programming.pdf
2. https://www.pdc.kth.se/about/links/linux-programming-for-beginners
3. http://www.tutorialspoint.com/unix/unix_tutorial.pdf
4. http://www.rpi.edu/dept/arc/training/shell/slides.pdf

E-Text Books:

1. http://onlinevideolecture.com/ebooks/?subject=Linux
2. http://www.onlineprogrammingbooks.com/linux-succinctly/
3. http://ebook-dl.com/item/beginning_linux_programming_4th_edition_neil_matthew_richard_stones/

RESEARCH METHODOLOGY

Open Elective II: AE / (CAD / CAM) / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCS703	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Identify an appropriate research problem in their interesting domain.
II. Organize and conduct research project.
III. Prepare a research project thesis report.
IV. Understand the law of patent and copyrights.
V. Adequate knowledge on process for filing Patent.

UNIT-I	INTRODUCTION	Classes: 09

Definition, types of research, research approaches, research process, validity and reliability in research, features of good design, types of research design, and basic principles of experimental design.

UNIT-II	MEASUREMENT AND SCALING TECHNIQUES	Classes: 09

Errors in measurement, tests of sound measurement, scaling and scale construction techniques, forecasting techniques, time series analysis, interpolation and extrapolation.

UNIT-III	METHODS OF DATA COLLECTION	Classes: 09

Primary data, questionnaire and interviews, collection of secondary data, cases and schedules.

Professional attitude and goals, concept of excellence, ethics in science and engineering, some famous frauds in science, case studies.

UNIT-IV	INTERPRETATION OF DATA AND REPORT WRITING	Classes: 09

Layout of a research paper, techniques of interpretation, making scientific presentation at conferences and popular lectures to semi technical audience, participating in public debates on scientific issues.

UNIT-V	INTRODUCTION TO INTELLECTUAL PROPERTY	Classes: 09

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights; Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law; Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Text Books:

1. C. R. Kothari, "Research Methodology: Methods and Techniques", New Age International Publishers, 2nd Edition, 2004.
2. P. Gupta, "Statistical Methods", Sultan Chand and Sons, New Delhi, 1st Edition, 2005.
3. Richard W. Stim, "Intellectual Property: Patents, Trademarks, and Copyrights", Cengage learning, 2nd Edition, 2001.

Reference Books:

1. P. Narayana Reddy, G. V. R. K. Acharyulu, "Research Methodology and Statistical Tools", Excel Books, New Delhi, 1st Edition, 2008.
2. Prabuddha Ganguli, "Intellectual Property Right, Unleashing the Knowledge Economy", Tata Mc Graw Hill Publishing Company Ltd, 1st Edition, 2001.

Web References:

1. http://nptel.ac.in/courses/109103024/40
2. http://study.com/academy/topic/introduction-to-research-methods.html
3. https://www.vutube.edu.pk/vu-lectures/viewcategory/240/research-methods-sta630

E-Text Books:

1. http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf
2. http://www.bits-pilani.ac.in/uploads/Patent_ManualOct_25th_07.pdf
3. http://euacademic.org/BookUpload/9.pdf

INDUSTRIAL AERODYNAMICS AND WIND ENERGY

Open Elective II : (CAD/CAM) / CSE / ES / SE / ST / PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BAE702	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			

OBJECTIVES:

The course should enable the students to:

I. Understand the atmospheric boundary layer and conditions.
II. Describe the wind energy and its application in turbines.
III. Familiarize with non-aeronautical uses of aerodynamics such as road vehicle, building aerodynamics and problems of flow induced vibrations.

UNIT-I	ATMOSPHERIC WINDS AND ATMOSPHERIC BOUNDARY LAYER	Classes: 08

Causes of wind thermal drive, Coriolis effect, pressure gradient effect, Geotropic winds; Land and sea breeze, mountain winds, thermals, cause of turbulence at ground level; Atmospheric boundary layer, velocity profile laws, effects of terrain on atmospheric boundary Layer; Wind tunnels basic features and components; Wind tunnel models, role of non-dimensional groups; Creation of atmospheric boundary layer type flow in a wind tunnel.

UNIT-II	WIND ENERGY	Classes: 10

Ship propulsion, sails, lift and drag translators, modern yachts; Horizontal and vertical axis wind turbines: History, first example of automatic feedback control for yaw in 16^{th} century English windmills, classification. Horizontal axis wind turbine: Elementary actuator disc theory, Betz coefficient; Definition of power coefficient and torque coefficient for all wind turbines; Working principle, power coefficients, tip speed ratio explanation, by introductory blade element theory, conventional horizontal axis wind turbine, savonious vertical axis wind turbine, Darries vertical axis wind turbine, merits and demerits of horizontal axis wind turbines and vertical axis wind turbines.

UNIT-III	VEHICLE AERODYNAMICS	Classes: 10

Relative importance of rolling resistance and aerodynamics resistance, power requirements and drag coefficients of automobiles, notch front and notch rear wind screens versus streamlined shape, causes of vortex formation and drag, attached transverse vortex , trailing vortex, trailing vortex drag, effect of floor height on lift, effects of cut bank angle; Rear end taper.

Side panels and bottom, effects of chamfering of edges and cambering of roof and side panels; Racing cars: Traction and steering strip and use of aerofoils, high cornering seed; Commercial transport vehicles: Drag reduction on buses and tucks, driver cabin and trailer combinations.

UNIT-IV	BUILDING AERODYNAMICS	Classes: 09
Use of light weight components in modern buildings, pressure distribution on low-rise buildings, wind forces on buildings-aerodynamics of flat plate and circular cylinder , critical Reynold's no, sub -, super- & ultra critical Reynold's No. Role of wind tunnel requirements in determining shape factors (Drag coefficients) of building/structure shapes such as circular cylinder (chimneys & towers), rectangle, I-shape, L-shape, H-shape etc. vortex shedding & transverse oscillating loads. Slenderness ratio & correction factor. Special problems of tall buildings, interference effect of building.		
UNIT-V	**FLOW INDUCED VIBATIONS**	**Classes: 08**
Classification: Vortex induced vibration and flow induced instability such as galloping and stall flutter; Effects of Reynolds number on wake formation of bluff shapes; Vortex induced vibration: Experimental determination of strouhal numbers for different shapes such as circular cylinder, square, rectangle, L-shape ect, universal strouhal number, unsteady Bernoulli equation, concept of added mass, resonance; Fluid-structure interaction: Effect of transverse cylinder motion on flow and wake, lock-in vortex shedding near resonant frequency, experimental evidence of cylindrical motion influencing flow and thereby reducing strength of shed vortices; Methods of suppression of vortex induced vibration; Galloping & Stall flutter: Motion of one degree-of-freedom, quasi steady flow assumption, aerodynamic damping; Galloping: Force in the direction of plunging (transverse motion) and positive force coefficient, critical speed, galloping of transmission wire with winter ice, stall flutter of airfoils.		

Text Books :

1. Siraj Ahmed, "Wind Energy theory and practice", PHI learning Pvt Ltd., 3rd Edition, 2015.
2. R. D. Blevins, "Flow Induced Vibrations", Van Nostard, 2nd Edition, 1990.
3. P. Sachs, "Wind Forces in Engineering", Pergamon press, 2nd Edition, 1988.
4. N. G. Calvert, "Wind Power Principles", Charles Griffin & co. London, 1st Edition, 1979.

Reference Books:

1. R. S. Scorer, "Environmental Aerodynamics", Ellis Harword Ltd, England, 1st Edition, 1978.
2. M. Sorvan, "Aerodynamics Drag Mechanisms of Bluff Bodies and Road vehicles", plenum press, 2nd Edition, 1978.

Web References:

1. http://www.mech.canterbury.ac.nz/research/fluid%20mechanics.shtml
2. http://www.journals.elsevier.com/journal-of-wind-engineering-and-industrial-aerodynamics

E-Text Books:

1. http://www.sciencedirect.com/science/journal/01676105
2. https://www.scribd.com/doc/42602999/Flow-Induced-Vibration-by-Robert-D-Blevins-2nd-Ed
3. http://store.elsevier.com/Wind-Forces-in-Engineering/Peter-Sachs/isbn-9781483148359/

VISION AND MISSION OF THE INSTITUTE

VISION

To bring forth professionally competent and socially sensitive engineers, capable of working across cultures meeting the global standards ethically.

MISSION

To provide students with an extensive and exceptional education that prepares them to excel in their profession, guided by dynamic intellectual community and be able to face the technically complex world with creative leadership qualities.

Further, be instrumental in emanating new knowledge through innovative research that emboldens entrepreneurship and economic development for the benefit of wide spread community.

M.TECH - PROGRAM OUTCOMES (PO's)

PO-1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems (**Engineering Knowledge**).

PO-2: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences **(Problem Analysis).**

PO-3: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations **(Design/Development of Solutions).**

PO-4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions **(Conduct Investigations of Complex Problems).**

PO-5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations **(Modern Tool Usage).**

PO-6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice **(The Engineer and Society).**

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development **(Environment and Sustainability).**

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice **(Ethics).**

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings **(Individual and Team Work).**

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions **(Communication).**

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change **(Life-long learning).**

OBJECTIVES OF THE DEPARTMENT

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Program Educational Objectives (PEO's)

A graduate of the Electronics and Communication Engineering Program should:

PEO – I: To be successful in professional career by acquiring the knowledge in the fundamentals of Electronics and Communication Engineering principles and professional skills.

PEO – II: To be in a position to analyze real life problems and design socially accepted and economically feasible solutions in the respective fields.

PEO – III: To involve themselves in lifelong learning and professional development by pursuing higher education and participation in research and development activities.

PEO – IV: To exhibit good communication skills in their professional career, lead a team with good leadership traits and good interpersonal relationship with the members related to other engineering streams.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO – I: **Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.

PSO – II: **Problem-Solving Skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

PSO – III: **Successful Career and Entrepreneurship:** An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. **Who grants Autonomy? UGC, Govt., AICTE or University**
   In case of Colleges affiliated to a university and where statutes for grant of autonomy are ready, it is the respective University that finally grants autonomy but only after concurrence from the respective state Government as well as UGC. The State Government has its own powers to grant autonomy directly to Govt. and Govt. aided Colleges.

2. **Shall IARE award its own Degrees?**
   No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3. **What is the difference between a Deemed University and an Autonomy College?**
   A Deemed University is fully autonomous to the extent of awarding its own Degree. A Deemed University is usually a Non-Affiliating version of a University and has similar responsibilities like any University. An Autonomous College enjoys Academic Autonomy alone. The University to which an autonomous college is affiliated will have checks on the performance of the autonomous college.

4. **How will the Foreign Universities or other stake – holders know that we are an Autonomous College?**
   Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5. **What is the change of Status for Students and Teachers if we become Autonomous?**
   An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6. **Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?**
   There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. **Will the students of IARE as an Autonomous College qualify for University Medals and Prizes for academic excellence?**
   No. IARE has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8. **Can IARE have its own Convocation?**
   No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9. **Can IARE give a provisional degree certificate?**
   Since the examinations are conducted by IARE and the results are also declared by IARE, the college

sends a list of successful candidates with their final Grades and Grade Point Averages including CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

10. **Will Academic Autonomy make a positive impact on the Placements or Employability?**
Certainly. The number of students qualifying for placement interviews is expected to improve, due to rigorous and repetitive classroom teaching and continuous assessment. Also the autonomous status is more responsive to the needs of the industry. As a result therefore, there will be a lot of scope for industry oriented skill development built-in into the system. The graduates from an autonomous college will therefore represent better employability.

11. **What is the proportion of Internal and External Assessment as an Autonomous College?**
Presently, it is 70 % external and 30% internal. As the autonomy matures the internal assessment component shall be increased at the cost of external assessment.

12. **Is it possible to have complete Internal Assessment for Theory or Practicals?**
Yes indeed. We define our own system. We have the freedom to keep the proportion of external and internal assessment component to choose.

13. **Why Credit based Grade System?**
The credit based grade system is an accepted standard of academic performance the world over in all Universities. The acceptability of our graduates in the world market shall improve.

14. **What exactly is a Credit based Grade System?**
The credit based grade system defines a much better statistical way of judging the academic performance. One Lecture Hour per week of Teaching Learning process is assigned One Credit. One hour of laboratory work is assigned half credit. Letter Grades like A, B,C,D, etc. are assigned for a Range of Marks. (e.g. 91% and above is A+, 80 to 90 % could be A etc.) in Absolute Grading System while grades are awarded by statistical analysis in relative grading system. We thus dispense with sharp numerical boundaries. Secondly, the grades are associated with defined Grade Points in the scale of 1 to 10. Weighted Average of Grade Points is also defined Grade Points are weighted by Credits and averaged over total credits in a Semester. This process is repeated for all Semesters and a CGPA defines the Final Academic Performance

15. **What are the norms for the number of Credits per Semester and total number of Credits for UG/PG programme?**
These norms are usually defined by UGC or AICTE. Usually around 25 Credits per semester is the accepted norm.

16. **What is a Semester Grade Point Average (SGPA)?**
The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \sum_{i=1}^{n} (C_i G_i) / \sum_{i=1}^{n} C_i$$

Where, C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course and i represent the number of courses in which a student registered in the concerned semester. SGPA is rounded to two decimal places.

17. **What is a Cumulative Grade Point Average (CGPA)?**
An up-to-date assessment of overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the students since he entered the Institute.

$$CGPA = \sum_{j=1}^{n} (C_i S_i) / \sum_{j=1}^{n} C_i$$

Where, S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester and j represent the number of courses in which a student's is registered upto the semester. CGPA is rounded to two decimal places.

18. **Is there any Software available for calculating Grade point averages and converting the same into Grades?**
Yes, The institute has its own MIS software for calculation of SGPA, CGPA, etc.

19. **Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?**
No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20. **Will there be any Revaluation or Re-Examination System?**
No. There will double valuation of answer scripts. There will be a makeup Examination after a reasonable preparation time after the End Semester Examination for specific cases mentioned in the Rules and Regulations. In addition to this, there shall be a 'summer term' (compressed term) followed by the End Semester Exam, to save the precious time of students.

21. **How fast Syllabi can be and should be changed?**
Autonomy allows us the freedom to change the syllabi as often as we need.

22. **Will the Degree be awarded on the basis of only final year performance?**
No. The CGPA will reflect the average performance of all the semester taken together.

23. **What are Statutory Academic Bodies?**
Governing Body, Academic Council, Examination Committee and Board of Studies are the different statutory bodies. The participation of external members in everybody is compulsory. The institute has nominated professors from IIT, NIT, University (the officers of the rank of Pro-vice Chancellor, Deans and Controller of Examinations) and also the reputed industrialist and industry experts on these bodies.

24. **Who takes Decisions on Academic matters?**
The Governing Body of institute is the top academic body and is responsible for all the academic decisions. Many decisions are also taken at the lower level like Boards of Studies. Decisions taken at the Board of Studies level are to be ratified at the Academic Council and Governing Body.

25. **What is the role of Examination committee?**
The Examinations Committee is responsible for the smooth conduct of internal, End Semester and make up Examinations. All matters involving the conduct of examinations, spot valuations, tabulations and preparation of Grade Cards etc fall within the duties of the Examination Committee.

26. **Is there any mechanism for Grievance Redressal?**
The institute has grievance redressal committee, headed by Dean - Student affairs and Dean - IQAC.

27. **How many attempts are permitted for obtaining a Degree?**
All such matters are defined in Rules & Regulation

28. **Who declares the result?**
The result declaration process is also defined. After tabulation work wherein the SGPA, CGPA and final Grades are ready, the entire result is reviewed by the Moderation Committee. Any unusual deviations or gross level discrepancies are deliberated and removed. The entire result is discussed in the Examinations and Result Committee for its approval. The result is then declared on the institute notice boards as well put on the web site and Students Corner. It is eventually sent to the University.

29. **Who will keep the Student Academic Records, University or IARE?**
It is the responsibility of the Dean, Academics of the Autonomous College to keep and preserve all the records.

30. **What is our relationship with the JNT University?**
We remain an affiliated college of the JNT University. The University has the right to nominate its members on the academic bodies of the college.

31. **Shall we require University approval if we want to start any New Courses?**
Yes, It is expected that approvals or such other matters from an autonomous college will receive priority.

32. **Shall we get autonomy for PG and Doctoral Programmes also?**
Yes, presently our PG programs also enjoying autonomous status.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	**Nature of Malpractices/Improper conduct**	**Punishment**
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the Controller of Examinations.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.

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

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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

UNDERTAKING BY STUDENT / PARENT

"To make the students attend the classes regularly from the first day of starting of classes and be aware of the College regulations, the following Undertaking Form is introduced which should be signed by both student and parent. The same should be submitted to the Dean, Academic".

I, Mr./ Ms. ---------- joining I Semester for the academic year 2016-2017 in Institute of Aeronautical Engineering, Hyderabad, do hereby undertake and abide by the following terms, and I will bring the ACKNOWLEDGEMENT duly signed by me and my parent and submit it to the Dean, Academic.

1. I will attend all the classes as per the timetable from the starting day of the semester specified in the institute Academic Calendar. In case, I do not turn up even after two weeks of starting of classes, I shall be ineligible to continue for the current academic year.
2. I will be regular and punctual to all the classes (theory/practical/drawing) and secure attendance of not less than 80% in every course as stipulated by Institute. I am fully aware that an attendance of less than 70% in more than three courses will make me lose one year.
3. I will compulsorily follow the dress code prescribed by the college.
4. I will conduct myself in a highly disciplined and decent manner both inside the classroom and on campus, failing which suitable action may be taken against me as per the rules and regulations of the institute.
5. I will concentrate on my studies without wasting time in the Campus/Hostel/Residence and attend all the tests to secure more than the minimum prescribed Class/Sessional Marks in each course. I will submit the assignments given in time to improve my performance.
6. I will not use Mobile Phone in the institute premises and also, I will not involve in any form of ragging inside or outside the campus. I am fully aware that using mobile phone to the institute premises is not permissible and involving in Ragging is an offence and punishable as per JNTUH/UGC rules and the law.
7. I declare that I shall not indulge in ragging, eve-teasing, smoking, consuming alcohol drug abuse or any other anti-social activity in the college premises, hostel, on educational tours, industrial visits or elsewhere.
8. I will pay tuition fees, examination fees and any other dues within the stipulated time as required by the Institution / authorities, failing which I will not be permitted to attend the classes.
9. I will not cause or involve in any sort of violence or disturbance both within and outside the college campus.
10. If I absent myself continuously for 3 days, my parents will have to meet the HOD concerned/ Principal.
11. I hereby acknowledge that I have received a copy of IARE - R16 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

I have carefully gone through the terms of the undertaking mentioned above and I understand that following these are for my/his/her own benefit and improvement. I also understand that if I/he/she fail to comply with these terms, shall be liable for suitable action as per Institute/JNTUH/AICTE/UGC rules and the law. I undertake that I/he/she will strictly follow the above terms.

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number