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
(Based on AICTE Model Curriculum)

IARE - R18

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2018 - 2019)

FAILURE TO READ AND UNDERSTAND THE REGULATIONS
IS NOT AN EXCUSE

INSTITUTE VISION | MISSION | QUALITY POLICY

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.

QUALITY POLICY

Our policy is to nurture and build diligent and dedicated community of engineers providing a professional and unprejudiced environment, thus justifying the purpose of teaching and satisfying the stake holders.

A team of well qualified and experienced professionals ensure quality education with its practical application in all areas of the Institute.

DEPARTMENT VISION | MISSION

VISION

To produce professionally competent engineers, innovators and entrepreneurs capable of effectively addressing the technical challenges with social responsibility and professional ethics.

MISSION

To provide an academic environment that will ensure high quality education, training and research by keeping students abreast of latest research and innovations in science and technology aimed at promoting employability, entrepreneurship, leadership qualities with ethics and research attitude.

M.TECH (EMBEDDED SYSTEMS) - PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

The students of M.Tech Embedded Systems are prepared to:

PEO - I	Be successful practicing professionals or pursue doctoral studies in areas related to the program, contributing significantly to research and development activities
PEO - II	Demonstrate technical competence, such as identifying, formulating, analyzing, and creating engineering solutions using appropriate current embedded engineering techniques, skills, and tools.
PEO - III	To work and communicate effectively in inter-disciplinary environment, either independently or in a team, and demonstrate leadership qualities.
PEO - IV	An ability to apply their in-depth knowledge in embedded systems to evaluate, analyze and synthesize existing and novel designs.

M.TECH - PROGRAM OUTCOMES (PO's)

Upon completion of M.Tech Degree, the students will be able to:

PO - 1	Independently carry out research / investigation and development work to solve practical problems.
PO - 2	Write and present a substantial technical report / document
PO - 3	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level of higher than the requirements in the appropriate bachelor program.
PO - 4	Apply the skills and knowledge needed to serve as a professional engineer skilful at designing embedded systems for effective use in communications, IoT, medical electronics and signal processing applications.
PO - 5	Function on multidisciplinary environments by working cooperatively, creatively and responsibly as a member of a team.
PO - 6	Recognize the need to engage in lifelong learning through continuing education and research.

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-R18" 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 2018 - 20)

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 /mini project work with seminar/ viva / seminars / 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 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	Electrical Power Systems	Electrical and Electronics Engineering	EPS
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	Aerospace Engineering	Aeronautical Engineering	AE

5.0 TYPES OF COURSES

Courses in a programme may be of four kinds: **Core, Elective, Open and Audit.**

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.

There shall be five professional core 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.

5.3 Open Elective Course:

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

5.4 Audit Course:

The value added courses are audit courses offered through joint ventures with various organizations providing ample Scope for the students as well as faculty to keep pace with the latest technologies pertaining to their chosen fields of study. A plenty of value added programs will be proposed by the departments one week before the commencement of class work. The students are given the option to choose the courses according to their desires and inclinations as they choose the desired items in a cafeteria. The expertise gained through the value added programs should enable them to face the formidable challenges of the future and also assist them in exploring new opportunities. Its result shall be declared with "Satisfactory" or "Not Satisfactory" performance.

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 Table2.

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 and Supplementary Exams			4 weeks
THIRD SEMESTER	I Spell Instruction Period	9 weeks	18 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Project Work Phase – I		
	Semester End Examinations		1 week
FOURTH SEMESTER	Project Work Phase - II		18 eeks

7.0 PROGRAM DURATION

A student shall be declared eligible for the award of M.Tech degree, if he/she 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 Core Courses, Laboratory Course, Mini Project with Seminar, Internship, Project Work-1 and Project Work-2.

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 2 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	Professional Core Elective Courses	3	3
3	Audit Courses	2	0
4	Laboratory Courses	4	2
5	Open Elective Courses	3	3
6	Mini Project with Seminar	2	2
7	Project Work-1 Dissertation	20	10
8	Project Work-2 Dissertation	32	16

8.2 Course wise break-up for the total credits:

Total Theory Courses (12) Core Courses (04)+Professional Core Electives (05) + Open Electives (01)	04@3credits + 05 @ 3 credits + 01@3 credits	30
Total Laboratory Courses (03)	04@2credits	08
Mini Project with Seminar(01)	1@2credit	02
Research Methodology and IPR	1@2 credit	02
Project Work-1	1 @10credit	10
Project Work-2	1 @16credits	16
TOTAL CREDITS		**68**

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   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.

9.3.1   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.

9.3.2   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.

9.3.3   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**

9.3.4   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).

9.3.5   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.

9.3.6   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.

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.

10.4 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.

10.5 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.

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

10.7 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.

10.8 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 / Project course in the semester end examination,

    ii. A minimum of 50% marks for each Laboratory / Mini project with Seminar / 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 10point grading system with the following letter grades as given below:

Range of Marks	Grade Point	Letter Grade
90% and above ($\geq$ 90% , $\leq$ 100%)	10	S (Superior)
Below 90% but not less than 80% ($\geq$80% , <90%)	9	A+ (Excellent)
Below 80% but not less than 70% ($\geq$70% , <80%)	8	A (Very Good)
Below 70% but not less than 60% ($\geq$60% , <70%)	7	B+ (Good)
Below 60% but not less than 50% ($\geq$ 50% , <60%)	6	B (Average)
Below 50% (< 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,

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

Where, C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course and n represent the number of courses in which a student's is registered in the concerned semester.

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

Where, S_j is the SGPA of the jth 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	S	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 68 credits.

17.2 A student who fails to earn 68 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 $\geq$ 7.5	CGPA $\geq$ 6.5 and < 7.5	CGPA $\geq$ 5.5 and < 6.5	CGPA $\geq$ 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 CATALOG – R18

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										
BESB01	Embedded System Design	PCC	Core	3	0	0	3	30	70	100
BESB02	Micro Controllers and Programmable Digital Signal Processing	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective - I	PEC	Elective	3	0	0	3	30	70	100
	Professional Core Elective – II	PEC	Elective	3	0	0	3	30	70	100
	Audit Course – I	Audit - I	Audit	2	0	0	0	30	70	100
PRACTICAL										
BESB09	Embedded Programming Laboratory	PCC	Core	0	0	4	2	30	70	100
BESB10	Microcontrollers and Programmable Digital Signal Processors Laboratory	PCC	Core	0	0	4	2	30	70	100
	TOTAL			**14**	**00**	**08**	**16**	**210**	**490**	**700**

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										
BESB11	Embedded System Architecture	PCC	Core	3	0	0	3	30	70	100
BESB12	Internet of Things	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective - III	PEC	Elective	3	0	0	3	30	70	100
	Professional Core Elective - IV	PEC	Elective	3	0	0	3	30	70	100
	Audit Course - II	Audit - II	Audit	2	0	0	0	30	70	100
PRACTICAL										
BESB19	Embedded Systems Laboratory	PCC	Core	0	0	4	2	30	70	100
BESB20	Internet of Things Laboratory	PCC	Core	0	0	4	2	30	70	100
BESB21	Mini Project with Seminar	PCC	Core	0	0	0	2	30	70	100
	TOTAL			**14**	**00**	**08**	**18**	**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										
BCSB31	Research Methodology and IPR	PCC	Core	2	0	0	2	30	70	100
	Professional Core Elective – V	PEC	Elective	3	0	0	3	30	70	100
	Open Elective	OE	Elective	3	0	0	3	30	70	100
PRACTICAL										
BESB40	Phase-I Dissertation	Major Project	Core	0	0	20	10	30	70	100
TOTAL				08	00	20	18	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
BESB41	Phase - II Dissertation	Major Project	Core	0	0	32	16	30	70	100
TOTAL				00	00	32	16	30	70	100

PROFESSIONAL CORE ELECTIVE COURSES

PROFESSIONAL CORE ELECTIVE – I

Course Code	Course Title
BESB03	Wireless LANS and PANS
BESB04	Real Time Systems
BESB05	Hardware Software Co- Design

PROFESSIONAL CORE ELECTIVE – II

Course Code	Course Title
BESB06	Principles of Distributed Embedded Systems
BESB07	Embedded Computing
BESB08	Robotics and Controls

PROFESSIONAL CORE ELECTIVE – III

Course Code	Course Title
BESB13	Embedded Networking
BESB14	Embedded Wireless Sensor Networks
BESB15	Image and Video Processing

PROFESSIONAL CORE ELECTIVE – IV

Course Code	Course Title
BESB16	Microcontrollers for Embedded System Design
BESB17	Embedded C
BESB18	Network Security and Cryptography

PROFESSIONAL CORE ELECTIVE – V

Course Code	Course Title
BESB22	Embedded Real Time Operating Systems
BESB23	RISC Processor Architecture and Programming
BESB24	Communication Network

OPEN ELECTIVE COURSES

Course Code	Course Title
BCSB25	Business Analytics
BCSB26	Industrial Safety
BCSB27	Operations Research
BCSB28	Cost Management of Engineering Projects
BCSB29	Composite Materials
BCSB30	Waste to Energy

AUDIT COURSES

Course Code	Course Title
BCSB32	English for Research Paper Writing
BCSB33	Disaster Management
BCSB34	Sanskrit for Technical Knowledge
BCSB35	Value Education
BCSB36	Constitution of India
BCSB37	Pedagogy Studies
BCSB38	Stress Management by Yoga
BCSB39	Personality Development through Life Enlightenment Skills

SYLLABUS
(I – III SEMESTERS)

EMBEDDED SYSTEMS DESIGN

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB01	**Core**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course is allows the students to learn the fundamentals of embedded system hardware and firmware design. It focuses on basics of embedded systems, embedded firmware design approaches, development languages and system design. The knowledge acquired from this course will enable the students to implement embedded hardware projects and models for engineering and scientific applications.

II. COURSE OBJECTIVES:
The students will try to learn:
  I.   The difference between embedded systems and general purpose systems.
  II. The hardware designs of custom single-purpose processors.
  III. How to compare different approaches in optimizing general-purpose processors.
  IV. The different peripheral interfaces to embedded systems.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO1	**Demonstrate** the concepts of embedded systems and formalismsfor System design	Understand
CO2	**Apply** the suitable memory technology and other components fordifferent applications to meet the ever growing needs of the embedded applications.	Apply
CO3	**Choose** the fundamental components that make up an embedded board to implement an Instruction Set Architecture's features in a processor	Apply
CO4	**Categorize** the embedded firmware design approaches and development languages used for programming embedded devices.	Analyze
CO5	**Make use of** the memory hierarchy to minimize the access time in embedded architecture design.	Apply
CO6	**Identify** the hardware software co- design issues pertaining to design of an embedded system using low power microcontrollers.	Apply

IV. SYLLABUS:

UNIT-I	INTRODUCTION TO EMBEDDED SYSTEMS	Classes: 09

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT-II	TYPICAL EMBEDDED SYSTEM	Classes: 09

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT-III	EMBEDDED FIRMWARE	Classes: 09

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer,

Embedded Firmware Design Approaches and Development Languages.

UNIT-IV	RTOS BASED EMBEDDED SYSTEM DESIGN	Classes: 09

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

UNIT-V	TASK COMMUNICATION	Classes: 09

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Books:

1. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley Publications, 3rd Edition, 2006.

Reference Books:

1. Raj Kamal, "Embedded Systems", TMH, 2nd Edition, 2008.
2. Shibu K.V, "Introduction to Embedded Systems, McGraw Hill, 3rd Edition, 2012.
3. Lyla, "Embedded Systems", Pearson Education , 2nd Edition, 2013.

MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSING

I Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB02	**Core**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course is intended to provide fundamentals of ARM Cortex-M3 Processor and LPC 17XX Micro- controller architectures and their features. It includes the architectures of the Cortex-M3, instruction set summary, Programmable DSP processor. It is used in the applications of microcontrollers pro- gramming models and programmable digital signal processors.

II. COURSE OBJECTIVES:
The students will try to learn:
I. Compare and select ARM processor core based SoC with several features/peripherals based on requirements of embedded applications.
II. Identify and characterize architecture of Programmable DSP Processors
III. Develop small applications by utilizing the ARM processor core and DSP processor based platform.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1	Illustrate the Internal architecture and memory operations of ARM Cortex M3 processor for interfacing microprocessor applications	Understand
CO 2	Analyze Exceptions handler mechanism to minimize interrupt latency using Nested Vectored Interrupt Controller	Analyze
CO 3	Construct the high level of integration in embedded applications using LPC 17XX Microcontroller	Apply
CO 4	Demonstrate various computational building blocks of programmable DSP architectures using interfacing of memory and I/O peripherals	Understand
CO 5	Identify the CPU architecture, peripherals, and development tools for the TMS320C6000 digital signal processors	Apply
CO 6	Develop the application for digital signal processing using code composer studio tool	Apply

IV. SYLLABUS:

UNIT-I	ARM CORTEX-M3 PROCESSOR	Classes: 09

ARM Cortex-M3 processor: Applications, Programming model – Registers, Operation modes, Exceptions and Interrupts, Reset Sequence Instruction Set, Unified Assembler Language, Memory Maps, Memory Access Attributes, Permissions, Bit-Band Operations, Unaligned and Exclusive Transfers. Pipeline, Bus Interfaces.

UNIT-II	EXCEPTIONS AND INTERRUPT	Classes: 09

Exceptions, Types, Priority, Vector Tables, Interrupt Inputs and Pending behaviour, Fault Exceptions, Supervisor and Pendable Service Call, Nested Vectored Interrupt Controller, Basic Configuration, SYSTICK Timer, Interrupt Sequences, Exits, Tail Chaining, Interrupt Latency.

UNIT-III	LPC 17XX MICROCONTROLLER	Classes: 09

LPC 17xx microcontroller- Internal memory, GPIOs, Timers, ADC.

UART and other serial interfaces, PWM, RTC, WDT.

UNIT-IV	PROGRAMMABLE DSP (P-DSP) PROCESSORS	Classes: 09

Programmable DSP (P-DSP) Processors: Harvard architecture, Multi port memory, architectural structure of P-DSP- MAC unit, Barrel shifters, Introduction to TI DSP processor family.

UNIT-V	VLIW ARCHITECTURE	Classes: 09

VLIW architecture and TMS320C6000 series, architecture study, data paths, cross paths, Introduction to Instruction level architecture of C6000 family, Assembly Instructions memory addressing, for arithmetic, logical operations Code Composer Studio for application development for digital signal processing, On chip peripherals , Processor benchmarking.

Text Books:

1. Joseph Yiu, "The Definitive Guide to ARM Cortex-M3", Elsevier, 3nd Edition 2014.
2. Venkatramani B., Bhaskar M. "Digital Signal Processors: Architecture, Programming and Applications", TMH, 2nd Edition 2011.

Reference Books:

1. Sloss Andrew N, Symes Dominic, Wright Chris, "ARM System Developer's Guide: Designing and Optimizing", Morgan Kaufman Publications,
2. Steve furber, "ARM System-on-Chip Architecture", Pearson Education.
3. Frank Vahid and Tony Givargis, "Embedded System Design", Wiley Publications.

<h1 style="text-align:center">WIRELESS LANS AND PANS</h1>

I Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB03	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course intended to provide wireless network communication over short distances using radio or infrared signals instead of traditional network cabling. The basic knowledge of the wireless system, IEEE standards, network architecture, and its protocols. It focuses on data transmission among devices such as computers, smartphones, tablets, and personal digital assistant

II. COURSE OBJECTIVES:

The students will try to learn:

I. The First and Second Generation Cellular Systems, Cellular Communications from 1G to3G, Wireless 4G systems.

II. The 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.

III. The Network Architecture, Physical layer, The Medium Access Control Layer; MAC Layer issues: Hidden Terminal Problem and Reliability.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Recall** the generations of cellular systems for understanding the connectivity of wireless communication networks.	Understand
CO 2	**Organize** the random-access protocols to decrease collision andavoid crosstalk.	Apply
CO 3	**Justify** the importance of wireless LANs for connecting different devices through wireless communication to form an area network.	Evaluate
CO 4	**Estimate** the wireless PANs for interconnecting electronicdevices within an individual person's workspace.	Evaluate
CO 5	**Analyze** the traffic engineering used to carry traffic flows thatvary from those chosen automatically by the routing protocol.	Analyze
CO 6	**Interpret** the wireless networking standards and protocols for wireless transmission approved by IEEE.	Analyze

IV. SYLLABUS:

UNIT-I	WIRELESS SYSTEM & RANDOM ACCESS PROTOCOLS	Classes: 08

Introduction, First and Second Generation Cellular Systems, Cellular Communications from 1G to3G, 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: 10
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: 08**
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: 10**
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 Assignment, Scatter net 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. Ad Hoc and Sensor Networks - Carlos de Morais Cordeiro and Dharma Prakash Agrawal,World Scientific, 2011.
2. Wireless Communications and Networking - Vijay K.Garg, Morgan Kaufmann Publishers, 2009

REFERENCE BOOKS:

1. Wireless Networks - KavehPahlaram, Prashant Krishnamurthy, PHI, 2002.
2. Wireless Communication- Marks Ciampor, Jeorge Olenewa, Cengage Learning, 2007.

REAL TIME SYSTEMS

I Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB04	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course introduces the foundation in the system concepts of distributed computing for widely used in small embedded systems. It covers basic system concepts, real time systems, real time communications, System design and CAN protocols. Through the knowledge of distributed embedded computing used to design and implement the prototype on embedded intelligence in an ever-growing array of application fields, and engineering disciplines.

II. COURSE OBJECTIVES:

The students will try to learn:

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

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Illustrate the principles of real time computer systems for the system design to controls the environment.	Understand
CO2	Demonstrate the classifications of real time systems and its components for the design of reliable embedded system.	Understand
CO3	Select the suitable Time based triggered or event-triggered control strategies for stabilization of rate constrained in the distributed real time communication systems.	Apply
CO4	Summarize the fundamental aspects of real time operating system as, Task scheduling, Task management, Intertask communication, Process input/output to implement in the real time applications.	Understand
CO5	Identify the scheduling problems and algorithms to resolve it in order to design and implementation of dependable distributed embedded systems.	Apply
CO 6	Model a time-triggered architecture system for the use of a single interrupt and to activate any specific activity either hardware or software.	Apply

IV. SYLLABUS:

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

HARDWARE SOFTWARE CO-DESIGN

I Semester: ES								

Course Code	Category	Hours / Week			Credits	Maximum Marks		
BESB05	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course intended to provide combined effort of hardware and software concurrent design in order to meet embedded system level objectives. It focuses on the hardware architectures, languages for systems design, system partitioning and design challenges. It gives the platform for designing applications in the area of aircraft, industrial automation, robotics, wireless communication and automobiles.

II. COURSE OBJECTIVES:

The students will try to learn:
  I.   The various prototyping and emulation techniques for co-design models.
  II. The compilation techniques for embedded processor architecture.
  III. Use verification tools for verification of co-design.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Illustrate** the co-design issues, models and languages used for the development of embedded systems.	Understand
CO2	**Demonstrate** the generic co-design methodology, co- synthesis algorithms used for the design of cost-effective systems.	Understand
CO 3	**Choose** the proper prototyping and emulation techniques for verifying complex hardware designs and validating the systems.	Apply
CO 4	**Interpret** the architecture for control dominated systems and data dominated systems to use in a wide class of applications in embedded systems	Understand
CO 5	**Utilize** the various compilation techniques and tools for implementing the compiler development environment.	Apply
CO 6	**Select** the latest tools available for both co-design and co-verification of systems for determining the optimum solution to any co-design problem.	Apply

IV. SYLLABUS:

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 AND TOOLS FOR EMBEDDED PROCESSOR ARCHITECTURES	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

I Semester: ES							
Course Code	**Category**	**Hours /Week**			**Credits**	**Maximum Marks**	
BESB06	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes: 45**		

I. COURSE OVERVIEW:

A distributed embedded system consists of hardware and software parts interacting via an inter-connection network. This course deals with the importance of real time communication systems, classification of real time systems, real time operating systems, and the design of real-time protocols. The applications include mobiles, routers, video games consoles, mp3 players, printers, GPS receivers, dishwashers, thermostats, anti-lock banking systems, medical imaging.

II. COURSE OBJECTIVES:
The students will try to learn:
I. The design principles of distributed embedded systems.
II. Design CAN network based systems.
III. The RTOS to design embedded system.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO1	Illustrate the principles of real time computer systems for the system design to controls the environment.	Understand
CO2	Demonstrate the classifications of real time systems and its components for the design of reliable embedded system.	Understand
CO3	Select the suitable Time based triggered or event-triggered control strategies for stabilization of rate constrained in the distributed real time communication systems.	Apply
CO4	Summarize the fundamental aspects of real time operating system as, Task scheduling, Task management, Intertask communication, Process input/output to implement in the real time applications.	Understand
CO5	Identify the scheduling problems and algorithms to resolve it in order to design and implementation of dependable distributed embedded systems.	Apply
CO 6	Model a time-triggered architecture system for the use of a single interrupt and to activate any specific activity either hardware or software.	Apply

IV. SYLLABUS:

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", PearsonEducation, 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 COMPUTING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB07	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW

This course introduces the basic knowledge of computer architecture, operating system concepts; inter process communication to handle interrupts for design of embedded systems. It includes both hardware and software tools to control the device and programming on LINUX, compilation of GNU and GNC tools, network basis and instruction set. This course provides a platform for Industrial Automation and Control, Intelligent transportation, medical imaging.

II. COURSE OBJECTIVES:
The students will try to learn:
I. The operating system concepts and inter process communication.
II. Use tools like simulator, assembler and debugger
III. The interrupts and interrupt latency to handle interrupts for design of embedded systems.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO1	**Understand** the programming of microcontroller for the functional stack of IoT ecosystem.	Understand
CO2	**Understand** the concepts of data synchronization for agility and autonomy in protocols.	Understand
CO3	**Apply** IEEE 802.11 protocol for topology and security in physical and MAC layer.	Apply
CO4	**Identify** the applications of IoT including home automation, smart cities, and smart environment to implement the real time applications	Apply
CO5	**Develop** the cloud environment using web enabling constrained devices in Internet of things.	Create
CO 6	**Make use** of appropriate communication protocolsto acquire the knowledge of programming with Raspberry PI	Apply

IV. SYLLABUS:

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.

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

ROBOTICS AND CONTROL

I Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB08	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course is an introduction to the field of robotics. It covers the fundamentals of kinematics, dynamics, trajectory planning, control of robot manipulators, and sensing. The course deals with homogeneous transformations, forward and inverse kinematics of robotic manipulators, differential kinematic equations, the manipulator Jacobian, and force relations. It also presents the fundamental principles on proximity, tactile, and force sensing. Students are expected to have a background in linear algebra, calculus, and basic physics

II. COURSE OBJECTIVES:
The students will try to learn:
I.   The robot terminologies and robotics sensors for controls of robotics.
II. Apply different robot control techniques for control of robotics.
III. 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 McGraw 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 PROGRAMMING LABORATORY

I Semester: ES								

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESB09	Core	-	-	3	2	30	70	100

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36	Total Classes: 36

I. COURSE OVERVIEW:

This course outlines the design and implementation of embedded systems using suitable hardware and Keil Embedded C software tools.The instruction set, Embedded C programming for I/O and memory interfacing techniques are covered.The hands-on experience acquired by the student's during the course makes them to carry out processor/controller based projects and extend their knowledge on the latest trends and technologies in the field of embedded system.

II. COURSE OBJECTIVES:

The students will try to learn:
I.   Use embedded C for reading data from port pins.
II. he interfacing of data I/O devices with microcontroller.
III. The serial communication and port RTOS on microcontroller.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use** of emulators and cross-compilers for writing, compiling and running an embedded C language programs on training boards.	Apply
CO 2	**Develop** Embedded C language programs for accomplishing code to reading the data from ports, blinking the LED and interfacing of switch andbuzzer and temperature sensors to the microcontrollers.	Apply
CO 3	**Select** suitable RTOS of microcontroller and write Embedded C language program to run 2 to 3 tasks simultaneously.	Apply
CO 4	**Choose** serial or parallel communication for transmitting the data between microcontroller and peripherals.	Apply
CO 5	**Utilize** the Analog to Digital and Digital to Analog converters with micro- controller for data conversion.	Apply
CO 6	**Build** an interface between micro controller and peripherals to provide solutions to the realworld problems.	Analyze

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

MICROCONTROLLERS AND PROGRAMMABLE
DIGITAL SIGNAL PROCESSORS LAB

I Semester: ESD

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESB 10	**Core**		-	3	2	30	70	100

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36	Total Classes: 36

I. COURSE OVERVIEW:

This course provides knowledge of basics of DSP processors and embedded C programming language. It covers the concepts like blinking an LED with software delay, system clock real time alteration using the PLL modules and controlling an LED using switch by polling method. Through laboratory experiments, students are provided learning experiences that enable them to provide in depth knowledge about embedded and DSP processors.

II. COURSE OBJECTIVES:

The students will try to learn:

I.   Demonstrate Keil IDE tool for development of Embedded system.
II. The Program the interfacing of various devices with ARM using Embedded C.
III. Implementation of digital signal processing algorithms in MATLAB and C.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Make use of Cortex-M3 development board write a assembly language program for LED display in various applications	Apply
CO 2	Analyze the various sleep modes by putting core in sleep and deep sleep modes using GNU tool chain	Analyze
CO 3	Develop an embedded C program for Temperature indication on an RGB LED and Verify the output in the Cortex-M3 kit	Apply
CO 4	Build an assembly code and C code to compute Euclidian distance between any two Points	Apply
CO 5	Examine various filters in C to enhance the features of given input sequence or signal	Apply
CO 6	Design an assembly and C code for convolution Operation using code composer studio (CCS).	Create

LIST OF EXPERIMENTS

Part A) Experiments to be carried out on Cortex-M3 development boards and using GNU tool chain.

Week-1	Blink an LED with software delay, delay generated using the SysTick timer.
Week-2	System clock real time alteration using the PLL modules.
Week-3	Control intensity of an LED using PWM implemented in software and hardware

Week-4	Control an LED using switch by polling method, by interrupt method and flash the LED once.
Week-5	UART Echo Test.
Week-6	Take analog readings on rotation of rotary potentiometer connected to an ADC channel.
Week-7	Temperature indication on an RGB LED.
Week-8	Mimic light intensity sensed by the light sensor by varying the blinking rate of an LED.
Week-9	Evaluate the various sleep modes by putting core in sleep and deep sleep modes.
Week-10	System reset using watchdog timer in case something goes wrong.
Week-11	Sample sound using a microphone and display sound levels on LEDs.
Part B) Experiments to be carried out on DSP C6713 evaluation kits and using Code Composer Studio (CCS).	
Week-12	To develop an assembly code and C code to compute Euclidian distance between any two points.
Week-13	To develop assembly code and study the impact of parallel, serial and mixed execution.
Week-14	To develop assembly and C code for implementation of convolution operation.
Week-15	To design and implement filters in C to enhance the features of given input sequence/signal

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**
BESB11	**Core**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course is allows the students to learn the fundamentals of embedded system hardware and firmware design. It focuses on basics of embedded systems, embedded firmware design approaches, development languages and system design. The knowledge acquired from this course will enable the students to implement embedded hardware projects and models for engineering and scientific appli- cations

II. COURSE OBJECTIVES:

The students will try to learn:
  I.   The fundamental embedded systems design paradigms, architectures.
 II.   The possibilities and challenges, both with respect to software and hardware.
III.   The system both as whole and in the included parts, to understand how these parts interact in the functionality and properties of the system.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Outline** the basic concepts and architectures of embedded system in real time applications.	Understand
CO2	**Illustrate** the challenges, design issues and cyclic process for the development of embedded system design.	Understand
CO3	**Demonstrate** the architecture and instruction set of ARM Processors for efficient embedded assembly language level programming.	Apply
CO4	**Make use of** memory and input/output peripherals to interface the programmable embedded devices for increasing time response of a system.	Apply
CO5	**Develop** embedded system programming using ARM thumb instruction set to increase the code density.	Apply
CO6	**Explore** the architecture and programming of Industry standard 32-bit popular ARM Cortex-M3 Microcontroller for high performance and low cost embedded devices.	Apply

IV. SYLLABUS:

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

INTERNET OF THINGS

II Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB12	**Core**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

The Internet of things allows every device to connect the world for exchange of information among the associated devices. It focuses on the concepts of data communication, network protocols, cloud computing and network security fundamental techniques, customs and terms including the basic com- ponents of hardware and software. The applications of IoT include home automation, smart parking, smart lighting, and smart phone detection.

II. COURSE OBJECTIVES:

The students will try to learn:

I.   The Principle and operation of software defined networking and Network Function Virtualization.
II. The knowledge of IoT enabled technologies, security protocols and architectures
III. Python programming skills to move into specific areas – Deep Learning (DL), Data Science, Machine Learning (ML), Artificial Intelligence (AI) etc.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Understand** the programming of microcontroller for the functional stack of IoT ecosystem.	Understand
CO2	**Understand** the concepts of data synchronization for agility and autonomy in protocols.	Understand
CO3	**Apply** IEEE 802.11 protocol for topology and security in physical and MAC layer.	Apply
CO4	**Identify** the applications of IoT including home automation, smart cities, and smart environment to implement the real time applications	Apply
CO5	**Develop** the cloud environment using web enabling constrained devices in Internet of things.	Create
CO 6	**Make use** of appropriate communication protocols to acquire the knowledge of programming with Raspberry PI	Apply

IV. SYLLABUS:

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 - MiddlewareTechnologies 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, April2002
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

EMBEDDED NETWORKING

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB13	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

Embedded networking is the network design and topology, hardware devices, and communication/data exchange protocols required to link and exchange information across embedded systems. It covers embedded communication protocols, USB and CAN bus for fast communication and Ethernet and protocols. The applications of embedded networking systems include home appliances, internet-of-things , office automation, security, telecommunication, instrumentation.

II. COURSE OBJECTIVES:

The students will try to learn:
I.   The embedded communication protocols to implement in embedded networking.
II. The design of CAN network based systems
III. The use UDP, TCP and FTP in design of embedded networks.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Illustrate** Serial and parallel communication protocols used fordata Communication in embedded networking systems.	Understand
CO 2	**Infer** the USB and CAN serial bus system used to communicate between several embedded micro controllers and network systems.	Apply
CO 3	**Explain** the basic principles of Ethernet for providing aninternet connection, connect devices to a local network	Apply
CO 4	**Develop** the frame work for embedded Ethernet protocols usedto create local area networks.	Apply
CO 5	**Make use of** the various client-server programming models for the users to access the information stored on a web server on the Internet	Apply
CO 6	**Classify** the wireless local area networks for the user device to communicate with the network.	Analyze

IV. SYLLABUS:

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^{2}C– 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: AUnified 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

II Semester: ES								
Course code	**Category**	Hours / Week			**Credits**	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB14	**Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course introducing basic ideas of wireless, embedded, internetworked sensor/actuator systems, anemerging technology that can provide visibility into and control over complex physical processes. This course covers the overview of WSN, Architecture of wireless networks, sensor programming techniques, programming models and wireless sensor networks for different applications. Wireless sensor networks are a becoming an important application of embedded systems, giving scope for unique designs and applications.

II.COURSE OBJECTIVES:

The students will try to learn:
I.   The concepts of sensor networks to use in embedded wireless sensor networks.
II.   Use sensor programming in wireless sensor networks
III. The wireless sensor networks for different applications.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Relate** the concept of wireless sensor networks with characteristic requirements involved in demonstrating of sensor nodes.	Understand
CO 2	**Make use of** energy consumption of sensor nodes to improvethe life span of wireless sensor networks.	Apply
CO 3	**Contrast** sensor network scenarios for designing of large scale wireless sensor networks.	Analyze
CO 4	**Identify** the optimisation and figure of merit to measure the performance characteristics of sensor networks.	Apply
CO 5	**Categorize** tiny os programming for providing interfaces among sensor nodes.	Analyze
CO 6	**Utilize** inter vehicle communication networks to enhance the safety of moving vehicles.	Apply

IV. SYLLABUS:

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

IMAGE AND VIDEO PROCESSING

II Semester: ESD

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB15	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course provides a mathematical framework to describe and analyze images and videos as two- and three-dimensional signals in the spatial and frequency domains. It focuses on fundamentals of digital images, transforms, image enhancement in spatial, frequency domains, image compression techniques and introduces video processing sampling, filtering operation and motion estimation in the videos. Digital image processing motivated by major applications to process images and videos for solving practical problems of commercial and scientific interests for machine applications in industries for quality control.

II. COURSE OBJECTIVES:

The students will try to learn:

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

III. COURSEOUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Outline** the principles and terminology of digital image processing for describing the features of image.	Understand
CO 2	**Demonstrate** 2D Fourier transforms and its properties for frequency domain representation of the image.	Understand
CO3	**Make use of** various image transform techniques like Walsh, Slant, Hadamard, DCT and Haar transforms for analyzing images in transform domain.	Apply
CO 4	**Construct** image intensity transformations and spatial filtering for image enhancement in the spatial domain.	Apply
CO 5	**Identify** 2D convolution and filtering techniques for smoothening and sharpening of images in frequency domain.	Apply
CO 6	**Illustrate** the analog video to digital video conversion using sampling and quantization methods.	Understand

IV. SYALLABUS:

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/

MICROCONTROLLERS FOR EMBEDDED SYSTEM DESIGN

II Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESB16	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course outlines the design and implementation of embedded systems using suitable hardware and software tools. It covers 8051 microcontroller architecture, PIC controller, Embedded RISC processor architecture, Interrupts and device drivers and network protocals. The knowledge acquired from this course will enable the students to develop embedded hardware projects and prototype models for engineering and scientific applications.

II. COURSE OBJECTIVES:
The students will try to learn:
I. The 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. How to analyze interrupt latency, context switching time, for development of device drives for timing devices.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO1	Summarize the concepts of Embedded Systems for system design with examples.	Understand
CO2	Compare the architecture and operation of RISC and ARM for designing embedded system	Analyze
CO3	Demonstrate 8051 microcontroller functionality using registers, memory and Hardware/Software interfacing	Understand
CO4	Construct programmable system on chip architecture using configurable analog and digital blocks	Create
CO5	Analyze interrupt latency, context switching time for development of device drivers	Analyze
CO6	Determine network protocols such as serial, ethernet, SDMA, IDMA for high-performance network communication	Evaluate

IV. SYLLABUS:

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/

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=4GrXJeC6 HFkC

EMBEDDED C

II Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB17	**Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

Embedded C is an extension to the standard C Programming Language. It focuses on the knowledge and skills required to define the functionality of the embedded systems. It includes multiple memory addressing; fixed-point arithmetic programming embedded systems in C. Embedded C is used in the development of microcontroller and embedded project applications.

II. COURSE OBJECTIVES:

The students will try to learn:
  I. The embedded C and use it for programming embedded system.
  II. The techniques for data transfer between I/O ports and memory.
  III. The object oriented programming for designing embedded system.
  IV. How to use timers to generate time delays.

III. COURSE OUTCOMES:

  After successful completion of the course, students should be able to:

CO1	**Summarize** the concepts of embedded C and develop the embedded C programming examples with Keil IDE and interfacing modules	Understand
CO2	**Apply** the basic concepts of embedded system to develop the quality based Intruder Alarm System	Apply
CO 3	**Explore** the fundamentals of timers , formatted data frames and its controls to generate delays for embedded applications	Understand
CO 4	**Make use** of debugging techniques in embedded software to know step-by-step software execution process	Apply
CO 5	**Develop** the embedded programming in C and assembly level language for real time embedded applications.	Apply
CO 6	**Explore** the working of switches for reading and writing of data in to the required ports	Understand

IV. SYLLABUS:

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

NETWORK SECURITY AND CRYPTOGRAPHY

II Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB18	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

The aim of this course is to introduce the student to the areas of cryptography and cryptanalysis. It develops a basic understanding of the algorithms used to protect users online and to understand some of the design choices behind these algorithms. The course emphasizes to give a basic understanding of previous attacks on cryptosystems with the aim of preventing future attacks. A wide variety of basic cryptographic primitives will be discussed along with recent developments in some advanced topics like identity-based encryption, attribute-based encryption, functional encryption, two-party/multi-party computation, bitcoin and crypto-currency and postquantum cryptography. The cryptanalysis part will help us understanding challenges for cybersecurity that includes network security, data security, mobile security, cloud security and endpoint security.

II. COURSE OBJECTIVES:

The students will try to learn:
- I. About Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security
- II. The simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.
- III. The IP Security Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management.

III. COURSEOUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Understand** principles and practice of network security and cryptography by gaining knowledge in cryptographic algorithms;	Understand
CO2	**Design** basic security architectures through selection and integration of relevant security components	Apply
CO3	**Make use** of advanced cryptographic algorithms in network protocols and network applications.	Apply
CO4	**Analyze and apply system security concept to recognize malicious code**	Analyze
CO5	**Understand** Key management using smart cards for authentication requires the use of a PKI.	Understand
CO6	**Illustrate** various Public key cryptographic techniques in encryption/ decryption.	Understand

IV. SYLLABUS:

UNIT-I	**INTRODUCTION**	**Classes: 08**

Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.

UNIT-II	MODERN TECHNIQUES	Classes: 10

MODERN TECHNIQUES:
Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.
Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. **Conventional encryption:** Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.
Public key cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

UNIT-III	NUMBER THEORY	Classes: 08

NUMBER THEORY:
Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler'stheorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

Message authentication and hash functions:
Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

UNIT-IV	HASH AND MAC ALGORITHMS	Classes: 10

HASH AND MAC ALGORITHMS:
MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC.
Digital signatures and authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.
Authentication applications: Kerberos, X.509 directory Authentication service. Electronic Mail Security: Pretty Good Privacy, S/MIME.

UNIT-V	IP SECURITY AND WEB SECURITY	Classes: 09

IP SECURITY:
Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management.
Web security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.
Intruders, viruses and worms: Intruders, Viruses and Related threats.
Fire walls: Fire wall Design Principles, Trusted systems.

TEXT BOOKS:
1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

REFERENCE BOOKS:
1. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Miken Speciner, Pearson/PHI.
3. Principles of Information Security, Whitman, Thomson.
4. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
5. Introduction to Cryptography, Buchmann, Springer.

EMBEDDED SYSTEMS LABORATORY

II Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB19	**Core**	-	-	3	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 36**				**Total Classes: 36**		

i. COURSE OVERVIEW:

This course outlines the design and implementation of embedded systems using suitable hardware (ARMand PSOC) and Keil Embedded C software tools. The instruction set, Embedded C programming for I/O and memory interfacing techniques are covered. The hands-on experience acquired by the student's during the course makes them to carry out processor/controller based projects and extend their knowledge on the latest trends and technologies in the field of embedded system.

II.COURSE OBJECTIVES:

The students will try to learn:

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

III.COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Make use of emulators and cross-compilers for writing, compiling and running an embedded C language programs on ARM and PSoC training boards.	Apply
CO2	Develop Embedded C language programs for accomplishing code to reading the data from ports, blinking the LED and interfacing of switch and buzzer , temperature sensors and other display units to the ARM processors	Apply
CO3	Select suitable RTOS of ARM and PSoC and write Embedded C language program to run 2 to 3 tasks simultaneously.	Apply
CO4	Identify different filters and timers in PSoC for transmitting the data between PSOC and peripherals	Apply
CO5	Utilize Analog to Digital and Digital to Analog converters with PSoC for data conversion	Apply
CO6	Build an interface between PSoC and peripherals to provide solutions to the real world problems	Analyze

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

INTERNET OF THINGS LABORATORY

I Semester: ES

Course Code	Category	Hours / Week				Credits	Maximum Marks		
		L	T	P	C		CIA	SEE	Total
BESB20	Core	-	-	4	2		30	70	100

Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36	Total Classes: 36

I. COURSE OVERVIEW:

This course outlines the design and implementation of embedded systems using suitable hardware(ARM and PSOC) and Keil Embedded C software tools.The instruction set, Embedded C programming for I/O and memory interfacing techniques are covered.The hands-on experience acquired by the stu- dent's during the course makes them to carry out processor/controller based projects and extend their knowledge on the latest trends and technologies in the field of embedded system.

II. COUSRE OBJECTIVES:

The students will try to learn:
  I.   The IoT using Arduino programming
  II. The interfacing of data I/O devices with Arduino.
  III. The design steps using Rasberry Pi.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Understand** the concept of Internet of Things for implementation of digital measuring devices	Understand
CO2	**Develop** the Arduino programming for controlling lightning appliances.	Apply
CO3	**Analyze** the characteristics of bluetooth modules for controlling the performance of appliances.	Analyze
CO4	**Make** use of direct and alternating type of electrical instruments using arduino	Analyze
CO5	**Categorize** the protection schemes of induction motor against over current and under voltage.	Analyze
CO6	**Build** a relay model for protection of home appliances from over and under voltages.	Apply

LIST OF EXPERIMENTS

Week-1	IOT WITH ARDUINO PROGRAMMING

Introduction to Internet of Things (IoT) using Arduino programming

Week-2	CONROLLING RGB LED

Programming for Controlling RGB LED using Arduino and Wi-Fi Module

Week-3	IOT TO CONTROL REMOTE LED

Programming for Internet of things with Android and Arduino. Build an Arduino IoT to control a remote LED	
Week-4	**INTERFACING BLUETOOTH MODULE**
Programming for how to interface HC-05 Bluetooth Module with Arduino UNO for various application	
Week-5	**INTERFACING TO TEMPERATURE SENSOR**
Programming to Interface Tempaetaure sensor and Monitoring using IoT with Arduino Uno and display digital value on LCD.	
Week-6	**INTERFCAING IR SENSOR**
Programming to Interface IR sensors and Blue tooth for detecting obstacle using Arduino with android Application.	
Week-7	**TRACK LOCATION**
Programming for Node MCU for track location without using GPS module	
Week-8	**SEND DATA FROM ARDUINO TO WEB PAGE**
Programming for how to send data from Arduino to Webpage using Wi-Fi module	
Week-9	**IOT WITH RASBERRY PI**
Introduction to Internet of things (IoT) by using a Raspberry Pi to connect devices.	
Week-10	**SETUP WI-FI ON RASBERRY PI USING USB**
Programming for how to Setup Wi-Fi on Raspberry Pi 2 using USB Dongle	
Week-11	**INTERFACE TO MOTION SENSOR**
Programming to interface a motion sensor to use GPIO pins with a Raspberry Pi.	
Week-12	**INTERFACE TO GAS SENSOR**
Programming to interface Gas sensor for detection and monitoring using Arduino and IoT	
Reference Books:	
1. Mark torvalds, "Arduino Programming: Step-by-step guide to mastering arduino hardware and software (Arduino, Arduino projects, Arduino uno, Arduino starter kit, Arduino ide, Arduino yun, Arduino mega, Arduino nano) Kindle Edition 2. Michael J. Pont, "Embedded C", Pearson Education, 2nd Edition, 2008.	

SOFTWARE AND HARDWARE REQUIREMENTS FOR 18 STUDENTS

SOFTWARE:
System Software: Microsoft windows/ Linux
Programming Languages: Python and Embedded C.

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

RESEARCH METHODOLOGY AND IPR

III Semester: CSE, ES, CAD/CAM, AE, ST, PEED							
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**	

Course Code	Category	L	T	P	C	CIA	SEE	Total
BCSB31	**Core**	2	-	-	2	30	70	100

Contact Classes: 30	**Tutorial Classes: Nil**	**Practical Classes: Nil**	**Total Classes: 30**

I. COURSE OVERVIEW:

This course imparts research methodology and philosophy of intellectual property rights, including basic concepts employed in quantitative and qualitative research methods, Patents, Copyrights, and Trademarks. It provides the research framework, research methodology research design, and formulation hypothesis, sampling techniques, data analysis and report writing. It implies on research skills and intellectual property rights to encourage new creations, including technology, artwork, and inventions, that might increase economic growth.

II. COURSE OBJECTIVES:

The course should enable the students to:
I. Understand research problem formulation.
II. Analyze research related information.
III. Follow research ethics.
IV. Understand that today's world is controlled by Computer, Information Technology; but tomorrow world will be ruled by ideas, concept, and creativity.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Interpret** the technique of determining a research problem for a crucial part of the research study.	**Remember**
CO2	**Examine** the way of methods for avoiding plagiarism in research.	**Apply**
CO3	**Apply** the feasibility and practicality of research methodology for a proposed project.	**Apply**
CO4	**Make use of** the legal procedure and document for claiming patent of invention.	**Understand**
CO5	**Identify** different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP.	**Understand**
CO6	**Defend** the intellectual property rights throughout the world with the involvement of world intellectual property organization	**Apply**

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 07

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.
Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II	RESEARCH ETHICS	Classes: 05
Effective literature studies approaches, analysis Plagiarism, Research ethics.		
UNIT-III	RESEARCH PROPOSAL	Classes: 06
Effective technical writing, how to write report, Paper Developing a Research Proposal. Format of research proposal, a presentation and assessment by a review committee		
UNIT-IV	PATENTING	Classes: 06
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.		
UNIT-V	PATENT RIGHTS	Classes: 06
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.		
Text Books:		
1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'" 2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" 3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"		
Reference Books:		
1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd , 2007. 2. Mayall , "Industrial Design", McGraw Hill, 1992.		
3. Niebel , "Product Design", McGraw Hill, 1974. 4. Asimov , "Introduction to Design", Prentice Hall, 1962.		
Web References:		
1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in NewTechnological Age", 2016 2. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008		
E-Text Books:		
1. http://nptel.ac.in/courses/107108011/		

EMBEDDED REAL TIME OPERATING SYSTEMS

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB22	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course is to introduce students with the basic concepts and approaches in the design and analysis of real-time operating systems. It covers design considerations of real time operating systems, task scheduling, threads, multitasking, task communication and synchronization. Applications of the course include real time operating systems in image processing, fault tolerant applications and control systems.

II. COURSE OBJECTIVES:

The students will try to learn:
I. How to analyze theory and implementation of tasks.
II. The synchronization problems and to use semaphore operations.
III. The interrupt service routines for interrupts and timers.

III. COURSEOUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Outline** the components of real time operating systems for the design of reliable embedded system.	Understand
CO2	**Interpret** real time operating system to provide resource management and synchronization for communication systems.	Apply
CO3	**Identify** Real-Time Clocks and System Clocks to keep tracks of current time and clock speeds.	Apply
CO4	**Construct** memory management system for fragmentation and compaction.	Apply
CO5	**Examine** hierarchical Timing Wheels to reduce timer overflow in single timing wheel and multiple timing wheels.	Analyze
CO6	**Analyze** finite state machine for the task scheduling and execution in kernel models.	Analyze

IV. SYLLABUS:

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

III Semester: ES

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESB23	**Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course emphasizes on comprehensive treatment of embedded hardware and real time operating systems along with case studies, in tune with the requirements of Industry. It focus on design, construct, program, verify, analyze and troubleshoot ARM assembly and C language programs and supporting hardware. This course enable exposure to ARM architecture and make the students to learn the ARM programming & Thumb programming models.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The programming model of ARM processor and create and test assembly level programming.
II. The processor architecture and organization.
III. How to create and test C programming for ARM.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Outline the** design philosophy of embedded systems and architecture of ARM for different ARM Processor families	Understand
CO2	**Distinguish** the performance of pipelining and non pipelining environment in a Risc processor	Analyze
CO3	**Discuss** various instruction set and addressing modes for ARM programming	Remember
CO4	**Inspect** aware of the Thumb mode for programming of ARM Processor	Analyze
CO5	**Apply** Architecture, modes of operations, Exceptions to write assembly language program of ARM Processors	Apply
CO 6	**Identify** various types of Processors & Peripherals required to design an RISC processor architecture	Remember

SYLLABUS:

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

COMMUNICATION NETWORK

Course code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESB24	Elective	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course provides the basic principles of communication networks and routing protocols. The performance of network architecture, TCP and various communication protocols. The applications include resource sharing, exchange of information by means of e-mails, video conferences and Parallel computing.

II.COURSE OBJECTIVES:

The students will try to learn:

I.   The protocols and algorithms, acknowledge tradeoffs and rationale
II. How to use routing, transport protocols for the given networking scenario and application
III. How to evaluate and develop small network applications.

III. COURSEOUTCOMES:

After successful completion of the course, students should be able to:

CO1	**Demonstrate** the functionality of layered and computernetwork architecture for reducing the complexity of communication network	Understand
CO2	**Make use of** various end to end protocols for delivering messages and synchronization between the sender and the receiver.	Apply
CO3	**Utilize** the applications World Wide Web and multimediainformation between computers on the Internet Clocks	Apply
CO4	**Apply** the mathematical functions to solve computationalproblems in computer networking domain resolutions..	Apply
CO5	**Illustrate** the importance of queuing models, IPv6, Switching and bridging for communication network. for communication network.	Understand
CO6	**Analyze** the routing algorithms to solve scaling issues andqueuing issues in communication network.	Analyze

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 09

Introduction: Network Architecture, Performance.

UNIT-II	CONNECTING NODES	Classes: 09

Connecting nodes: - Connecting links, Encoding, framing, Reliable transmission, Ethernet and Multiple access networks, Wireless networks

UNIT-III	QUEUING MODELS	Classes: 09

Queuing models - For a) one or more servers b) with infinite and finite queue size c) Infinite population

Internetworking: - Switching and bridging, IPv4, Addressing, Routing Protocols, Scale issues, Routers - Architecture, IPv6

UNIT-IV	END-TO-END PROTOCOLS	Classes: 09

End-to-End Protocols: - Services, Multiplexing, De-multiplexing, UDP, TCP, RPC, RTP

UNIT-V	CONGESTION CONTROL AND RESOURCE ALLOCATION	Classes: 09

Congestion control and Resource Allocation - Issues, Queuing disciplines, TCP congestion control, Congestion Avoidance, QoS Applications: - Domain Name Resolution, File Transfer, Electronic Mail, WWW, Multimedia Applications.Network monitoring – Packet sniffing tools such as Wireshark Simulations using NS2/OPNET

Text Books:

1. Larry L. Peterson, Bruce S, Devie, "Computer Networks" , MK, 5th Edition

Reference Books:

1. Aaron Kershenbaum, "Telecommunication Network Design Algorithms", MGH, International Edition 1993.
2. Vijay Ahuja, "Communications Network Design and Analysis of Computer Communication Networks", MGH, International Editions.
3. Douglas E. Comer, "Internetworking with TCP/IP", Pearson Education, 6th Edition

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/Web course-contents/IIT.../comp...risk/1_Intro_risc_Suroj.doc
2. nptel.ac.in /reviewepdfs /106102062/lec7.pdf

BUSINESS ANALYTICS

Open Electives

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB25	**Open Elective**	3	-	-	3	30	70	100

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

I. COURSE OVERVIEW:

This course covers the fundamentals of data analysis, such as data gathering or data mining .this course covers concepts of data analysis, regression analysis, organization structures, forecasting techniques and decision analysis. The *data analytics* tools help in the data mining processes from loading to transformation, aggregation, automated parameter, and process optimization.

II. COURSE OBJECTIVES:

The students will try to learn:

I.   The role of business analytics within an organization.
II.   The relationships between the underlying business processes of an organization.
III. To gain an understanding of how managers use business analytics to formulate

III COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO1	Analyze data using statistical and business analytics technology	Analyze
CO2	Solve business problems and to support managerial decision making	Apply
CO3	Choose business decision Strategies with the without outcome probabilities	Apply
CO4	Perform statistical analysis on variety of data	Apply
CO5	Experiment Data using Business Analytics Technology	Apply

UNIT-I	BUSINESS ANALYTICS	Classes: 09

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modeling, sampling and estimation methods overview.

UNIT-II	REGRESSION ANALYSIS	Classes: 09

Trendiness and Regression Analysis: Modeling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT-III	ORGANIZATION STRUCTURES	Classes: 09

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

UNIT-IV	FORCASTING TECHNIQUES	Classes: 09

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.
Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V	DECISION ANALYSIS	Classes: 09

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Text Books

1. James Evans, "Business Analytics", Persons Education.

Reference Books

 1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications", Pearson FT Press.

 Web References

 1. http://nptel.ac.in/courses/110107092/

E-Text Books

 1. http://nptel.ac.in/downloads/110107092/

INDUSTRIAL SAFETY

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB26	**Open Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

In this course, students develop a comprehensive understanding of industrial safety principles and practices. They are equipped with the skills to identify, assess, and manage workplace hazards, promoting a culture of safety in their future engineering careers.

II. COURSE OBJECTIVES:

The students will try to learn:

I.   Ensuring duty holders apply inherent safety principles in managing risks.
II. Prioritizing interventions based on the inherent hazards of the site and/or pipeline, performance of duty holders in controlling risks and other defined operational intelligence.
III. Identifying the underlying, as well as the immediate, causes of any deficiencies in duty holders arrangements for managing risks.
IV. Taking action to ensure immediate and underlying causes of failures of risk management are addressed.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Describe the theories of accident causation and preventive measures of industrial accidents.	Understand
CO 2	Summarize the functions of maintenance department and application tools used for maintenance	Understand
CO 3	Recall the corrosion and its prevention methods	Remember
CO 4	Outline the fault tracing methods of various types of equipment	Understand
CO 5	Explain the Periodic and preventive maintenance of mechanical and electrical equipment	Understand

IV. SYLLABUS

UNIT-I	INDUSTRIAL SAFTEY	Classes: 09

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT-II	MAINTENANCE ENGINEERING	Classes: 09

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III	CORROSION AND PREVENTION TECHNIQUES	Classes: 09

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i.e. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication.

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.		
UNIT-IV	**FAULT TRACING**	**Classes: 09**
Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.		
UNIT-V	**PERODIC AND PREVENTIVE MAINTENANCE**	**Classes: 09**
Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.		
Text Books		
1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services. H. P. Garg, "Maintenance Engineering", S. Chand and Company.		
Reference Books		
1. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London.		
Web References		
1. https://onlinecourses.nptel.ac.in/noc18_mg42/preview		
E-Text Books		
1. http://portal.unimap.edu.my/portal/page/portal30/Lecturer%20Notes/KEJURUTERAAN_KOMPUTER/Semester%201%20Sidang%20Akademik%2020142015/DPT333%20Industrial%20safety%20and%20health/Chapter%201%20-%20Introduction%20-Zaizu_0.pdf		

OPERATIONS RESEARCH

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB27	**Open Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

The course allow students to possess a solid understanding of optimization techniques and their applications. They are equipped with the skills to formulate and solve optimization problems, analyze and interpret results, and make optimal decisions in various domains such as operations management, logistics, finance, and engineering.

II. COURES OBJECTIVES:

The students will try to learn:

I. Apply the dynamic programming to solve problems of discreet and continuous variables.
II. Understand the concept of nonlinear programming.
III. Describe the sensitivity analysis.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO1	Recall the basics of operation research	Understand
CO2	Explain the characteristics and scope of OR	Understand
CO3	Outline and formulate mathematical problems	Understand
CO4	Select optimal problems solving techniques for a given problem using LP	Apply
CO5	Solve transportation, travelling sales man and Assignment problems	Apply

IV. COURSE OUTCOMES:

UNIT-I	INTRODUCTION	Classes: 09

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT-II	FORMULATION TECHNIQUES	Classes: 09

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.

UNIT-III	NON LINEAR METHODS	Classes: 09

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem.

max flow problem - CPM/PERT.

UNIT-IV	SCHEDULING MODELS	Classes: 09

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT-V	DYNAMIC PROGRAMMING AND GAME THEORY	Classes: 09

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Text Books
1. H.A. Taha, "Operations Research - An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982.
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008

Reference Books
1. Hitler Libermann,"Operations Research" McGraw Hill Publications, 2009.
2. Pannerselvam, "Operations Research" Prentice Hall of India, 2010.
3. Harvey M Wagner, "Principles of Operations Research" Prentice Hall of India, 2010.

Web References
1. https://onlinecourses.nptel.ac.in/noc17_mg10/preview

E-Text Books
1. http://nptel.ac.in/courses/112106134/

COST MANAGEMENT OF ENGINEERING PROJECTS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB28	**Open Elective**	3	-	-	3	30	70	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		

I. COURSE OVERVIEW:

The course allow students to have a comprehensive understanding of cost management principles and practices in engineering projects. They are equipped with the skills to plan, estimate, control, and communicate project costs effectively, contributing to the successful delivery of projects within budgetary constraints

II. COUSRE OBJECTIVES:

The students will try to learn:

I. Establish systems to help streamline the transactions between corporate support departments and the operating units.
II. Devise transfer pricing systems to coordinate the buyer-supplier interactions between decentralized organizational operating units
III. Use pseudo profit centers to create profit maximizing behavior in what were formerly cost centers.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Summarize the concept of strategic cost management, strategic cost analysis – target costing, life cycle costing and Kaizen costing and the cost drive concept.	Understand
CO 2	Describe the decision-making; relevant cost, differential cost, incremental cost and opportunity cost, objectives of a costing system.	Understand
CO 3	Interpret the meaning and different types of project management and project execution, detailed engineering activities.	Understand
CO 4	Understand the project contracts, cost behavior and profit planning types and contents, Bar charts and Network diagram	Understand
CO 5	Analyze by using quantitative techniques for cost management like PERT/CPM.	Analyze

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 09

Introduction and Overview of the Strategic Cost Management Process

UNIT-II	COST CONCEPTS	Classes: 09

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and OpportUNITy cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT-III	PROJECT MANAGEMENT	Classes: 09

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents.

Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

UNIT-IV	COST BEHAVIOR AND PROFIT PLANNING	Classes: 09

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement, Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT-V	QUANTITATIVE TECHNIQUES	Classes: 09

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation Problems, Assignment problems, Simulation, Learning Curve Theory.

Text Books

1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting.
2. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Reference Books

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi.
2. Charles T. Horngren and George Foster, Advanced Management Accounting.
3. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher.

Web References

1. https://onlinecourses.nptel.ac.in/noc16_ce02/preview

E-Text Books

1. http://nptel.ac.in/downloads/110101003/

COMPOSITE MATERIALS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB29	**Open Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

In this course, students will gain insight into the manufacturing processes for composites, from choosing appropriate reinforcement fibers to integrating them with suitable matrices. They will develop an understanding of the challenges and considerations involved in achieving desired strength properties. This knowledge will enable them to evaluate and optimize the manufacturing processes for different types of composites based on specific application requirements.

II. COUSE OBJECTIVES:

The students will try to learn:
I. The manufacturing processes of reinforcement fibers and matrices for composites.
II. The concept of tailored design philosophy.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the basic mechanical behavior of composite materials and make sound prediction on the likely behavior of new combinations of materials.	Understand
CO 2	Explain the properties of and applications of fibers, particle reinforcements and make use of rule of mixtures	Understand
CO 3	Interpret Manufacturing of Metal Matrix Composites, Properties and applications.	Understand
CO 4	Understand Manufacturing of polymer Matrix Composites, Properties and applications	Understand
CO 5	Recall the concepts of failure criteria of strength	Remember

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 09

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT-II	REINFORCEMENTS	Classes: 09

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-III	MANUFACTURING OF METAL MATRIX COMPOSITES	Classes: 09

Casting, Solid State diffusion technique, Cladding, Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites.

Liquid Metal Infiltration, Liquid phase sintering. Manufacturing of Carbon, Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV	MANUFACTURING OF POLYMER MATRIX COMPOSITES	Classes: 09
Preparation of Moulding compounds and prepregs, hand layup method, Autoclave method, Filament winding method, Compression moulding, Reaction injection moulding. Properties and applications.		
UNIT-V	STRENGTH	Classes: 09
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.		

Text Books:

1. R.W.Cahn, "Material Science and Technology" VCH, West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam, "Materials Science and Engineering, An introduction", John Wiley & Sons, NY, Indian edition, 2007.

Reference Books:

1. ed-Lubin, "Hand Book of Composite Materials"
2. Deborah D.L. Chung, "Composite Materials Science and Applications"
3. Danial Gay, Suong V. Hoa, and Stephen W. Tasi, "Composite Materials Design and Applications"

Web References:

1. https://freevideolectures.com/course/3479/processing-of-non-metals/5

E-Text Books:

1. https://www.asminternational.org/documents/10192/1849770/05287G_Sample_Chapter.pdf

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB30	**Open Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

In this course, students will gain insights into the principles associated with effective energy management using biomass resources. They will understand the different conversion technologies and their applications in sustainable energy systems. By applying these principles in their daily lives, students will be able to make informed decisions regarding energy consumption, resource utilization, and environmental sustainability.

II. COURSE OBJECTIVES:
The students will try to learn:
I. The principles associated with effective energy management and to apply these principles in the day to day life.
II. The collection, transfer and transport of municipal solid waste.
III. The design and operation of a municipal solid wasteland fill.
IV. The key processes involved in recovering energy from wastes, systematically evaluate the main operational challenges in operating thermal and biochemical energy from waste facilities.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1	**Identify** the different sources and types of solid waste by the properties of municipal solid waste for segregation and collection of waste.	Remember
CO 2	**Explain** the energy generation technologies from waste treatment plants and disposal of solid waste by aerobic composting and incineration process.	Understand
CO 3	**Illustrate** the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases.	Analyze
CO 4	**Understand** the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate.	Understand
CO 5	**Outline** the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.	Create

IV. SYLLABUS:

UNIT-I	INTRODUCTION TO ENERGY FROM WASTE	Classes: 09

Introduction to Energy from Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste. MSW, Conversion devices. Incinerators, gasifiers, digestors

UNIT-II	BIOMASS PYROLYSIS	Classes: 09

Biomass Pyrolysis: Pyrolysis, Types, slow fast, Manufacture of charcoal, Methods, Yields and application, Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III	BIOMASS GASIFICATION	Classes: 09

Gasifiers, Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation. Gasifier burner arrangement for thermal heating.

Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV	BIOMASS COMBUSTION	Classes: 09

Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V	BIOGAS	Classes: 09

Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system. Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion. Types of biogas Plants, Applications. Alcohol production from biomass, Bio diesel production. Urban waste to energy conversion, Biomass energy programme in India.

Text Books:

1. Desai, Ashok V, "Non Conventional Energy", Wiley Eastern Ltd., 1990.

Reference Books:

1. Khandelwal, K. C. and Mahdi, S. S, "Biogas Technology - A Practical Hand Book", Vol. I & II Tata McGraw Hill Publishing Co. Ltd., 1983.
2. Challal, D. S, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.

Web References:

1. http://nptel.ac.in/courses/103107125/

E-Text Books:

1. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996..

NGLISH FOR RESEARCH PAPER WRITING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB32	**Audit**	2	-	-	0	30	70	100
Contact Classes: 24	**Tutorial Classes: Nil**	**Practical Classes: Nil**			**Total Classes: 24**			

I. COURSE OVERVIEW:

In this course, students will be equipped with the necessary tools to effectively communicate their research findings in a scholarly manner. They will develop the ability to write clear, concise, and well-structured research papers that adhere to academic standards. These skills will not only benefit them in their academic pursuits but also in their future professional careers as researchers, scholars, and professionals in various fields

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Understand that how to improve your writing skills and level of readability
II. Learn about what to write in each section
III. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Interpret the technique of determining a research problem for a crucial part of the research study	Apply
CO 2	Examine the way of methods for avoiding plagiarism in research	Understand
CO 3	Apply the feasibility and practicality of research methodology for a proposed project.	Apply
CO 4	Make use of the legal procedure and document for claiming patent of invention.	Apply
CO 5	Identify different types of intellectual properties, the right of ownership, scope of protection to create and extract value from IP	Apply

IV. SYLLABUS:

UNIT-I	**PLANNING AND PREPARATION**	**Classes: 04**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II	**ABSTRACT**	**Classes: 05**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III	**DISCUSSION AND CONCLUSIONS**	**Classes: 05**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT-IV	**WRITING SKILLS**	**Classes: 05**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT-V	QUALITY AND TIME MAINTENANCE	Classes: 05
Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission		

Text Books:

1. Goldbort R, "Writing for Science", Yale University Press. 2011.
2. Adrian Wallwork, "English for Writing Research Papers", Springer New York Dordrecht Heidelberg London, 2011.

Reference Books:

1. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM Highman's book.

Web References:

1. http://saba.kntu.ac.ir/eecd/ecourses/Seminar90/2011%20English%20for%20Writing%20Research%20Papers.pdf

E-Text Books:

1. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

DISASTER MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB33	**Audit**	2	-	-	0	30	70	100

Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 24

I. COURSE OVERVIEW:

In the course on disaster management, students will explore a range of important topics and gain valuable knowledge and skills to effectively address and mitigate the impact of disasters and covers areas like Repercussions of Disasters and Hazards, Disaster-Prone Areas in India, Risk Assessment and Disaster Mitigation

II. COURSE OBJECTIVES:

The course should enable the students to:

I. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

II. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

III. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

IV. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand to describe the basic types of Environmental hazards and disasters. Understand how to react effectively to natural, manmade, and technological threats.	Understand
CO 2	Understand how to react effectively to natural, manmade, and planetary hazards	Understand
CO 3	Explore the history of the field and comprehend how past events are earthquake, landslides, and volcanic hazards.	Analyze
CO 4	Describe the basic concepts of the emergency management cycle mitigation, preparedness, response, and recovery	Understand
CO 5	Recognizes the stakeholders in disaster management system, their jurisdiction and responsibilities	Remember

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 04

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT-II	REPERCUSSIONS OF DISASTERS AND HAZARDS	Classes: 05

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT-III	DISASTER PRONE AREAS IN INDIA	Classes: 05
Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics		

UNIT-IV	DISASTER PREPAREDNESS AND MANAGEMENT	Classes: 05
Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.		

UNIT-V	RISK ASSESSMENT & DISASTER MITIGATION	Classes: 05
Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival. Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.		

Text Books:

 1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company.

Reference Books:

1.   Sahni, PardeepEt.Al, "Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
Goel S. L. "Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

Web References:

1. http://nptel.ac.in/courses/105101010/downloads/Lecture37.pdf

E-Text Books:

1. Disaster management by Vinod k. Sharma

SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB34	**Audit**	2	-	-	0	30	70	100

Contact Classes: 24	**Tutorial Classes: Nil**	**Practical Classes: Nil**	**Total Classes: 24**

I. COURSE OVERVIEW:

In this course, Studying Sanskrit enhances students' analytical thinking and problem-solving abilities. The intricate grammar and logical structure of Sanskrit nurture their analytical skills, enabling them to dissect complex concepts and extract profound insights. This heightened analytical thinking can be applied across different technical disciplines, fostering innovative solutions to contemporary challenges

II. COURSE OBJECTIVES:

The course should enable the students to:

I.   Get a working knowledge in illustrious Sanskrit, the scientific language in the world
II. Learning of Sanskrit to improve brain functioning
III. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
IV. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Understand the basic Sanskrit grammar	Understand
CO 2	Formulate simple sentences	Apply
CO 3	Apply order and roots	Apply
CO 4	Understand Ancient Sanskrit literature about science & technology	Understand
CO 5	Develop logical thinking being a logical language in technical concepts	Apply

IV. SYLLUBUS:

UNIT-I	**INTRODUCTION**	**Classes: 04**

Alphabets in Sanskrit, Past/Present/Future Tense

UNIT-II	**SENTENCES**	**Classes: 04**

Simple Sentences

UNIT-III	**ROOTS**	**Classes: 04**

Order, Introduction of roots

UNIT-IV	**SANSKRIT LITERATURE**	**Classes: 04**

Technical information about Sanskrit Literature

UNIT-V	**TECHNICAL CONCEPTS**	**Classes: 08**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Text Books:

1.   Suresh Soni, "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi..

Reference Books:
1.   Dr.Vishwas, "Abhyaspustakam", Samskrita-Bharti Publication, New Delhi
Web References:
1.   http://learnsanskritonline.com/
E-Text Books:
1.   Prathama Deeksha-Vempati Kutumb Shastri, "Teach Yourself Sanskrit", Rashtriya Sanskri Sansthanam, New Delhi Publication.

VALUE EDUCATION

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB35	**Audit**	2	-	-	0	30	70	100

Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 24

I. COURSE OVERVIEW:

In the course on value education, students emerge with a heightened sense of self-awareness, a strong moral foundation, and the skills necessary for personal and professional success. They are equipped with the knowledge and tools to navigate ethical challenges, contribute positively to society, and lead a purposeful and fulfilling life based on their core values and principles.

II. COURSE OBJECTIVES:
The course should enable the students to:
I.   Understand value of education and self- development
II. Imbibe good values in students
III. Let the should know about the importance of character

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO 1	Understand the significance of ethical human conduct and self-development	Understand
CO 2	Adopt value-based living and holistic technologies to save nature	Apply
CO 3	Inculcate positive thinking, dignity of labor and religious tolerance	Apply
CO 4	Develop the overall Character and Competence through self-management	Analyze
CO 5	Practice Self-control. Honesty through Studying effectively all religious messages	Apply

IV. SYLLABUS:

UNIT-I	VALUES AND SELF-DEVELOPMENT	Classes: 04

Values and self-development. Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

UNIT-II	CULTIVATION OF VALUES	Classes: 06

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

UNIT-III	PERSONALITY AND BEHAVIOR DEVELOPMENT	Classes: 06

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT-IV	CHARACTER AND COMPETENCE	Classes: 03

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.

UNIT-V	SELF CONTROL	Classes: 03
All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.		

Text Books:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

Web References:

1. http://www.best-personal-development-books.com/personal-value-development.html
2. http://nptel.ac.in/courses/109104068/

E-Text Books:

1. R.P. Shukla, "Value education and human rights".

CONSTITUTION OF INDIA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB36	**Audit**	2	-	-	0	30	70	100

Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 24

I. COURSE OVERVIEW:

The course on the Constitution of India provides students with a comprehensive understanding of the historical context, principles, and structure of the Indian Constitution. It explores the journey and philosophy behind the making of the Indian Constitution, highlighting the vision and ideals of the founding fathers.

II. COURSE OBJECTIVES:

The course should enable the students to:

I.   Understand the premises informing the twin themes of liberty and freedom from a civil right perspective.
II.   Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
III. Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Describe historical background of the constitution making and its importance for building a democratic India.	Understand
CO 2	Understand the Constitutional Rights and and duties	Understand
CO 3	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary	Understand
CO 4	Analyse the decentralization of power between central, state and local self-government.	Analyze
CO 5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy	Apply

IV. SYLLABUS:

UNIT-I	HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION	Classes: 08

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)
Philosophy of the Indian Constitution: Preamble, Salient Features

UNIT-II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	Classes: 04

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III	ORGANS OF GOVERNANCE	Classes: 04

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive President, Governor, Council of Minister.

Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT-IV	LOCAL ADMINISTRATION	Classes: 04

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT-V	ELECTION COMMISSION	Classes: 04

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. Dr. S. N. Busi, "Dr. B. R. Ambedkar framing of Indian Constitution", 1st Edition, 2015.
2. M. P. Jain, "Indian Constitution Law", Lexis Nexis, 7th Edition,2014.

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Web References:

1. http://www.constitution.org/cons/india/p18.html

E-Text Books:

1. https://www.india.gov.in/my-government/constitution-india/constitution-india-full-text

PEDAGOGY STUDIES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB37	**Audit**	2	-	-	0	30	70	100
Contact Classes: 24	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 24**		

I. COURSE OVERVIEW:

In this course in pedagogy studies, students gain a solid foundation in educational principles and practices. They develop a deep understanding of effective teaching and learning strategies, empowering them to create engaging and meaningful learning experiences for their future students. Whether pursuing a career in teaching or any other field that involves knowledge transfer, students emerge with the knowledge and skills to inspire and facilitate learning, making a positive impact on the lives of others.

II. COURSE OBJECTIVES:

The course should enable the students to:
I. Review existing evidence on the review topic to inform program design and policy making undertaken by the DFID, other agencies and researchers.
II. Identify critical evidence gaps to guide the development.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	Identify the Methodology and conceptual framework of teachers education	Understand
CO 2	Understand pedagogical practices are being used by teachers in formal and informal classrooms in developing countries	Understand
CO 3	Interpret the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners	Understand
CO 4	Classify the importance of class room practice, curriculum and learning in Professional Development.	Understand
CO 5	Summarize teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy	Understand

IV. SYLLABUS:

UNIT-I	INTRODUCTION	Classes: 04

Introduction And Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT-II	THEMATIC OVERVIEW	Classes: 02

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III	PEDAGOGICAL PRACTICES	Classes: 04

Evidence on the effectiveness of pedagogical practices. Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.

Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV	PROFESSIONAL DEVELOPMENT	Classes: 04

Professional Development: alignment with classroom practices and follows up Support. Peer support. Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.

UNIT-V	RESEARCH GAPS	Classes: 02

Research gaps and future directions, Research design**,** Contexts**,** Pedagogy**.** Teacher education**.** Curriculum and assessment**.** Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom interaction in Kenyan primary schools", Compare, 31 (2), 245-261.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361-379.

Reference Books:

1. AkyeampongK, "Teacher training in Ghana - does it count?" Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving Teaching and Learning of Basic Maths and Rreading in Africa: Does teacher preparation count?" International Journal Educational Development, 33 (3): 272–282.

Web References:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell

E-Text Books:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.

STRESS MANAGEMENT BY YOGA

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCSB38	**Audit**	2	-	-	0	30	70	100

Contact Classes: 24	**Tutorial Classes: Nil**	**Practical Classes: Nil**	**Total Classes: 24**

I. COURSE OVERVIEW:

In a course on stress management by yoga, engineering students learn a variety of yoga techniques and principles that promote physical, mental, and emotional well-being. These techniques include yoga postures (asanas), breathing exercises (pranayama), meditation, and relaxation techniques.

II. COURSE OBJECTIVES:

The students will try to learn:
I.   How to achieve overall health of body and mind.
II. How to overcome stress.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to: (Same as R18)

CO 1	Understand Ashtanga yog and its impartance	Understand
CO 2	Identify the Dos and Do nots of Life by practicing the Yam and Niyam	Analyze
CO 3	Interpret the Shaucha and its components	Understand
CO 4	Make use of breathing techniques and Asan and Pranayam	Understand
CO 5	Develop healthy mind in a healthy body thus improving social health also	Apply

IV. SYLLABUS:

UNIT-I	**INTRODUCTION**	**Classes: 08**

Definitions of Eight parts of yog. (Ashtanga)

UNIT-II	**YAM AND NIYAM**	**Classes: 04**

Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT-III	**SHAUCHA**	**Classes: 04**

Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV	**ASAN AND PRANAYAM**	**Classes: 04**

Asan and Pranayam. Various yog poses and their benefits for mind & body

UNIT-V	**BREATHING TECHNIQUES**	**Classes: 04**

Regularization of breathing techniques and its effects-Types of pranayam

Text Books:
1. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata
Reference Books:
1. Janardan Swami, "Yogic Asanas for Group Tarining-Part-I", Yogabhyasi Mandal, Nagpur
Web References:

1. https://americanyoga.school/course/anatomy-for-asana/
2. https://www.yogaasanasonline.com/

E-Text Books:

1. "Stress Management By Yoga" by Todd A. Hoover, M. D. D., Ht.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSB39	Audit	2	-	-	0	30	70	100

Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 24

I. COURSE OVERVIEW:

In this course, students delve into various aspects of personal development and self-awareness. They learn techniques to improve self-confidence, self-esteem, and self-awareness, which are vital for thriving in their engineering careers. Students explore their strengths, weaknesses, values, and beliefs, enabling them to develop a clearer understanding of themselves and their goals.

II. COURSE OBJECTIVES:

The students will try to learn:

I.   How to achieve the highest goal happily
II.   How a person become with stable mind, pleasing personality and determination
III.   Awaken wisdom in students

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Summarize** steps to develop personality with stable mind, pleasing manners and determination.	Understand
CO 2	**Identify** day to day work and duties for developing peace and prosperity as depicted in Geeta.	Analyze
CO 3	**Formulate** the daily life style by depicting the verses from Bhagavatgeetha.	Analyze
CO 4	**Outline** the verses of Shrimad Bhagavad Geetha for holistic development.	Create
CO 5	Demonstrates personality development by verses of Bhagavatgeetha.	Create

IV. SYLLUBUS:

UNIT-I	HOLISTIC DEVELOPMENT	Classes: 08

Neetisatakam-Holistic development of personality, Verses- 19,20,21,22 (wisdom), Verses- 29,31,32 (pride & heroism), Verses- 26,28,63,65 (virtue),Verses- 52,53,59 (dont's),Verses- 71,73,75,78 (do's)

UNIT-II	BHAGWAD GEETA	Classes: 04

Approach to day to day work and duties. Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48. Chapter 3-Verses 13, 21, 27, 35.

UNIT-III	BHAGWAD GEETA	Classes: 04

Shrimad BhagwadGeeta: Chapter 6-Verses 5, 13, 17, 23, 35, Chapter 18-Verses 45, 46, 48.

UNIT-IV	BASIC KNOWLEDGE	Classes: 04

Statements of basic knowledge. Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68. Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT-V	ROLE MODEL	Classes: 04
	Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39. Chapter18 – Verses 37,38,63	

Text Books:

1. P.Gopinath, "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", Rashtriya Sanskrit Sansthanam, New Delhi.

Reference Books:

1. Swami Swarupananda, "Srimad Bhagavad Gita",Advaita Ashram (Publication Department), Kolkata.

Web References:

1. http://openlearningworld.com/section_personality_development.html

E-Text Books:

1. http://persmin.gov.in/otraining/UNDPProject/undp_UNITs/Personality%20Dev%20N%20DLM.pdf

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.

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

Where, C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith 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.

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

Where, S_i is the SGPA of the ith 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 make up 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 2018-2019 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 - R18 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

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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