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 CATALOG AND SYLLABI
PG21

M.Tech Regular Two Year Degree Program
(for the batches admitted from the academic year 2021 - 2022)

These rules and regulations may be altered/changed from time to time by the academic council
FAILURE TO READ AND UNDERSTAND THE RULES 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 "PG21" 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 2021 - 22)

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 program 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	PS
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 program 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 two semesters. Each semester shall be of 23 weeks' 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. The duration for each semester shall be a minimum of 17 weeks of instruction. The Academic calendar shall be declared at the beginning of the academic year as shown in Table 2.

Table 2: Academic Calendar

FIRST SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 week	
	Preparation and Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Semester Break and Supplementary Exams			2 weeks
SECOND SEMESTER (23 weeks)	I Spell Instruction Period	9 weeks	21 weeks
	I Mid Examinations	1 week	
	II Spell Instruction Period	8 weeks	
	II Mid Examinations	1 Week	
	Preparation & Practical Examinations	2 weeks	
	Semester End Examinations		2 weeks
Summer Vacation and Supplementary Exams			4 weeks
THIRD SEMESTER	I Spell Instruction Period	9 weeks	19 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 Weeks

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 CGPA ≥ 6.0, and shall pass all the mandatory Audit Courses to complete the M.Tech program successfully.
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, Professional core elective courses, Audit courses, Open elective courses, Laboratory courses, Mini project with seminar, 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 (04)	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, out of which 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE).

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. CIA is conducted for a total of 30 marks, with 20 marks for Continuous Internal Examination (CIE), 05 marks for Assignment and 05 marks for Alternative Assessment Tool (AAT). **Two CIE Tests are Compulsory** and sum of the two tests, along with the scores obtained in the assignment / AAT shall be considered for computing the final CIA of a student in a given course.

The CIE Tests/Assignment /AAT shall be conducted by the course faculty with due approval from the HOD. Advance notification for the conduction of Assignment/AAT is mandatory and the responsibility lies with the concerned course faculty.

Table 4: Assessment pattern for Theory Courses

Component		Marks	Total Marks
CIA	Continuous Internal Examination – 1 (Mid-term)	10	30
	Continuous Internal Examination – 2 (End-term)	10	
	Assignment	5	
	Alternative Assessment Tool (AAT)	5	
SEE	Semester End Examination (SEE)	70	70
Total Marks			**100**

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 9th and 17th week of the semester respectively for 10 marks each of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered. The valuation and verification of answer scripts of CIE exams shall be completed within a week after the conduct of the Examination.

Assignment:

To improve the writing skills in the course an assignment will be evaluated for 05 marks. One assignment has to submit at the end of the CIE2 for the questions provided by the each course coordinator in that semester. Assignments to be handed in as loose paper collection stapled together at the top left corner. The assignment should be presented as a professional report. It must consist of a cover sheet, content page, and should have an introduction, a body, a conclusion or recommendation, and a reference page.

Alternative Assessment Tool (AAT):

In order to encourage innovative methods while delivering a course, the faculty members are encouraged to use the Alternative Assessment Tool (AAT). This AAT enables faculty to design own assessment patterns during the CIA. The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. If properly applied, the AAT converts the classroom into an effective learning center. **The AAT may includes, concept videos, course related term paper, technical seminar, term paper, paper presentations conducted by reputed organizations relevant to the course etc.**

9.2 Laboratory Course:

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.

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 75% 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 10% may be condoned by the College Academic Committee (CAC) on the recommendation of Head of the Department if his/her attendance is between 75% 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 / 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 (≥ 90% , ≤ 100%)	10	S (Superior)
Below 90% but not less than 80% (≥80% , <90%)	9	A+ (Excellent)
Below 80% but not less than 70% (≥70% , <80%)	8	A (Very Good)
Below 70% but not less than 60% (≥60% , <70%)	7	B+ (Good)
Below 60% but not less than 50% (≥ 50% , <60%)	6	B (Average)
Below 50% (<50%)	0	F (Fail)
Absent	0	AB (Absent)

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

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

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

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

Where, S_j is the SGPA of the j^{th} semester and $C_j$is the total number of credits upto the semester and m represent the number of semesters completed in which a student registered upto the semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

15.0 ILLUSTRATION OF COMPUTATION OF SGPA AND CGPA

15.1 Illustration for SGPA

Course Name	Course Credits	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	4	A	8	4 x 8 = 32
Course 2	4	S	10	4 x 10 = 40
Course 3	4	B	6	4 x 6 = 24
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B	6	3 x 6 = 18
	21			**159**

Thus, SGPA = 159 / 21 = 7.57

15.2 Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credits: 24 SGPA: 7	Credits: 24 SGPA: 6	Credits: 24 SGPA: 6.5	Credits: 24 SGPA: 6

Thus, *CGPA* = $\frac{24x7 + 24x6 + 24x6.5 + 24x6}{96} = 6.37$

16.0 REVALUATION

If the examinee is not satisfied with the marks awarded, he/she may apply for revaluation of answer book in prescribed format online within three (3) working days from the date of declaration of result of the examination or issue of the statement of marks, whichever is earlier. The revaluation facility shall be for theory papers only. The revaluation of answer book shall not be permitted in respect of the marks awarded to the scripts of practical examination / project work (including theory part) and in viva voce / oral / comprehensive examinations.

The revaluation will be done by a second independent examiner. The result after revaluation shall be as follows:

- The revaluation marks are considered only if the difference between the original award and award on revaluation is more than equal to 15% of 70 marks (11 marks).
- If the difference between the original award and the award on reevaluation is more than 20% (14 marks), a third evaluator is to be appointed and the average of two nearest awards (in the range of 15%) shall be considered.

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 as per the specified course catalogue, and as indicated above, within four academic years from the date of commencement of his first year first semester, shall forfeit his/her seat in M. Tech. program and his admission shall stand cancelled.

18.0 AWARD OF DEGREE

After a student has earned the requirements prescribed for the completion of the program and is eligible for the award of M.Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	CGPA
First Class with Distinction	≥ 7.75
First Class	$6.75 \leq$ CGPA < 7.75
Second Class	$6.00 \leq$ CGPA < 6.75

A student with final CGPA (at the end of the M.Tech program) < 6.00 shall not be eligible for the Award of Degree.

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 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.

20.0 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.

21.0 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.

22.0 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.

23.0 TRANSITORY REGULATIONS

23.1 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.

23.2 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.

24.0 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 – PG21

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										
BESC01	Embedded System Design and Architecture	PCC	Core	3	0	0	3	30	70	100
BESC02	Microcontrollers and Programmable Digital Signal Processing	PCC	Core	3	0	0	3	30	70	100
	Professional Core Elective - I	PCE	Elective	3	0	0	3	30	70	100
	Professional Core Elective – II	PCE	Elective	3	0	0	3	30	70	100
	Audit Course	Audit - I	Audit	2	0	0	0	30	70	100
PRACTICAL										
BESC11	Embedded Systems Laboratory	PCC	Core	0	0	4	2	30	70	100
BESC12	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										
BESC13	Advanced Microprocessors and Interfacing	PCC	Core	3	0	0	3	30	70	100
BESC14	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	Audit - II	Audit	2	0	0	0	30	70	100
PRACTICAL										
BESC23	Advanced Microprocessors and Interfacing Laboratory	PCC	Core	0	0	4	2	30	70	100
BESC24	Internet of Things Laboratory	PCC	Core	0	0	4	2	30	70	100
BESC25	Mini Project with Seminar	PCC	Core	0	0	4	2	30	70	100
TOTAL				**14**	**00**	**12**	**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										
BHSC11	Research Methodology and IPR	PCC	Core	2	0	0	2	30	70	100
	Professional Core Elective – V	PCE	Elective	3	0	0	3	30	70	100
	Open Elective Courses	OEC	Elective	3	0	0	3	30	70	100
PROJECT										
BESC31	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
BESC32	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
BESC03	Microcontrollers for Embedded System Design
BESC04	Advanced Operating Systems
BESC05	Hardware Software Co-Design
BESC06	Wireless LANS and PANS

PROFESSIONAL CORE ELECTIVE – II

Course Code	Course Title
BESC07	Embedded C
BESC08	CPLD and FPGA Architecture
BESC09	Sensors and Actuators
BESC10	Principles of Distributed Embedded Systems

PROFESSIONAL CORE ELECTIVE – III

Course Code	Course Title
BESC15	Embedded Wireless Sensor Networks
BESC16	Embedded Real Time Operating Systems
BESC17	Digital Image and Video Processing
BESC18	Embedded Computing

PROFESSIONAL CORE ELECTIVE – IV

Course Code	Course Title
BESC19	Embedded Networking
BESC20	Network Security and Cryptography
BESC21	System On Chip Architecture
BESC22	RISC Processor Architecture and Programming

PROFESSIONAL CORE ELECTIVE – V

Course Code	Course Title
BESC26	Embedded Processors & Peripherals
BESC27	Design of Embedded Communication Software
BESC28	Sensor Technologies and MEMS
BESC29	Communication Network

OPEN ELECTIVE COURSES

Course Code	Course Title
BAEC30	Elements of Aerospace Engineering
BCSC30	Data Analytics
BESC30	Real Time Operating Systems
BPSC30	Waste to Energy
BCCC30	Operations Research
BSTC30	Project Management and Planning

AUDIT COURSES

Course Code	Course Title
BHSC01	English for Research Paper Writing
BHSC02	Disaster Management
BHSC03	Sanskrit for Technical Knowledge
BHSC04	Value Education
BHSC05	Constitution of India
BHSC06	Pedagogy Studies
BHSC07	Stress Management by Yoga
BHSC08	Personality Development through Life Enlightenment Skills
BHSC09	Business Sustainability and Management
BHSC10	Business Ethics and Corporate Governance

SYLLABUS
(I – III SEMESTERS)

EMBEDDED SYSTEM DESIGN AND ARCHITECTURE

I Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**		**CIA**	**SEE**	**Total**
BESC01	**Core**	3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:45**		

I. COURSE OVERVIEW:

This course 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 basics of embedded systems then the difference between embedded systems and general purpose systems.
II. The embedded firmware design approaches and development languages.
III. The typical engineering issues of embedded software development.

III. COURSEOUTCOMES:

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 for different 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:

MODULE – I: INTRODUCTION TO EMBEDDED SYSTEMS (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. Core of the Embedded System: ASICs, PLDs, Commercial Off-The-Shelf Components (COTS).

MODULE – II: EMBEDDED FIRMWARE (09)

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit. Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Sensors and Actuators, Communication Interface. Embedded Firmware Design Approaches and Development Languages. Introduction, object oriented programming with C, the project header (main.h), the port header (port.h).

MODULE – III: PROCESSOR HARDWARE (09)

Embedded system model, Embedded board using Von Neuman model; EMBEDDED processors: ISA architecture models-application specific ISA models and general purpose ISA models.

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

MODULE – IV: SOFTWARE (09)

Board memory: ROM, RAM, cache, auxiliary memory, memory management, memory performance. Middleware and applications: PPP, IP middleware UDP, Java. Application layer: FTP client, SMTP, HTTP server and client.

MODULE – V: SYSTEM DESIGN (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.

V. TEXT BOOKS:

1. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley Publications, 3rd Edition, 2006.
2. Shibu K.V, "Introduction to Embedded Systems", McGraw Hill, 3rd Edition, 2006.

VI. REFERENCE BOOKS:

1. Tammy Noergaard, "Embedded system architecture", Elsevier, 2006.
2. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", The publisher, Paul Temme, 2011.
3. Raj Kamal, "Embedded Systems", TMH, 2nd Edition, 2008.
4. Shibu K.V, "Introduction to Embedded Systems, McGraw Hill, 3rdEdition, 2012.
5. Lyla, "Embedded Systems", Pearson Education, 2nd Edition, 2013.

VII. 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).html
3. http://www.sciencedirect.com/science/book/9780750677929
4. https://books.google.co.in/books/about/Embedded_systems.html?id=tgLm2g8KnH0C

VIII. E-TEXT BOOKS:

1. https://www.scribd.com/doc/233633895/Intro-to-Embedded-Systems-by-Shibu-Kv
2. http://www.ee.eng.cmu.ac.th/~demo/think/_DXJSq9r3TvL.pdf
3. https://www.scribd.com/doc/55232437/Embedded-Systems-Raj-Kamal
4. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf

MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSING

I Semester: ECE(ES)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESC02	Core	3	-	0	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 17XXMicrocontroller 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 programming models and programmable digital signal processors.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The programming models of ARM processors core-based System on Chip with several features / peripherals based on requirements of embedded applications.
II. Identify and characterize architecture of Programmable DSP Processors.
III. Design and 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 ofARM Cortex M3 processor for interfacing microprocessor applications	Understand
CO 2	**Analyze** Exceptions handler mechanism to minimize interruptlatency 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 andI/O peripherals	Understand
CO 5	**Identify** the CPU architecture, peripherals, and developmenttools for the TMS320C6000 digital signal processors	Apply
CO 6	**Develop** the application for digital signal processing using codecomposer studio tool	Apply

IV. SYLLABUS:

MODULE – I: ARM CORTEX-M3 PROCESSOR (9)

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

MODULE – II: EXCEPTIONS AND INTERRUPT (9)

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

MODULE – III: LPC 17XX MICROCONTROLLER (9)

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

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

MODULE – IV: PROGRAMMABLE DSP (P-DSP) PROCESSORS (9)
Programmable DSP (P-DSP) Processors: Harvard architecture, Multiport memory, architectural structure of P-DSP- MAC unit, Barrel shifters, Introduction to TI DSP processor family.

MODULE – V: VLIW ARCHITECTURE (9)
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.

V. TEXT BOOKS:

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

VI. REFERENCE BOOKS:

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

VII. 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

VIII. E-TEXT BOOKS:

1. https://university.ti.com
2. http://www.everythingvtu.wordpress.com

MICROCONTROLLERS FOR EMBEDDED SYSTEM DESIGN

I Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC03	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:45**		

I. COURSE OVERVIEW:

Microcontrollers are the key components in most of the modern embedded and system-on-chip designs. This course outlines the design and implementation of embedded systems using suitable hardware and software tools .The instruction set, Embedded C programming for I/O and memory interfacing techniques are covered. 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 techniques essential to design and implementation of embedded systems using suitable hardware and software tools
II. 8051, ARM and PIC microcontroller which has good capacity for processing real world signals with serial communication protocols.
III. The Embedded C- language programming and interfacing various peripherals for designing of new embedded systems in the field of Communications, Electronic measurement, Control systems, Consumer electronics industry and other real-time systems.

III. COURSEOUTCOMES:

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:

MODULE – I: INTRODUCTION TO EMBEDDED SYSTEMS (9)

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.

MODULE – II: MICROCONTROLLERS (9)

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.

MODULE – III: EMBEDDED RISC PROCESSORS (9)
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

MODULE – IV: INTERRUPTSANDDEVICEDRIVERS (9)
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.

MODULE – V: NETWORKPROTOCOLS (9)
Serial communication protocols, Ethernet protocol, SDMA, Channel and IDMA, external bus interface.

V. TEXT BOOKS:

1. RajKamal, "Embedded Systems, Architecture Programming and Design", Tata McGraw Hill, 2nd Edition, 2008.
2. Muhammad Ali Mazidi, RolinD. Mckinaly,Danny Causy, "PIC Microcontroller and Embedded Systems", Pearson Education, 1st Edition, 2008.
3. RobertAshpy, "Designers Guide to the Cypress PSOC", Elsevier, 1st Edition, 2005.

VI. 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", PHInc, 1st Edition,1998.

VII. WEB REFERENCES:

1. http://nptel.ac.in/syllabus/108102045/

VIII. E-TEXT BOOKS:

1. http://https://www.mistralsolutions.com/services/product-design-
2. 2. https://bookauthority.org/books/best-embedded-systems.

ADVANCED OPERATING SYSTEMS

I Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC04	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	0	4	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 distributed operating system, algorithms for dead lock detection , memory sharing algorithms , fault tolerance procedures ,data security and protection mechanisms .It also introduces study of other operating systems multiprocessor operating systems and database Operating systems. The study of this gives understanding of any type of operating system in real world.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Basic concepts on distributed operating system that includes architecture, mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
II. The concepts of distributed resource management components, the algorithms for implementing of distributed shared memory, recovery, data protection and security.
III. The fundamentals of multiprocessor operating systems and database operating systems for real time and mobile operating systems applications.

III. COURSEOUTCOMES:

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

CO1	Recall the basics of operating system for better understanding of distributed operating system architecture.	Remember
CO2	Demonstrate the principles, importance and design issues of distributed operating system.	Understand
CO 3	Apply suitable algorithm to detect and control dead lock in distributed systems	Apply
CO 4	Explain the security issues associated with distributed systems and techniques for increasing system security.	Understand
CO 5	Model the Distributed File System and Distributed Shared Memory based on requirement.	Understand
CO 6	Identify the agreement problems and algorithms to resolve it in order to reduce errors in distributed system.	Apply

IV. SYLLABUS:

MODULE – I: ARCHITECTURES OF DISTRIBUTED SYSTEMS (09)

System Architecture types, issues in distributed operating systems, communication networks, communication primitives. Theoretical Foundations, inherent limitations of a distributed system, lamp ports logical clocks, vector clocks, casual ordering of messages, global state, cuts of a distributed computation, termination detection. Distributed Mutual Exclusion, introduction, the classification of mutual exclusion and associated algorithms, a comparative performance analysis.

MODULE – II: DISTRIBUTED DEADLOCK DETECTION (9)

Introduction - deadlock handling strategies in distributed systems – issues in deadlock detection and resolution – control organizations for distributed deadlock detection – centralized and distributed deadlock detection algorithms –hierarchical deadlock detection algorithms. Agreement protocols – introduction-the system model,

a classification of agreement problems, solutions to the Byzantine agreement problem, applications of agreement algorithms. Distributed resource management: introduction-architecture – mechanism for building distributed file systems – design issues – log structured file systems.

MODULE – III: DISTRIBUTED SHARED MEMORY (9)

Architecture– algorithms for implementing DSM – memory coherence and protocols – design issues. Distributed Scheduling – introduction – issues in load distributing – components of a load distributing algorithm – stability – load distributing algorithm – performance comparison – selecting a suitable load sharing algorithm – requirements for load distributing -task migration and associated issues. Failure Recovery and Fault tolerance:

Introduction– basic concepts – classification of failures – backward and forward error recovery, backward error recovery- recovery in concurrent systems – consistent set of check points – synchronous and asynchronous check pointing and recovery – check pointing for distributed database systems- recovery in replicated distributed databases

MODULE – IV: SOFTWARE (09)

Preliminaries, the access matrix model and its implementations.-safety in matrix model- advanced models of protection. Data security – cryptography: Model of cryptography, conventional cryptography- modern cryptography, private key cryptography, data encryption standard- public key cryptography – multiple encryption – authentication in distributed systems.

MODULE – V: MULTIPROCESSOR OPERATING SYSTEMS AND DATABASE OPERATING SYSTEMS (9)

Basic multiprocessor system architectures – inter connection networks for multiprocessor systems – caching – hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads- process synchronization and scheduling.. Introduction- requirements of a database operating system Concurrency control : theoretical aspects – introduction, database systems – a concurrency control model of database systems- the problem of concurrency control – serializability theory- distributed database systems, concurrency control algorithms – introduction, basic synchronization primitives, lock based algorithms-timestamp based algorithms, optimistic algorithms – concurrency control algorithms, data replication.

V. TEXT BOOKS:

1. "Advanced Concepts In Operating Systems", McGraw-Hill computer science series
2. Mukesh Singhal, Niranjan G. Shivaratri , "Advanced Operating Systems - Distributed, Multiprocessor and Database Operating Systems", 1994.

VI. REFERENCE BOOKS:

1. Sape Mullender, "Distributed Systems", Addison-Wesley publications.
2. Maekawa, Oldehoeft, "OS: Advanced Concepts", Addison-Wesley publications.

VII. WEB REFERENCES:

1. https://nptel.ac.in/courses/106/105/106105214/#2.
2. https://nptel.ac.in/courses/106/106/106106144/

VIII. E-TEXT BOOKS:

1. https://www.scribd.com/doc/233633895/Intro-to-Embedded-Systems-by-Shibu-Kv
2. http://www.ee.eng.cmu.ac.th/~demo/think/_DXJSq9r3TvL.pdf

HARDWARE SOFTWARE CO-DESIGN

I Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC05	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	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 fundamental principles of synthesis algorithms, methodologies and co-design challenges.
II. The knowledge of target architectures, prototyping and emulation techniques of embedded processors.
III. The compilation techniques, tools and system level specification languages relevant to 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:

MODULE – I: CO- DESIGN ISSUES (9)

Co- Design Models, Architectures, Languages, A Generic Co-design Methodology Co- Synthesis Algorithms: Hardware software synthesis algorithms: hardware – software partitioning distributed system co-synthesis.

MODULE – II: PROTOTYPING AND EMULATION (9)

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.

MODULE – III: COMPILATION TECHNIQUES AND TOOLS FOR EMBEDDED PROCESSOR ARCHITECTURES I (9)

Modern embedded architectures, embedded software development needs

compilation technologies, practical consideration in a compiler development environment

MODULE – IV: DESIGN SPECIFICATION AND VERIFICATION (9)

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

MODULE – V: LANGUAGES FOR SYSTEM – LEVEL SPECIFICATION AND DESIGN-I (9)

System – level specification, design representation for system level synthesis, system level specification languages, Languages for System – Level Specification and Design-II: Heterogeneous specifications and multi-language co-simulation, the cosyma system and lycos system

V. TEXT BOOKS:

1. Jorgen Staunstrup, "Hardware / Software Co- Design Principles and Practice", Wayne Wolf – 2009, Springer.
2. Giovanni De Micheli, Mariagiovanna Sami, "Hardware / Software Co- Design", 2002, Kluwer Academic Publishers.

VI. REFERENCE BOOKS :

1. Patrick R. Schaumont, "A Practical Introduction to Hardware/Software Co-design", 2010, Springe

VII. 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

VIII. E-TEXT BOOKS:

1. https://www.ece.iastate.edu/~zambreno/classes/cpre583/documents/Wol94A.pdf
2. https://books.google.co.in/books/about/Hardware_Software_Co_Design.html?id=SkGcGUHyQ3QC

WIRELESS LANS AND PANS

I Semester: ECE(ES)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESC06	ELECTIVE	3	0	0	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, smart phones, tablets, and personal digital assistants.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The basic concepts of wireless LANs and comparison of wired and wireless LANs
II. Network architecture using a physical layer and the medium access control layer and issues.
III. The function of the IEEE 802.15 working group for WPANs

III. COURSEOUTCOMES:

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

CO 1	**Recall** the generations of cellular systems for understanding theconnectivity 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 differentdevices 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 forwireless transmission approved by IEEE.	Analyze

IV. SYLLABUS:

MODULE-I: WIRELES SYSTEM & RANDOM-ACCESS PROTOCOLS (9)

Introduction, First- and Second-Generation Cellular Systems, Cellular Communications from 1G to3G, Wireless4Gsystems, 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).

MODULE-II: WIRELESS LANS (9)

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.

MODULE-III: THE IEEE802.11 STANDARD FOR WIRELESS LANS (9)

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

MAC Layer issues: Hidden Terminal Problem, Reliability, Collision avoidance, Congestion avoidance, Congestion control, Security, The IEEE802.11eMACprotocol.

MODULE-IV: WIRELESS PANS (9)

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.

MODULE – V: THE IEEE802.15 WORKING GROUP FOR WPANS (9)

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.

V. TEXT BOOKS:

1 Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "AdHoc and Sensor Networks", World Scientific, 2011.
2 VijayK.Garg, "Wireless Communications and Networking", Morgan Kaufmann Publishers, 2009.

VI. REFERENCE BOOKS:

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

VII. WEB REFERENCES:

1. www.edufind.com

VIII. E-TEXT BOOKS:

1. https://books.google.co.in/books/about/Emerging_Wireless_LANs_Wireless_PANs_and.html?id=JqgYH9i67sC&redir_esc=y

EMBEDDED C

I Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESC07	**ELECTIVE**	3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:45**		

Prerequisites: There are no prerequisites to take this course.

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 importance of embedded C and microcontrollers to design real time timers with various constraints.
II. The hardware/software signaling mechanism to implement effective communication between embedded software and hardware.
III. The significance of embedded C programming in real time microcontroller applications

III. COURSEOUTCOMES:

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:

MODULE – I: PROGRAMMING EMBEDDED SYSTEMS IN C (9)

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. Introducing the 8051 Microcontroller Family: 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.

MODULE – II: SWITCHES (12)

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.

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MODULE – III: ADDING STRUCTURE TO THE CODE (12)

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, Conclusions

MODULE – IV: MEETING REAL-TIME CONSTRAINTS (12)

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, Example: Testing loop timeouts, Example: A more reliable switch interface, Creating hardware timeouts, Example: Testing a hardware timeout, Conclusions.

MODULE – V: CASE STUDY: INTRUDER ALARM SYSTEM (12)

Introduction, The software architecture, Key software components used in this example, running the program, the software, Conclusions.

V. TEXT BOOKS:

1. Michael J. Pont, "Embedded C", A Pearson Education.

VI. REFERENCE BOOKS:

1. Nigel Gardner, "PIC micro MCU C-An introduction to programming, The Microchip PIC in CCS C".

VII. 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).html
3. http://www.sciencedirect.com/science/book/9780750677929
4. https://books.google.co.in/books/about/Embedded_systems.html?id=tgLm2g8KnH0C

VIII. E-TEXT BOOKS:

1. http://www.ecpe.nu.ac.th/ponpisut/22323006-Embedded-c-Tutorial-8051.pdf
2. https://www.eng.auburn.edu/~nelson/courses/elec3040_3050/C%20programming%20for%20embedded%20system%20applications.pdf
3. https://www.bogotobogo.com/cplusplus/files/embed/OReilly_Programming_Embedded_Systems_Second_edition_ebook.pdf

CPLD AND FPGA ARCHITECTURE

I Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC08	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	0	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes:60**		

I.COURSE OVERVIEW:

Programmable logic has become more and more common as a core technology used to build electronic systems. By integrating soft-core or hardcore processors, these devices have become complete systems on a chip, steadily displacing general purpose processors and ASICs.This course will give you the foundation for FPGA design in embedded systems along with practical design skills.

II.COURSE OBJECTIVES:

The students will try to learn:

I. The operational principles, characteristics of semiconductor devices and circuits.
II. The principles of operating semiconductor devices for rectification, amplification, conditioning and voltage regularization of signals.
III. The analytical skills needed to model analog and digital integrated circuits (IC) at discrete and micro circuit level
IV. The foundations of basic electronic circuits necessary for building complex electronic hardware.

III. COURSEOUTCOMES:

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

CO1	**Understand** the features and architectures of industrial CPLDs with different families.	Understand
CO2	**Understand** the features and architectures of industrial FPGAs with different families.	Understand
CO3	**Make use of** the programming techniques used in FPGA design methodology.	Apply
CO4	**Design** and implement complex real time digital circuits.	Create
CO5	**Analyze** system level design and their application for combinational and sequential Circuits.	Analyze
CO 6	**Explore** the types of programmable logic, SPLDs and CPLDs, their basic structure.	Understand

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO PROGRAMMABLE LOGIC DEVICES:

Introduction, Simple Programmable Logic Devices – Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Programmable Logic Devices/Generic Array Logic; Complex Programmable Logic Devices – Architecture of Xilinx Cool Runner XCR3064XL CPLD, CPLD Implementation of a Parallel Adder with Accumulation.

MODULE – II:FELID PROGRAMMABLE GATE ARRAYS:

Organization of FPGAs, FPGA Programming Technologies, Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs, Dedicated Specialized

Components of FPGAs, and Applications of FPGAs.

MODULE – III: SRAM PROGRAMMABLE FPGAS:
Introduction, Programming Technology, Device Architecture, the Xilinx XC2000, XC3000 and XC4000 Architectures.

MODULE – IV: ANTI-FUGE PROGRAMMED FPGAs:
Introduction, Programming Technology, Device Architecture

The Actel ACT1, ACT2 and ACT3 Architectures.

MODULE – V: DESIGN APPLICATIONS:
General Design Issues, Counter Examples, A Fast Video Controller, and A Position Tracker for a Robot Manipulator, A Fast DMA Controller, Designing Counters with ACT devices, Designing Adders and Accumulators with the ACT Architecture.

V. TEXT BOOKS:

1. Stephen M. Trim Berger, "Field Programmable Gate Array Technology," Springer International Edition.
2. Charles H. Roth Jr, Lizy Kurian John, "Digital Systems Design," Cengage Learning.

VI. REFERENCE BOOKS:

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

VII. E-TEXT BOOKS:

1.https://www.gacbe.ac.in/images/E%20books/Grout%20%20Digital%20(Elsevier,%202008).pdf
2.http://www.ee.ic.ac.uk/pcheung/teaching/ee2_digital/fpga%20&%20cpld%20tutorial.pdf

SENSORS AND ACTUATORS

I Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC09	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes:60**		

I. COURSE OVERVIEW:

This course introduces the students to Comprehensive fundamental and technical knowledge of advanced sensor systems and instrumentation and Use Numerical modeling for sensors Understand the problem and select a sensor and design, model the system. understanding basic laws and phenomena on which operation of sensors and actuators-transformation of energy is based.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The constructions and working principle of different types of sensors and transducers.
II. The measuring instruments and the methods of measurement and the use of different transducers.
III. The concepts of Electro analytic and smart sensors.

III. COURSEOUTCOMES:

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

CO1	Illustrate fundamental physical and technical base of sensors and actuators	Understand
CO2	Distinguish basic laws and phenomena that define behavior of sensors and actuators	Knowledge
CO3	Analyze various premises, approaches, procedures and results related to sensors and actuators	Analyze
CO4	Create analytical design and development solutions for sensors and actuators	Create
CO5	Utilize the acquired data and measured results for sensors in IOT	Apply
CO 6	Interpret fundamental physical and technical base of sensors and actuators	Understand

IV. SYLLABUS:

MODULE – I: Sensors / Transducers(9)

Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges, Inductive Sensors- Sensitivity and Linearity of the Sensor. Types- Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors using Quartz Resonators, Ultrasonic Sensors.

MODULE – II: Thermal Sensors(9)

Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index Thermo-sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo-EMF Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermo-electric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors. Magnetic Sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive

Sensors, Anisotropic Magneto-resistive Sensing, Semiconductor Magneto-resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros, Synchroresolvers, Eddy Current Sensors, Electromagnetic Flowmeter, Switching Magnetic Sensors, SQUID Sensors.

MODULE – III: Radiation Sensors(9)
Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors.

Electro Analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes – Sensor Electrodes – Electro ceramics in Gas Media .

MODULE – IV: Smart Sensors(9)
Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation. Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

MODULE – V: Actuators(9)
Pneumatic and Hydraulic Actuation Systems- Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators, Mechanical Actuation Systems Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl, Belt and chain drives, Bearings, Mechanical aspects of motor selection, Electrical Actuation Systems, Electrical systems, Mechanical switches, Solid-state switches, Solenoids, D.C. Motors, A.C. Motors, Stepper motors.

V.TEXT BOOKS:

1. D. Patranabis, “Sensors and Transducers”, PHI Learning Private Limited.
2. W. Bolton, “Mechatronics”, Pearson Education Limited.

VI.REFERENCE BOOKS:

1. Patranabis, “Sensors and Actuators”, PHI, 2nd Edition, 2013
2. Evgeni Gusev and Eric Garfunkel. “Advanced Materials and Technologies for Micro/Nano-Devices, Sensors and Actuators”. 3nd Edition, 2010.

VII. WEB REFERENCES:

1 https://www.youtube.com/watch?v=sCTgZv33tuA
2 https://www.youtube.com/watch?v=oRydUfgMdgA
3 https://www.youtube.com/watch?v=1uPTyjxZzyo\
4 https://www.yokogawa.com/special/sensing-technology/definition/
5 http://engineering.nyu.edu/mechatronics/Control_Lab/Criag/Craig_RPI/2001/Hydraulic_and_Pneumatic_Actuators_1

VIII. E-TEXT BOOKS:

1. https://content.kopykitab.com/ebooks/2016/06/7440/sample/sample_7440.pdf
2.https://doc.lagout.org/science/0_Computer%20Science/8_Electronics%20%26%20Robotics/The%20Mechatronics%20Handbook.pdf

PRINCIPLES OF DISTRIBUTED EMBEDDED SYSTEMS

I Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC10	ELECTIVE	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	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. Design principles of real time systems and its classifications for the design of embedded system.
II. The working environment of real time operating system for processes data and events that have time constraints.
III. The CAN protocol and its standards to allow the all embedded devices to communicate with each other in a network.

III. COURSE VOUTCOMES:

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:

MODULE-I: REAL-TIME ENVIRONMENT (9)

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.

MODULE-II: REAL-TIME OPERATING SYSTEMS (9)

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

MODULE-III: SYSTEM DESIGN(9)
Scheduling problem, static and dynamic scheduling, system design.

Validation, time-triggered architecture.

MODULE-IV: INTRODUCTION TO CAN(9)
Introduction to CAN open CAN open standard, object directory, electronic data sheets and devices.

MODULE – V: CAN STANDARDS (9)
D Introduction to CAN open CAN open standard, object directory, electronic data sheets and devices.

V. 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 CANopen", Copperhill Media Corporation, 1st Edition, 2008.

VI. REFERENCE BOOKS:

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

VII. WEB REFERENCES:

1. https://www.upf.edu/pra/en/3376/22580.
2. https://onlinecourses.nptel.ac.in/noc20_cs16/preview
3. https://www.coursera.org/learn/ real time embedded systems.
4. https://mitpress.mit.edu/books/ real time embedded systems.
5. http://www.apress.com

VIII. E-TEXT BOOKS:

1. http://infinity.wecabrio.com/1441982361-real-time-systems-design-principles-for-distribut.pdf
2. https://do1-vbox1.web.tku.edu.tw/kVuxfO_real-time-systems-design-principles-fordistribut_XJQN. pdf

EMBEDDED SYSTEM LABORATORY

I Semester: ES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC11	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	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 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 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 and buzzer 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 real world 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 soundas 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. UseLCD 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 RAMDot
matrix Printers: 02

MICROCONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS LABORATORY

I Semester: ESD

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESC12	Core	-	-	4	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 languageprogram for LED display in various applications	Apply
CO 2	**Analyze** the various sleep modes by putting core in sleep and deep sleepmodes using GNU tool chain	Analyze
CO 3	**Develop** an embedded C program for Temperature indication on an RGBLED and Verify the output in the Cortex-M3 kit	Apply
CO 4	**Build** an assembly code and C code to compute Euclidian distance betweenany 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 codecomposer 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

ADVANCED MICROPROCESSORS AND INTERFACING

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC13	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:45**		

I. COURSE OVERVIEW:

This course provides the exposure to ARM architecture, programming model and its interfacing with peripherals. It covers the ARM cortex processor, memory management, programming model and interfacing peripherals with ARM processor. Programming skills to develop the model using ARM processors.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The architecture of ARM series microprocessors and its programming models.
II. The memory management in ARM processors
III. The peripherals interfacing with ARM processors using high and low level languages.

III. COURSEOUTCOMES:

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

CO 1	**Describe** the features of ARM processors for signal description and architecture.	Understand
CO 2	**Illustrate** the programmer‘s model of ARM processor and test the programming model using high level and low level languages.	Understand
CO 3	**Demonstrate** the internal architecture and various modes of operation of the devices used for interfacing memory and I/O deviceswith ARM processor.	Understand
CO 2	**Apply** the memory management architecture for allocating the MMU	Apply
CO 4	**Analyze** floating point processor architecture and its architectural support for higher level language.	Analyze
CO 6	**Build** prototype models and products subsequently in embedded field for real life needs and applications.	Apply

IV. SYLLABUS:

MODULE – I:ARM ARCHITECTURE and INSTRUCTION SET(9)

ARM Design Philosophy, Registers, PSR, Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Instruction Set: Data Processing Instructions, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

MODULE – II:ARM PROGRAMMING MODEL(9)

Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Interrupts, Software Interrupt Instructions, Exception handling

MODULE – III: MEMORY MANAGEMENT(9)

Cache Architecture, Polices, Flushing and Caches, MMU

Page Tables, Translation, Access Permissions, Content Switch.

MODULE – IV: **ARM PROGRAMMING USING HIGH LEVEL LANGUAGE(9)**

Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops.

MODULE – V:PERIPHERAL INTERFACING OF ARM PROCESSOR(9)

Timer – UART –interrupt structure – ADC and DAC Interfacing, keyboard Interface, LCD interface, on chip ADC/DAC interface. Implementation using Keil: Interfacing ADC for LCD display, Interfacing DAC to RELAY, Interfacing KEYPAD

V. TEXT BOOKS:

1 Andrew Sloss, Dominic systems and chris wright, "ARM System Developers guide designing and optimizing system", Elsevier India private limited, New Delhi, 2009.
2 Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guides- Designing & Optimizing System Software", 2008, Elsevier.

VI. REFERENCE BOOKS:

1 Dr. Jonathan W. Valvano, "Embedded Systems: Introduction to ARM Cortex-M Microcontrollers", 2012. (UNIT III, IV)
2 A.K.Ray& K.M Bhurchandi, 'Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing', Tata McGraw Hill, 2006.
3 Richard Stevens, "Advanced UNIX Programming", Addison-Wesley Professional, 3rd Edition, 2013.
4 Jonathan W. Valvano – Brookes / Cole, "Embedded Microcomputer Systems, Real Time Interfacing", Thomas Learning, 1999.

VII. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1 https://jntukucen.ac.in/ebook_files/155.pdf
2 https://thebookee.net/ece-611-advanced-microprocessors-george-doc-dl2659322
3 https://www.k-space.org/Class_Info/STM32_Lec1.pdf

INTERNET OF THINGS

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC14	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	0	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes:60**		

I. COURSE OVERVIEW:

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The fundamentals Smart Objects and IoT Architectures and learn about various IOT-related protocols.
II. The build simple IoT Systems using Arduino and Raspberry Pi.
III. The data analytics, cloud in the context of IoT and to develop IoT infrastructure for popular applications

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:

MODULE – I: Fundamentals of IoT(9)

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects.

MODULE – II: IoT Protocols IoT access technologies(9)

Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy

Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

MODULE – III: Design and development design methodology(9)

Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details

IDE programming -Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

MODULE – IV: Data analytics and supporting services(9)

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG Developing.

MODULE – V:IoT Physical Servers and Cloud Offerings(9)

Introduction to cloud storage models and communication APIs; WAMP: AutoBahn for IoT, Xively cloud for IoT; Case studies illustrating IoT design: Home automation, smart cities, smart environment.

V. TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.
2. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1st Edition, 2014.
3. Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O"Reilly (SPD), 3rd Edition, 2014.

VI. REFERENCE BOOKS:

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", John Wiley and Sons, 1st Edition, 2014.
2. Francis Da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications, 1st Edition, 2013.

VII. WEB REFERENCES:

1. https://www.upf.edu/pra/en/3376/22580.
2. https://www.coursera.org/learn/iot.
3. https://bcourses.berkeley.edu.
4. www.innovianstechnologies.com.
5. https://mitpress.mit.edu/books/internet-things
6. http://www.apress.com

VIII. E-TEXT BOOKS:

1. https://mitpress.mit.edu/books/internet-things
2. http://www.apress.com

EMBEDDED WIRELESS SENSOR NETWORKS

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC15	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	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, an emerging 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 characteristic requirements and sensor network scenarios to design the embedded wireless sensor networks.

II. The fundamentals of programming sensors and models are used to implement the wireless sensor networks.

III. Develop program wireless sensor networks using embedded C for real time 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 scalewireless 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 amongsensor nodes.	Analyze
CO 6	**Utilize** inter vehicle communication networks to enhance thesafety of moving vehicles.	Apply

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO WSN (9)

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.

MODULE – II: NETWORK ARCHITECTURE (9)

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

MODULE – III: SENSOR NETWORK IMPLEMENTATION (9)
Sensor programming, introduction to tiny OS programming and fundamentals of programming sensors using nes C.

Algorithms for WSN: Techniques for protocol programming, Real world scenarios: Sensor Deployment Abstraction.

MODULE – IV: PROGRAMMING MODELS (9)
An introduction to the concept of cooperating objects and sensor networks, system architectures and programming models.

MODULE – V:CASE STUDIES (9)
Wireless sensor networks for environmental monitoring, wireless sensor networks with mobile nodes, autonomous robotic teams for surveillance and monitoring, Inter-vehicle communication networks.

V. TEXT BOOKS:

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

VI. 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.

VII. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1 https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470443521.fmatter3.
2 http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w024.

EMBEDDED REAL TIME OPERATING SYSTEMS

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC16	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	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 overview of LINUX commands and approaches in the design of real-time operating systems. It covers design considerations, task scheduling, communication and synchronization. The knowledge acquired from this course will enable the students to develop real time operating systems in image processing, fault tolerant and control system applications.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The operating systems principles and implementation aspects of real time concepts in embedded systems.
II. The design of real time operating system and digital integrated circuits (IC) at discrete and micro circuit level.
III. The software development process and Vxworks and µCOS tools for real time operating system.

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:

MODULE – I:INTRODUCTION

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

MODULE – II:REAL TIME OPERATING SYSTEMS

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

MODULE – III:OBJECTS, SERVICES AND I/O

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

Basic I/O concepts, I/O subsystem.

MODULE – IV:EXCEPTIONS, INTERRUPTS AND TIMERS

Exceptions, interrupts, applications, Closer Look at Exceptions and Interrupts, processing of exceptions and spurious .

Interrupts, real time clocks, programmable timers, timer interrupt service routines, soft timers, Timing Wheels, operations.

MODULE – V:CASE STUDIES OF RTOS

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

V. TEXT BOOKS:

1. QingLi,"RealTimeConceptsforEmbeddedSystems",Elsevier,1st Edition,2011

VI. REFERENCE BOOKS:

1. Rajkamal, "Embedded Systems, Architecture, Programming and Design", Tata McGraw Hill, 2nd Edition, 2003.
2. RichardStevens,"AdvancedUNIXProgramming",Addison-WesleyProfessional,3rd Edition, 2013.
3. Dr. Craig Hollabaugh, "Embedded Linux: Hardware, Software and Interfacing", Addison Wesley, 1st Edition, 2002.

VII. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1.https://xesoa.com/wp-content/uploads/2014/04/APUE-3rd.pdf
2.https://www.csie.ntu.edu.tw/~b98902107/Advanced%20Programming%20in%20the%20Unix%20Environment%20-%202.pdf

DIGITAL IMAGE AND VIDEO PROCESSING

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESC17	**ELECTIVE**	3	0	0	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 fundamentals of digital image and video processing and algorithms for most of the image and video applications.
II. The image enhancement, image segmentation and compression techniques in spatial and frequency domains and motion estimation in videos.
III. The algorithms to solve image and video processing problems to meet design specifications of various applications of image processing in industry, medicine and defense.
IV. Fundamentals of image and video representation and processing in MATLAB.

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
CO12	**Design and implement** MATLAB algorithms for image processing operations such as histogram equalization, enhancement, and restoration, filtering and denoising.	Create

IV. SYLLABUS:

MODULE – I:FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS (9)

Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels. 2-D Transforms of Haar, Walsh transformations. Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

MODULE – II: IMAGE ENHANCEMENT(9)

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.

MODULE – III:IMAGE COMPRESSION(9)

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

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

MODULE – IV:BASIC STEPS OF VIDEO PROCESSING(9)

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.

MODULE – V:2-DMOTIONESTIMATION

Optical flow, General Methodologies, Pixel Based Motion Estimation, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Wave form based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

V. TEXT BOOKS:

1. Gonzalezand Woods, "Digital Image Processing", Pearson 3rd Edition, 2007.
2. Yao Wang, JoemOster Mann and Ya–quin Zhang, "Video Processing and Communication ", ,PHInt, 1st Edition, 2007.

VI. REFERENCE BOOKS:

1. Scotte Umbaugh, "Digital Image Processing and Analysis Human and Computer Vision Application with CVIP Tools", CRC Press, 2nd Edition, 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", Elsevier, 2nd Edition, 2009.
5. Vipula Singh, "Digital Image Processing with MATLAB and Labview", Elsevier.
6. KeithJack, "Video Demystified –A Hand Book for the Digital Engineer", Elsevier, 5th Edition, 2010.

VII. 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/

VIII. E-TEXT BOOKS:

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

EMBEDDED COMPUTING

II Semester: ECE(ES)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESC18	ELECTIVE	3	0	0	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 fundamental principles of software tools, scheduling tasks, compiling for software design of embedded system.
II. The embedded system design using the GNU tool chain GCC, Git version control and developing Software in LINUX on a virtual machine.
III. The basics of various networking and modules to interface with display and audio signal processing applications.

III. COURSE OUTCOMES:

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

CO1	**Recall** the concepts of processes, threads, tasks, multitasking, multithreading in context of real time systems using LINUX kernel.	Remember
CO2	**Analyze** the GCC, GNU's compile Collections used to compile Objective C and Objective C++.	Analyze
CO3	**Illustrate** the benefits of software development tools to distributed systems that support multiple computers for hosting different applications.	Understand
CO4	**Utilize** Ports, UDP, TCP/IP, client server model, firewalls and network security used for data transmission across the multiple networks over the internet.	Apply
CO5	**Demonstrate** the IA32 Instruction Set, assembler directives, macros, simulation and debugging tools for application binary interface.	Understand
CO 6	**Classify** the wireless local area networks for the user device to communicate with in intranet and internet.	Understand

IV. SYLLABUS:

MODULE-I: PROGRAMMING ON LINUX PLATFORM (9)

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

MODULE-II: INTRODUCTION TO SOFTWARE DEVELOPMENT TOOLS (9)

GNUGCC, make, gdb, static and dynamic linking, Clibraries, compiler options, code optimization switches, lint, code profiling tools.

MODULE-III: INTERFACINGMODULES (9)

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

GSM module interfacing with data processing and display, open CV form a chine vision, audio signal processing.

MODULE-IV: NETWORKING BASICS (9)

Sockets,ports,UDP,TCP/IP,clientservermodel,socketprogramming,802.11,Bluetooth,ZigBee,SSH,firewalls,networksecurity.

MODULE – V: IA32 INSTRUCTION SET (9)

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

V. TEXT BOOKS:

1. Peter Barry and Patrick Crowley, "Modern Embedded Computing", Elsevier / Morgan Kaufmann, 1st Edition, 2012.
2. Michael K.Johnson, ErikW.Troan,"Linux Application Development", Adission Wesley 1st Edition,1998.
3. KipR.Irvine, "Assembly Language for x86Processors", Pearson, 7th Edition, 2014.

VI. REFERENCE BOOKS:

1. Abraham Silberschatz, PeterB.Galvin and Greg Gagne, "Operating System Concepts", Wiley, 9th Edition, 2013.
2. MauriceJ.Bach,"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.

VII. 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

VIII. 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

EMBEDDED NETWORKING

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESBC19	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes:60**		

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 OBJECTIVE:

The students will try to learn:

I. The basic embedded communication protocols and their use in embedded systems.
II. The fundamental concepts of Ethernet, its design and protocols used in embedded networking.
III. The characteristics of wireless embedded networking protocols useful for design and implementation of internet and wireless devices.

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:

MODULE – I: EMBEDDEDCOMMUNICATIONPROTOCOLS

Embedded Networking: Introduction,serial/parallelcommunication,serialcommunicationprotocols, RS232 standard, RS485, synchronous serial protocols, serial peripheral interface, inter integratedcircuitsI2C– pc parallel port programming, ISA/PCI bus protocols, fire wire.

MODULE – II: USBANDCANBUS

USB bus, introduction, speed identification on the bus, USB states, USB bus communication: Packets ,dataflow types, enumeration, descriptors,PIC18 microcontroller USB interface, C programs;
CANbus: Introduction, frames, bitstuffing, types of errors, nominal bittiming, PIC microcontroller CAN interface, simple application with CAN.

MODULE – III: ETHERNETBASICS

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

MODULE – IV: EMBEDDEDETHERNET
Exchanging messages using UDP and TCP: Inside 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.

MODULE – V:WIRELESSEMBEDDEDNETWORKING
Wireless sensor networks: Introduction, applications, network topology, localization approaches, time synchronization, energy efficient MAC protocols, SMAC, energy efficient and robust routing, data centric routing: direct diffusion, pullvs. push diffusion

V. TEXT BOOKS:

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

VI. REFERENCE BOOKS:

1. Dogan Ibrahim, "Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18 F series", Elsevier, 1st Edition, 2008.
2. Jan Axelson, "Embedded Ethernet and Internet Complete", Penram Publications, 2003.
3. Bhaskar Krishnamachari, "Networking Wireless Sensors", Cambridge Press 2005.

VII. 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

VIII. E-TEXT BOOKS:

1. http://dsp-book.narod.ru/ESDUA.pdf
2. https://booksite.elsevier.com/samplechapters/9780750686112/Sample_Chapters/01~Front_Matter.pdf

NETWORK SECURITY AND CRYPTOGRAPHY

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC20	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	1	0	4	30	70	100
Contact Classes: 45	**Tutorial Classes: 15**	**Practical Classes: Nil**				**Total Classes:60**		

I. COURSE OVERVIEW:

This course provides a general overview of network security and cryptography. It gives a better understanding of cryptography and its types which are being leveraged to enhance security and privacy online. After completing this course, students will be able to analyze conventional block ciphers as well as public key cryptography.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Fundamental network security concepts and mechanisms.
II. The use of cryptography in achieving network security and understand how to design and build secure systems.
III. A wide variety of basic cryptographic primitives along with recent developments.

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:

MODULE – I: SECURITY

Need, security services, Attacks, OSI Security Architecture, one time passwords, Model for Network security, Classical Encryption Techniques like substitution ciphers, Transposition ciphers, Cryptanalysis of Classical Encryption Techniques.

MODULE – II: NUMBER THEORY

Number Theory: Introduction, Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Euclidean Algorithm, Extended Euclidean Algorithm and Modular Arithmetic.

MODULE – III: PRIVATE-KEY (SYMMETRIC) CRYPTOGRAPHY

Block Ciphers, Stream Ciphers, RC4 Stream cipher, Data Encryption Standard (DES)

Advanced Encryption Standard (AES), Triple DES, RC5, IDEA, Linear and Differential Cryptanalysis.

MODULE – IV: PUBLIC-KEY (ASYMMETRIC) CRYPTOGRAPHY
RSA, Key Distribution and Management, Diffie Hellman Key Exchange, Elliptic Curve Cryptography, Message Authentication Code, hash functions, message digest algorithms:MD4MD5,Secure Hash algorithm,RIPEMD-160, HMAC.

MODULE – V: AUTHENTICATION AND SYSTEM SECURITY:
IP and Web Security Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure Socket Layer, Secure Electronic Transaction Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Counter measures, Firewalls, Trusted Systems

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, 3rd Edition, 2007.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security, Private Communication in a PublicWorld", Prentice Hall, 2nd Edition, 2009.

REFERENCE BOOKS:

1. Christopher M.King, Ertem Osmanoglu, Curtis Dalton,"Security Architecture, Design Deployment and Operations", RSA Press, 2nd Edition, 2009.
2. Stephen Northcutt, Leny Zeltser, Scott Winters, Karen Kent and RonaldW.Ritchey, "Inside Network Perimeter Security", Pearson Education, 2nd Edition, 2010.
3. Richard Bejtlich,"The Practice of Network Security Monitoring: Understanding Incident Detection and Response",William Pollock Publisher, 2013.

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WEB REFERENCES:

1. https://accessengineeringlibrary.com
2. http://www.radio-electronics.com
3. https://www.jntubook.com
4. http://www.iare.ac.in

SYSTEM ON CHIP ARCHITECTURE

II Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC21	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

This course provides the basic knowledge on design, programming of system and processor architecture. It includes memory designing, interconnect customization and configuration, SOC Design approach, AES algorithms, image compression. It provides skills for embedded systems and mobile computing applications, on-chip memories and communication networks, I/O interfacing, RTL design of accelerators.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The system on chip fundamentals and their applications.
II. The various computation models of SOCs and basic concepts of processor architecture and instructions.
III. The SOC customization and reconfiguration technologies and external, internal memory of SOC.
IV. The SOC Design approach for design and evaluation of Image compression.

III. COURSE OUTCOMES:

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

CO1	Recall the knowledge of all the components required for SOC Design and System Architecture.	Remember
CO2	Interpret the basic elements and architectures required for different types of processors.	Understand
CO 3	Design SOC internal and external memory for interpreting different memory architectures.	Apply
CO 4	Develop the analytical skill for deciding the type of processor required to design the desired application SoC.	Apply
CO 5	Classify the types and applications of different memory devices using SOC design concept.	Understand
CO 6	Analyze different types of interconnect buses required for different applications.	Analyze

IV. SYLLABUS:

MODULE – I:INTRODUCTION TO THE SYSTEM APPROACH (9)

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

MODULE – II:PROCESSORS(9)

Introduction, Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

MODULE – III: MEMORY DESIGN FOR SOC(9)

Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache

Organization, Cache data, Write Policies, Strategies for line replacement at miss time.

Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation , SOC Memory System, Models of Simple Processor – memory interaction.

MODULE – IV: INTERCONNECT CUSTOMIZATION AND CONFIGURATION(9)

Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses , Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance Specific design, Customizable Soft Processor, Reconfiguration – overhead analysis and trade-off analysis on reconfigurable Parallelism.

MODULE – V: APPLICATION STUDIES / CASE STUDIES(9)

SOC Design approach, AES algorithms, Design and evaluation, Image compression – JPEG compression.

V. TEXT BOOKS:

1. Michael J. Flynn and Wayne Luk, "Computer System Design System-on-Chip", Wiley India Pvt. Ltd.
2. Steve Furber, "ARM System on Chip Architecture ", 2nd Edition, 2000, Addison Wesley Professional

VI. REFERENCE BOOKS:

1. Ricardo Reis, "Design of System on a Chip: Devices and Components", 1st Edition, 2004, Springer
2. Jason Andrews, "Co-Verification of Hardware and Software for ARM System on Chip Design Embedded Technology)", Newnes, BK and CDROM.
3. Prakash Rashinkar, Peter Paterson and Leena Singh L, "System on Chip Verification – Methodologies and Techniques", 2001, Kluwer Academic Publishers.

VII. WEB REFERENCES:

1. www.edufind.com

VIII. E-TEXT BOOKS:

1. https://www.ele.uva.es/~jesman/BigSeti/ftp/Microcontroladores/ARM/Arm%20System-OnChip%20Architecture. pdf
2. https://www.intechopen.com/chapters/53952.

RISC PROCESSOR ARCHITECTURE AND PROGRAMMING

II Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESC22	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 processor architecture and organization for programming model of ARM processor.
II. Arm-based embedded system and programming models using instruction set to satisfy given user specification.
III. Memory management in Arm-based microcontrollers for modern embedded computing platforms.

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

V. SYLLABUS:

MODULE – I: ARMARCHITECTURE

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

MODULE – II: ARMPROGRAMMINGMODEL – I

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

MODULE – III: ARM PROGRAMMING MODEL – II

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.

MODULE – IV: ARM PROGRAMMING

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

MODULE – V: MEMORYMANAGEMENT

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. JonathanW.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

VIII. 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

ADVANCED MICROPROCESSORS AND INTERFACING LABORATORY

II Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESC23	Core	-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

Processor and Controller cores are the key components in most of the modern embedded and systemon-chip designs. This course outlines the ARM architecture, programming model and its interfacing with peripherals. It also covers the ARM cortex processor, memory management, programming model and interfacing peripherals with ARM processor. The applications include Calculators, Accounting system, Games machine, Complex industrial controllers, Military applications, Defense systems, Computation systems etc.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The architecture of ARM series microprocessors and its programming models.
II. The memory management in ARM processors
III. The peripherals interfacing with ARM processors using high and low level languages.

III. COURSE OUTCOMES:

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

CO 1	**Make use of** Led blinking to toggle all the led to port and with some time delay. .	Apply
CO 2	**Demonstrate** Interfacing of LCD to ARM7 for displaying messageon screen.	Apply
CO 3	**Demonstrate** interfacing keypad with ARM 7 for key pressed on PC terminal using UART communication.	Understand
CO 4	**Identify** Interface LED with ARM7 for illustrating low power applications.	Apply
CO 5	**Make use of** INTERFACING OF STEPPER MOTOR for investigating the reaction Small robotics.	Apply
CO 6	**Distinguish** the performance characteristics of on-chip ADCs andDACs. for Data Acquisition.	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

II Semester: ES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC24	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	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 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 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, 2nd Edition, 2009.
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

MINI PROJECT WITH SEMINAR

II Semester: CAD/CAM								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESC25	**Core**	0	0	4	2	30	70	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes:45**		

I. COURSE OBJECTIVES:

The student will try to learn:

I. How to identify various engineering problems and reviewing available literature.
II. The different techniques used to analyze the complex structural systems.
III. Work on the solutions given and present solution by using his/her technique applying engineering principles.

Guidelines to be followed

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the
Departmental committee.

RESEARCH METHODOLOGY AND IPR

III Semester: CSE, ES, CAD/CAM, AE, ST, PEED

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC11	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 students will try to learn:

I. The Knowledge on formulate the research problem, characteristics of a good research and interpretation of collected data.
II. The importance of research ethics while preparing literature survey and writing thesis to achieve plagiarism free report.
III. The intellectual property rights such as patent, trademark, geographical indications and copyright for the protection of their invention done.

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:

MODULE – I: INTRODUCTION (9)

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.

MODULE – II: RESEARCH ETHICS(9)

Effective literature studies approaches, analysis Plagiarism, Research ethics.

MODULE – III: RESEARCHPROPOSAL

Effective technical writing, how to write report, Paper Developing a Research Proposal.

Format of research proposal, a presentation and assessment by a review committee

MODULE – IV: PATENTING (9)

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.

MODULE – V: PATENTRIGHTS(9)

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.

V. TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering student".
2. Wayne Goddard and Stuart Melville ,"Research Methodology: An Introduction"
3. RanjitKumar, "Research Methodology: A Step by Step Guide for beginners". 2nd Edition, 2007.

VI. 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.

VII. WEB REFERENCES:

1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016
2. T.Ramappa,"IntellectualPropertyRightsUnderWTO",S.Chand,2008

VIII. E-TEXT BOOKS:

1. http://nptel.ac.in/courses/107108011/

EMBEDDED PROCESSORS AND PERIPHERALS

III Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC26	**ELECTIVE**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:45**		

I. COURSE OVERVIEW:

This course provides the architectures and features of embedded processors to process instructions and data of embedded and system-on-chip designs. It focuses on the architecture of Embedded systems, ARM processors, and Cortex-M3and development tools for debugging. It gives the necessary background for design, development of embedded models for communication, industrial automation, automobiles, large and small house hold appliances.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The hardware and software architecture, features, challenges and debugging tools of embedded system.
II. The architecture and instruction set of ARM processor& Cortex-M3 with peripheralsto build embedded applications.
III. The case studies in the area of real time embedded applications using embedded processors.

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:

MODULE – I: INTRODUCTION TO EMBEDDED SYSTEMS(9)

Overview of Embedded System Architecture, Challenges & Trends of Embedded Systems, Hardware Architecture, Software Architecture. Application areas of Embedded Systems and Categories of Embedded Systems. Embedded System Design and Co-Design issues and Design Cycle Process.

MODULE – II: ARM ARCHITECTURE(9)

ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

MODULE – III: ARM THUMB INSTRUCTION SET(9)

Register Usage, Other Branch Instructions, Data Processing Instruction Single-Register and Multi Register

Load-Store Instructions, Stack, Software Interrupt Instructions.

Exception and interrupt handling. ARM Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation Access Permissions, Context Switch.

MODULE – IV: OVERVIEW OF CORTEX-M3(9)

Cortex-M3 Basics: Registers, General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence. Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions. Cortex-M3 Implementation Overview: Pipeline, Block Diagram, Bus Interfaces on Cortex-M3, I-Code Bus, D-Code Bus, System Bus, External PPB and DAP Bus.

MODULE – V:DEVELOPMENT& DEBUGGING TOOLS (9)

Software and Hardware tools like Cross Assembler, Compiler, Debugger, Simulator, In Circuit Emulator (ICE), Logic Analyzer etc. Case Studies: Design of Embedded Systems using Microcontrollers – for applications in the area of communication and automotive. (GSM/GPRS, CAN, ZigBee).

V. TEXT BOOKS:

1. Raj Kamal, "Embedded Systems – Architecture, Programming and Design", TMH, 2nd Edition, 2008.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM Systems Developer's Guides – Designing & Optimizing System Software", Elsevier, 2008.
3. Mazidi, MCKinlay and Danny Causey, "PIC Microcontrollers and Embedded Systems", Pearson Education, 2007.
4. David.E. Simon, "An Embedded Software Primer", Pearson Education, 1st Edition, 1999.
5. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Elsevier Inc, 2nd Edition, 2010.
6. Prasad, KVK, "Embedded / Real Time Systems Concepts", Design and Programming Black Book", 1st Edition, 1999.
7. David Seal "ARM Architecture Reference Manual", 2001 Addison Wesley, England; Morgan Kaufmann Publishers.

VI. REFERENCE BOOKS:

1. Steve Furber, "ARM System-on-Chip Architecture", Pearson Education, 2nd Edition 2001.
2. Cortex-M series-ARM Reference Manual.
3. Cortex-M3 Technical Reference Manual (TRM).
4. STM32L152xx ARM Cortex M3 Microcontroller Reference Manual.
5. ARM Company Ltd. "ARM Architecture Reference Manual– ARM DDI 0100E".
6. ARM v7-M Architecture Reference Manual (ARM v7-M ARM).
7. Ajay Deshmukh, "Microcontroller - Theory & Applications", Tata McGraw Hill.

VII. WEB REFERENCES:

1. http://www.nptel.ac.in/downloads/106108100/
2. http://www.the8051microcontroller.com/web-references
3. http://www.iare.ac.in
4. https://books.google.co.in/books
5. http://www.www.jntubook.com
6. http://www.ebooklibrary.org/articles/mpmc
7. https://www.smartzworld.com/notes/embedded-systems-es/
8. http://notes.specworld.in/embedded-systems-es/
9. http://education.uandistar.net/jntu-study-materials

DESIGN OF EMBEDDED COMMUNICATIONS SOFTWARE

III Semester: ECE(ES)

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESC27	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 knowledge over embedded communications systems, specifically those which use a real time operating system, communications software design from the perspective of a designer of embedded systems software. This course is intended to describe the different procedures used in software partitioning, various modules for multi board communication

II. COURSE OBJECTIVES:

The students will try to learn:

I. Open Systems Interconnect (OSI) model, communication devices, system software includes the RTOS, drivers, buffer/timer management and other infrastructure functions.
II. Familiarize the concepts of partitioning of software and structures, system and management functions can include buffer and timer management.
III. Apply various management schemes in communication software design and common multi-board designs used in communications.

III. COURSE OUTCOMES:

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

CO1	**Explain** the OSI reference model is used for building communications systems and networks.	Understand
CO2	**Outline** the real time operating system (RTOS) software platform for communications functionality and applications.	Understand
CO3	**Apply** the concept of partitioning in communications software, both in terms of functionality and system implementation	Apply
CO4	**Distinguish** spanning tree protocol (STP) with rapid spanning tree protocol (RSTP) in terms of port roles and states	Analyze
CO5	**Explain** the buffer management scheme in communications systems is to minimize data copying	Understand
CO6	**Examine** the components of the management subsystem for an embedded communications device and its implementation	Analyze

IV. SYLLABUS:

MODULE – I: OSI REFERENCE MODEL

OSI Reference Model – Communication Devices – Communication Echo System – Design Consideration – Host Based Communication – Embedded Communication System – OS Vs RTOS.

MODULE – II:SOFTWARE PARTITIONING

Software Partitioning – Limitation of strict Layering – Tasks & Modules – Modules and Task Decomposition – Switch - Bridges - Routers – Protocol Implementation: STP - RSTP – Management Types (SNMP) – Debugging Protocols.

MODULE – III: DATA STRUCTURES

Tables & other Data Structures – Partitioning of Structures and Tables – Implementation – Speeding Up access.

Table Resizing – Table access routines – Buffer and Timer Management – Third Party Protocol Libraries.

MODULE – IV: MANAGEMENT SCHEMES

Management Software – Device Management – Management Schemes – Router Management – Management of Sub System Architecture – Device to manage configuration – System Start up and configuration.

MODULE – V: MULTI BOARD COMMUNICATION

Multi Board Communication Software Design – Multi Board Architecture – Single control Card and Multiple line Card Architecture – Interface for Multi Board software – Failures and Fault – Tolerance in Multi Board Systems – Hardware independent development – Using a COTS Board – Development Environment – Test Tools.

V. TEXT BOOKS:

1. Sridhar .T, "Designing Embedded Communication Software", CMP Books, 2003.

VI. REFERENCE BOOKS:

1. Ahmed Amine Jerraya, SungjooYoo, DiederixVeskest and Norbest Whn, "Embedded Software for SOC", 1st Edition, 2001.
2. Kulwar Academic Publishers, 2004. Comer. D, "Computer Networks and Internet, Prentice Hall, 3rd Edition, 2001.

VII. WEB REFERENCES

1. https://www.coursera.org/learn/introduction-embedded-systems

VIII. E-TEXTBOOKS:

1. http://bookboon.com/en/communication-ebooks-zip
2. https://www.routledge.com/Designing-Embedded-Communications-Software
3. https://ptolemy.berkeley.edu/books/leeseshia/releases/LeeSeshia_DigitalV2_2.pdf

SENSOR TECHNOLOGIES AND MEMS

III Semester: ECE(ES)								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC28	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	30	70	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:45**		

I. COURSE OVERVIEW:

This course introduces the fundamental characteristics of the advanced sensor systems,the operating principles of transducers and development of MEMS Technology. It focuses on the mechanical and electromechanical Sensors, fabrication processes of MEMS and the recent advances in sensor technologies. The application aspects of sensors used in several fields such as automobiles, manufacturing, medical, environment and also designed to serve the needs of the engineering disciplines such as instrumentation, chemical, mechanical, and electrical.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The operating principles, parameters and characteristics of electromechanical sensors and transducers.
II. The different types of techniques for design and develop sensors and their applications.
III. To analyze materials used for fabrication processes of MEMS technology and acquire knowledge on polymer and optical MEMS

III. COURSEOUTCOMES:

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

CO1	**Classify** the electromechanical sensors for the conversion of physical to non-physical quantity.	Understand
CO2	**Illustrate** the characteristics of sensors to perform a required measurement.	Understand
CO3	**Demonstrate** the working principles of electro analytical sensors for the automatic sensor applications.	Understand
CO4	**List** the different types of smart sensors for the performance of analog and digital communication systems.	Apply
CO5	**Examine** the appropriate automotive sensors for the measurement of electro mechanical parameters to solve real time world problems.	Apply
CO6	**Select** an appropriate sensor to monitor the environmental conditions.	Understand

IV. SYLLABUS:

MODULE – I: Sensors / Transducers:

Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization. Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges, Inductive Sensors- Sensitivity and Linearity of the Sensor. Types- Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors using Quartz Resonators, Ultrasonic Sensors

MODULE – II: Radiation Sensors: Introduction – Basic Characteristics – Types of Photosensistors / Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors. Electro Analytical Sensors: Introduction – The Electrochemical Cell – The Cell Potential – Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes – Sensor Electrodes – Electro ceramics in Gas Media .

MODULE – III: Smart Sensors:
Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation. Sensors

Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

MODULE – IV: Introduction to MEMS :
Introduction, Development of MEMS Technology, Present, Future and Challenges, Fabrication Processes: Fundamentals of Material Science, Substrates: Single crystal substrates, Silicon on Insulator Substrate, Physical vapour deposition, Chemical vapour Deposition, Etching Processes, patterning, wafer bonding, annealing, chemical mechanical polishing, material doping, MEMS application in life sciences

MODULE – V:Polymer and Optical MEMS :
Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses

V. TEXT BOOKS:

1. D. Patranabis, “Sensors and Transducers”, PHI Learning Private Limited.
2. W. Bolton, “Mechatronics”, Pearson Education Limited

VI. REFERENCE BOOKS:

1. Patranabis, “Sensors and Actuators”, 2nd Edition, PHI, 2013
2. Allen James J, Micro Electromechanical System Design, First edition, Taylor and Farancis, FL (USA), 2005.
3. Maluf Nadim and Williams Kirt, An Introduction to Micro electromechanical Systems Engineering, ARTECH House, MA (USA), 2nd Edition, 2004.
4. N. Maluf, “An Introduction to Micro-electro Mechanical System Engineering", Artech. House.

VII. WEB REFERENCES:

1. https://www.youtube.com/watch?v=sCTgZv33tuA
2. https://www.youtube.com/watch?v=oRydUfgMdgA
3. https://www.youtube.com/watch?v=1uPTyjxZzyo\
4. https://www.yokogawa.com/special/sensing-technology/definition/
5. http://www.http//mail.vdivde-it.de/ut/EMSTO
6. https://nptel.ac.in/courses/117105082/

VIII. E-TEXTBOOKS:

1. http://bookboon.com/en/communication-ebooks-zip
2. https://bookauthority.org/books/new-electronic-sensors-books
3.https://www.elsevier.com/books/sensor-technology-handbook/wilson

COMMUNICATION NETWORK

III Semester: ECE

CourseCode	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESC29	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes:60		

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. COURSEOBJECTIVES:

The Students will try to learn:

I The computer networks, printers and other peripherals are the transmission medium for data communication and network.

II The computer and communication network applications are for the storage devices, Internet and Instant messaging.

III The queuing models are for the mathematical study of waiting in lines along with simulation of the network.

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:

MODULE-I: **INTRODUCTION**

Introduction: Network Architecture, Performance.

MODULE–II: CONNECTING NODES

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

MODULE–III: QUEUING MODELS

Queuing models –For a) one or more servers b) within finite and finite queue size c) Infinite population

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

MODULE–IV: END-TO-END PROTOCOLS
End-to-End Protocols:-Services, Multiplexing, De-multiplexing, UDP, TCP, RPC, RTP.

MODULE–V: CONGESTION CONTROL AND RESOURCE ALLOCATION
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.

V. TEXT BOOKS:

1. Larry L. Peterson, Bruce S, Devie, "Computer Networks", MK, 5th Edition, 2020.

VI. REFERENCEBOOKS:

1. Aaron Kershenbaum, "Telecommunication Network Design Algorithms", MGH, 2nd International Edition, 1993.
2. VijayAhuja, "Communications Network Design and Analysis of Computer Communication Networks".
3. Douglas E.Comer, "Internet working with TCP / IP", Pearson Education, 6th Edition, 2010.

VII. WEBREFERENCES:

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

VIII. E-TEXTBOOKS:

1. http://bookboon.com/en/communication-ebooks-zip
2. https://www.elsevier.com/books/computing-in-communication-networks/fitzek
3. https://www.cambridge.org/highereducation/books/communication-networks

ELEMENTS OF AEROSPACE ENGINEERING

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours /Week**			**Credits**	**Maximum Marks**		
BAEC30	**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:

Aeronautical engineering is the specialized branch of engineering and study of science that deals with design, construction, maintenance of various aircrafts and their components. Candidates who have an inclination towards airplanes and their mechanisms can opt to study aeronautical engineering.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Historical evaluation of Airplanes
II. The different component systems and functions
III. The various types of power plants used in aircrafts

III. COURSE OUTCOMES:

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

CO 1	**Learn** the history of aircraft & developments over the years	Understand
CO 2	**Understand** ability to identify the types & classifications of components and control systems	Understand
CO 3	**Understand** the basic concepts of flight & Physical properties of Atmosphere	Understand
CO 4	**Understand** the different Newtonian law and its application in aerospace domain	Understand
CO 5	**Explain** the Different types of Engines and principles of Rocket	Understand
CO 6	**Understand** ability to differentiate the types of fuselage and constructions	Understand

IV. COURSE SYLLABUS:

MODULE-I: HISTORY OF FLIGHT (07)

Balloon flight-ornithopers-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

MODULE-II: AIRCRAFT CONFIGURATIONS AND ITS CONTROLS (08)

Different types of flight vehicles, classifications-Components of an airplane and their functions-Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation.

MODULE-III: BASICS OF AERODYNAMICS (06)

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

MODULE-IV: BASICS OF PROPULSION (06)

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

MODULE-V: BASICS OF AIRCRAFT STRUCTURES (06)

General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials. Stresses and strains-Hooke's law- stress-strain diagrams-elastic constants-Factor of Safety.

V. TEXT BOOKS:

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

VI. REFERENCE BOOKS:

Kermode, A.C. "Flight without Formulae", Pearson Education, 11th Edition, 2011.

VII. WEBREFERENCES:

1. http://memberfiles.freewebs.com/94/47/55224794/documents/airport%20planning%20and%20management.pdf
2. https://books.google.co.in/books?id=RYR6cu4YSBcC&dq=Planning%20and%20Design%20of%20Airports&source=gbs_similarbooks

VIII. E-TEXTBOOKS:

https://nptel.ac.in/courses/101/101/101101079/

DATA ANALYTICS

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BCSC30	**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 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

IV. COURSE SYLLABUS:

MODULE – I: BUSINESS ANALYTICS (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.

MODULE – II: REGRESSION ANALYSIS (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.

MODULE – III: ORGANIZATION STRUCTURES (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.

MODULE – IV: FORCASTING TECHNIQUES (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.

MODULE – V: DECISION ANALYSIS (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.

V. TEXT BOOKS

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

VI. REFERENCE BOOKS

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

VII. WEB REFERENCES

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

VIII. E-TEXT BOOKS

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

REAL TIME OPERATING SYSTEMS

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BESC30	**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 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:

IV. The concepts of operating systems and principles of real time operating system, implementation aspects of real time concepts in embedded systems.

V. The design of real time operating system by using the concepts of Timers, I/O subsystem and Memory management units.

VI. Software development process and tools like Vxworks and muCOS for real timeoperating system applications.

III. COURSE OUTCOMES:

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

CO1	**Recall** real time operating system to provide resource managementand synchronization for communication systems.	Understand
CO2	**Compare** soft real-time operating system and hard real-timeoperating systems for the priority based task scheduling.	Analyze
CO 3	**Outline** the components of real time operating systems for the designof reliable embedded system.	Understand
CO 4	**Analyze** finite state machine for the task scheduling and execution inkernel models.	Analyze
CO 5	**Develop** a semaphore token for the execution of one or more threadsin mutual exclusion.	Create
CO 6	**Interpret** message queue in asynchronous communications protocolfor send and receive messages simultaneously.	Understand

IV. SYLLABUS:

MODULE – I: REAL TIME OPERATING SYSTEM PRINCIPLES (10)

History of operating systems, defining RTOS, classification of real-time systems, The scheduler, objects, services and key characteristics of RTOS, Tasks: Defining a task, task states and scheduling, typical task operations, typical task structure.

MODULE – II: REAL TIME KERNEL OBJECTS (09)

Semaphores: Defining semaphores, typical semaphore operations, typical semaphore use; Message Queues: Defining message queues, message queue states, message queue content, message queue storage, typical message queue operations; Typical message queue use other kernel objects: Pipes, event registers, signals, condition variables.

MODULE – III: RTOS DESIGN CONSIDERATIONS (08)
Timer and Timer Services: Real-time clocks and system clocks, programmable interval timers, timer interrupt service routines, model for implementing the soft-timer handling facility, timing wheels.
I/O sub system: Basic I/O concepts, the I/O sub system; Memory management: Dynamic memory allocation, fixed-size memory management, blocking vs. Non-blocking memory functions, hardware memory management units.

MODULE – IV: TASKS COMMUNICATION AND SYNCHRONIZATION (08)
Synchronization and Communication: Synchronization, communication, resource synchronization methods, common practical design patterns; common design problems: Resource classification, deadlocks, priority inversion.

MODULE – V: RTOS APPLICATION DOMAINS (10)
Comparison and study of RTOS: Vxworks and COS, Case studies: RTOS for image processing, embedded RTOS for voice over IP, RTOS for fault tolerant applications, RTOS for control systems.

V. TEXT BOOKS:

1. Andrew Troelsen,"Pro C and the .NET 4 Platform, Springer (India) Private Limited, New Delhi, India, 5th Edition, 2010.
2. David Chappell, "Understanding .NET – A Tutorial and Analysis", Addison Wesley, 2nd Edition, 2002.
3. S. Thamarai Selvi, R. Murugesan, A Textbook on C, Pearson Education, 1st Edition, 2003.

VI. REFERENCE BOOKS:

1. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI, 1st Edition, 1999.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design", Kindle Publishers, 2nd Edition, 2005.
3. Tanenbaum, "Modern Operating Systems", Pearson Edition, 3rd Edition, 2007.

VII. WEB REFERENCES:

1. https://www.jntumaterials.co.in
2. http://www.inf.ed.ac.uk/teaching/courses/es/PDFs/RTOS.pdf
3. https://nptel.ac.in/courses/106108101/pdf/Lecture_Notes/Mod%208_LN.pdf
4. http://wwww.iare.ac.in

VIII. E-TEXT BOOKS:

1. http://www.bookzz.org/
2. http://www.jntubook.com
3. http://www.4shared.com/web/preview/pdf/BhrrT3m0
4. http://www.archive.org

WASTE TO ENERGY

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BPSC30	**Core**	3	0	0	3	30	70	100
Contact Classes: 45	**Total Tutorials: Nil**	**Total Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

The course is designed to create environmental awareness and consciousness among the present generation to become environmental responsible citizens. The course will discuss on the municipal solid waste composition, characteristics and to improve the methods to minimize municipal solid waste generation. This course deals with methods of disposal of solid waste by thermal biochemical processes and production of energy from different types of waste sand to know the environmental impacts of all types of municipal waste.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The principles of solid waste management in reducing and eliminating dangerous impacts of waste materials on human health and the environment to contribute economic development and superior quality of life.
II. The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.
III. The insight of the design and operations of a municipal solid waste landfill by collection, transfer and transportation of municipal solid waste for the final disposal.

III COURSE OUTCOMES:

After successful completion of the course, students will 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.	Apply
CO 2	**Illustrate** the classification, preliminary design considerations of landfill and methods of landfill disposal of solid to control greenhouse gases.	Understand
CO 3	**Understand** the Composition, characteristics of leachate to control the emission of gases by monitoring the movement of landfill leachate.	Understand
CO 4	**Outline** the Biochemical conversion of biomass for energy generation by anaerobic digestion of solid waste.	Understand
CO 5	**Apply** the knowledge in planning and operations of waste to Energy plants by following legal legislation related to solid waste management.	Apply
CO 6	**Illustrate** the thermo-chemical conversion of Biogas by using Gasification process for energy generation.	Understand

IV. SYLLABUS

MODULE –I: WASTE SOURCES & CHARACTERIZATION (09)

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

MODULE –II: TECHNOLOGIES FOR WASTE TO ENERGY (09)

Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

MODULE –III: WASTE TO ENERGY & ENVIRONMENTAL IMPLICATIONS (09)

Environmental standards for Waste to Energy Plant operations and gas clean-up. Savings on non-renewable fuel resources.

Carbon Credits: Carbon foot calculations and carbon credits transfer mechanisms.

MODULE –IV: THERMO-CHEMICAL CONVERSION (09)

Biogas production, land fill gas generation and utilization, thermo-chemical conversion: Sources of energy generation, gasification of waste using gasifies briquetting, utilization and advantages of briquetting, environmental benefits of bio-chemical and thermo- chemical conversion, comparison of various thermo-chemical conversion.

MODULE –V: E- CENTRALIZED AND DECENTRALIZED WASTE TO ENERGY PLANTS (09)

Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. Centralized and Decentralized Energy production, distribution and use. Comparison of Centralized and decentralized systems and its operations.

V. TEXT BOOKS:

1. Nicholas P Cheremisinoff, "Handbook of Solid Waste Management and Waste Minimization Technologies", An Imprint of Elsevier, New Delhi, 2003.
2. Paul Breeze, "Energy from Waste", An Imprint of Elsevier, New Delhi, 2018.
3. P Aarne V esilind, William A Worrell and Debra R Reinhart, "Solid Waste Engineering", 2nd Edition 2002.

VI. REFERENCE BOOKS:

1. Challal, D S, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1st Edition, 1991.
2. C Y Were Ko-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1st Edition, 1996.
3. C Parker and T Roberts (Ed), "Energy from Waste", An Evaluation of Conversion Technologies, Elsevier Applied Science, London, 1985.
4. KL Shah, "Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, Reprint Edition, 2000.
5. M Datta, "Waste Disposal in Engineered Landfills", Narosa Publishing House, 1997

VII. WEB REFERENCES:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 2013)
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: SairudeenPattazhy

VIII. E-TEXT BOOKS:

1. https://www.e-waste Management: From waste to Resource Klaus Hieronymi, RamzyKahnat, Eric williams Tech. &Engg.-2013 (Publisher: Earthscan 2013)
2. https://www.What is the impact of E-waste: Tamara Thompson
3. https://www. E-waste poses a Health Hazard: SairudeenPattazhy

OPERATIONS RESEARCH

III Semester: COMMON FOR ALL BRANCHES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BCCC30	**Elective**	3	-	-	3	30	70	100
Contact Classes: 45	**Tutorials Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		

I. COURSE OVERVIEW:

Operations Research (OR) is a discipline that helps to make better decisions in complex scenarios by the application of a set of advanced analytical methods. It couples theories, results and theorems of mathematics, statistics and probability with its own theories and algorithms for problem solving. Applications of OR techniques spread over various fields in engineering, management and public systems. This course includes the following topics : Linear Programming, Transportation problems, Assignment and Theory of games problems. Advanced topics on waiting line and simulation.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The description, characteristics of operation research and mathematical model of real time problem for optimization.
II. Establish the problem formulation by using linear, dynamic programming, game theory and queuing models.
III. Apply stochastic models for discrete and continuous variables to control inventory.
IV. Visualize the computer-based manufacturing simulation models.

III. COURSE OUTCOMES:

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

CO1	Recall the basics of operation research	Remember
CO2	Explain the characteristics and scope of OR	Understand
CO3	Select optimal problems solving techniques for a given problem using LP	Apply
CO4	Solve transportation, travelling sales man and Assignment problems	Apply
CO5	Demonstrate and solve simple models of Game theory.	Understand
CO6	Choose appropriate simulation model for practical application	Apply

IV. COURSE SYLLABUS:

MODULE -I: INTRODUCTION AND ALLOCATION (09)

Development, definition, characteristics and phases, types of operation research models, applications;
Allocation: linear programming, problem formulation, graphical solution, simplex method, artificial variables techniques, two–phase method, big-M method.

MODULE -II: TRANSPORTATION AND ASSIGNMENT PROBLEM (09)

Transportation problem: Formulation, optimal solution, unbalanced transportation problem, degeneracy; Assignment problem, formulation, optimal solution, variants of assignment problem, traveling salesman problem.

MODULE -III: SEQUENCING AND REPLACEMENT (09)

Sequencing: Introduction, flow, shop sequencing, n jobs through two machines, n jobs through three machines, job shop sequencing, two jobs through “m” machines.

Replacement: Introduction: Replacement of items that deteriorate with time, when money value is not counted and counted, replacement of items that fail completely, group replacement.

MODULE -IV: THEORY OF GAMES AND INVENTORY (09)

Theory Of Games: Introduction, minimax (maximin) criterion and optimal strategy, solution of games with saddle points, rectangular games without saddle points, dominance principle, mx2 and 2xn games, graphical method; Inventory: Introduction, single item, deterministic models, purchase inventory models with one price break and multiple price breaks, shortages are not allowed, stochastic models, demand may be discrete variable or continuous variable, instantaneous production, instantaneous demand and continuous demand and no set up cost, single period model.

MODULE -V: WAITING LINES AND SIMULATION (09)

Waiting Lines: Introduction, single channel, poisson arrivals , exponential service times, with infinite population and finite population models, multichannel, poisson arrivals, exponential service times with infinite population single channel Poisson arrivals; Simulation: Definition, types of simulation models, phases of simulation, applications of simulation, inventory and queuing problems, advantages and disadvantages, brief Introduction of simulation languages.

V. TEXT BOOKS:

1. J. K. Sharma, "Operations Research", Macmillan, 5th Edition, 2012.
2. R. Pannerselvan, "Operations Research", PHI Publications, 2nd Edition, 2006.

VI. REFERENCE BOOKS:

1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 1st Edition, 2013.
2. Maurice Saseini, ArhurYaspan, Lawrence Friedman, "Operations Research: Methods & Problems", 1st Edition, 2013.
3. Hamdy A. Taha, "Introduction to O.R", PHI, 8th Edition, 2013.
4. Harvey M.Wagner, "Operations Research", PHI Publications, 2nd Edition, 2013.

VII. WEB REFERENCES:

1. http://people.brunel.ac.uk/~mastjjb/jeb/or/contents.html
2. https://pe.gatech.edu/degrees/online-masters-degrees/operations-research
3. http://nptel.ac.in/courses/112106134/1

VIII. E-TEXT BOOKS:

1. http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_qt.pdf 2_
2. http://www.ggu.ac.in/download/Class-Note14/Operation%20Research07.04.14.pdf

PROJECT MANAGEMENT AND PLANNING

III Semester: COMMON FOR ALL BRANCHES								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
BSTC30	Elective	L	T	P	C	CIA	SEE	Total
		3	0	0	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Construction project planning and administration the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality and participation satisfaction. Teaching these requirements by the designed course content.

II. COURSE OBJECTIVES:

The student will try to learn:

I. The construction project schedules, documents for planning and management of construction processes.
II. The various types of planning tools like bar chart, CPM networks and PERT analysis
III. The different methods of project delivery, roles and responsibilities of all constituencies involved in the design and construction process.
IV. The various types of construction contracts, their legal aspects and provisions.

III. COURSE OUTCOMES:

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

CO1	Apply the knowledge of management functions like planning, scheduling, executing and controlling of projects for completion of project within given time.	Apply
CO2	Apply the knowledge of network analysis of construction activities and optimize resources by using bar chart, CPM networks.	Apply
CO3	Apply the knowledge of modern construction practices and techniques to achieve quality of work in projects	Apply
CO4	Identify the resource planning and management in construction to improve the performance management and organizational effectiveness.	Apply
CO5	Understand the computer based models adopted in construction industry for optimization of cost and schedule of a project	Understand
CO6	Identify the different types of contracts in construction, arbitration, legal aspects and provision to safe guard the labor and human rights.	Apply

IV. SYLLABUS

MODULE –I: PROJECT MANAGEMENT (09)

Introduction, Project planning, scheduling, controlling, Role of decision in project management, Project management Process and role of Project Manager.

MODULE –II: PROJECT PLANNING TOOLS (09)

Bar Charts and Milestones Chart: Introduction, Development of bar chart, Short comings and remedial measures, Milestone charts.CPM & PERT: Elements of network, Time estimates, frequency distribution, mean, variance and standard deviation, probability distribution. Network Analysis: Slack, Float, Critical path, crashing of activity.

MODULE –III: COST ANALYSIS & UPDATING (09)

Introduction, Projects cost: Direct cost, Indirect cost, slope of direct cost curve, total project cost and optimum duration, cost optimization.

Project Updating: Introduction, updating process, data required for updating, steps in process updating.

MODULE –IV: RISK ANALYSIS AND RESOURCE ALLOCATION (09)

Certainty, risk and uncertainty, risk management, identification and nature of construction risks, contractual allocation of risk, types of risks, minimizing risks and mitigating losses, use of expected values, utility in investment decisions, decision trees, sensitivity analysis. Resource Allocation: Resource usage profiles, Resource smoothing and levelling.

MODULE –V: CONSTRUCTION EQUIPMENT (09)

Types of compaction Equipment's, Types of Excavation and digging Equipment's, Types of hoisting equipment's, Types of Material handling Equipment's and Types of heavy earth moving equipment's.

V. TEXT BOOKS:

1. B. C. Punmia, K.K. Khandelwal, Project Planning and Control with PERT and CPM, Laxmi Publications, 2005.
2. Sharma S.C. "Construction Equipment and Management, Khanna Publishers, New Delhi, 2002.

VI. REFERENCE BOOKS:

1. Peurifoy,R.L, Ledbetter.W.B and schexnayder,C, "Construction Planning and Equipment methods, McGraw Hill, Singapore, 1993.
2. Callahan,M.T., Quackenbush,D.G.,and rowing,J.E., "Construction Project Scheduling, McGraw Hill, New York, 1998.
3. Cleland, D.I. and Ireland, L.R., "Project Management: Strategic Design and Implementation, McGraw Hill, New York, 2002.

VII. WEB REFERENCES:

1. https://nptel.ac.in/courses/105/106/105106149/
2. https://onlinecourses.nptel.ac.in/noc19_mg30/preview

VIII. E-TEXT BOOKS:

https://books.google.co.in/books/about/Project_Management_Planning_and_Control.html?id=BQa8wudi6AAC&redir_esc=y

ENGLISH FOR RESEARCH PAPER WRITING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC01	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 students will try to learn:

I. How to improve the writing skills and level of readability.
II. The methodology that what to write in each section
III. 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:

MODULE – I: PLANNING AND PREPARATION (04)

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

MODULE – II: ABSTRACT (05)

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

MODULE – III: DISCUSSION AND CONCLUSIONS (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.

MODULE – IV: DISCUSSION AND CONCLUSIONS (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.

MODULE – V: QUALITY AND TIME MAINTENANCE (05)

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

V. 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.

VI. REFERENCE BOOKS:

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

VII. WEB REFERENCES:

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

VIII. 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		
BHSC02	Audit	L	T	P	C	CIA	SEE	Total
		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 students will try to learn:

I. How to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
II. How critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
III. The understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
IV. 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

MODULE – I: INTRODUCTION (04)

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

MODULE – II: REPERCUSSIONS OF DISASTERS AND HAZARDS (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.

MODULE – III: DISASTER PRONE AREAS IN INDIA (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.

MODULE – IV: DISASTER PREPAREDNESS AND MANAGEMENT (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.

MODULE – IV: RISK ASSESSMENT & DISASTER MITIGATION (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.

V. TEXT BOOKS:

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

VI. REFERENCE BOOKS:

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

VII. WEB REFERENCE:

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

VIII. 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
BHSC03	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 students will try to learn:

I. A working knowledge in illustrious Sanskrit, the scientific language in the world.
II. The Sanskrit to improve brain functioning.
III. The Sanskrit language 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:

MODULE – I: INTRODUCTION (06)

Alphabets in Sanskrit, Past/Present/Future Tense.

MODULE – II: SENTENCES (04)

Simple Sentences

MODULE – III: ROOTS (04)

Order, Introduction of roots

MODULE – IV: SANSKRIT LITERATURE (04)

Technical information about Sanskrit Literature

MODULE – V: TECHNICAL CONCEPTS (06)

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

V. TEXT BOOKS:

1. Suresh Soni, “India’s Glorious Scientific Tradition”, Ocean books (P) Ltd., New Delhi.

VI. REFERENCE BOOKS:

1. Dr.Vishwas, “Abhyaspustakam”, Samskrita-Bharti Publication, New Delhi.

VII. WEB REFERENCES:

1. http://learnsanskritonline.com/

VIII. 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
BHSC04	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 students will try to learn:

I. The value of education and self- development.
II. Imbibe good values in students.
III. 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:

MODULE – I: VALUES AND SELF-DEVELOPMENT (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.

MODULE – II: CULTIVATION OF VALUES (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.

MODULE – III: PERSONALITY AND BEHAVIOR DEVELOPMENT (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.

MODULE – IV: CHARACTER AND COMPETENCE (04)

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

MODULE – V: SELF CONTROL (04)

All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

V. TEXT BOOKS:

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

VI. WEB REFERENCES:

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

VII. 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
BHSC05	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 students will try to learn:

I. The premises informing the twin themes of liberty and freedom from a civil right perspective.
II. 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. 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:

MODULE – I: HISTORY OF MAKING OF THE INDIAN CONSTITUTION & PHILOSOPHY OF THE INDIAN CONSTITUTION (08)

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

MODULE – II: CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES (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.

MODULE – III: ORGANS OF GOVERNANCE (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

MODULE – IV: LOCAL ADMINISTRATION (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.

MODULE – V: ELECTION COMMISSION (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.

V. 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.

VI. 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.

VII. WEB REFERENCES:

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

VIII. 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
BHSC06	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. COUSE OBJECTIVES:

The students will try to learn:

I. Review existing evidence on the review topic to inform program design and policy making undertaken by the DFID, other agencies and researchers.
II. The 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:

MODULE – I: INTRODUCTION (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.

MODULE – II: THEMATIC OVERVIEW (04)

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

MODULE – III: PEDAGOGICAL PRACTICES (06)

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.

MODULE – IV: PROFESSIONAL DEVELOPMENT (05)

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.

MODULE – V: RESEARCH GAPS (05)

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

V. 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.

VI. 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.

VII. WEB REFERENCE:

1. www.pratham.org/images/resource%20working%20paper%202.pdf.
2. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell

VIII. 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
BHSC07	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:

MODULE – I: INTRODUCTION (06)

Definitions of Eight parts of yog. (Ashtanga)

MODULE – II: YAM AND NIYAM (04)

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

MODULE – III: SHAUCHA (05)

Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

MODULE – IV: ASAN AND PRANAYAM (05)

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

MODULE – V: BREATHING TECHNIQUES (04)

Regularization of breathing techniques and its effects-Types of pranayam

V.TEXT BOOKS:

1. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.

VI.REFERENCE BOOKS:

1. Janardan Swami, "Yogic Asanas for Group Tarining-Part-I", Yogabhyasi Mandal, Nagpur.

VII. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

1. Todd A. Hoover, M. D. D., Ht, “Stress Management by Yoga”.

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC08	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:

MODULE – I: HOLISTIC DEVELOPMENT (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)

MODULE – II: BHAGWAD GEETA (04)

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

MODULE – III: BHAGWAD GEETA (04)

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

MODULE – IV: BASIC KNOWLEDGE (04)

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

MODULE – V: ROLE MODEL (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

V. TEXT BOOKS:

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

VI. REFERENCE BOOKS:

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

VII. WEB REFERENCES:

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

VIII. E-TEXT BOOKS:

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

BUSINESS SUSTAINABILITY MANAGEMENT

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC09	Audit	2	-	-	0	30	70	100
Contact Classes: 24	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 24		

I. COURSE OVERVIEW:

In this course student will be able to learn sustainability management, business sustainability dimensions, paradigms of business sustainability, sustainability management knowledge and methods.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The sustainability challenges and opportunities in the global economy.
II. The design, technology and planning for sustainability.
III. The regulatory environment and international policies for sustainability.
IV. The contemporary paradigms of business sustainability.
V. The design, technology and planning for sustainability management.

III. COURSE OUTCOMES:

After successful completion of the course, students shouldbe able to:

CO 1	Understand sustainability challenges and opportunities in the global economy	Understand
CO 2	explore opportunities for value creation through stakeholder and partner collaboration	Understand
CO 3	Investigate the potential of technology, design, and innovation to enable or limit sustainable business practices.	Understand
CO 4	Understand product sustainability life cycle and management	Understand
CO 5	Develop proactive plans for enhancing sustainability and resilience of Corporate firms.	Apply

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO SUSTAINABILITY MANAGEMENT (06)

Definition, nature and characteristics of sustainability management, history of sustainability management, future of sustainability management, sustainability and environmental management, emerging trends in sustainability.

MODULE – II: BUSINESS SUSTAINABILITY DIMENSIONS (04)

Dimensions of Sustainability, Challenges Facing Business, Stakeholders and Stakeholder Management Issues in Sustainability management, sustainability management approaches.

MODULE – III: EMERGING PARADIGMS OF BUSINESS SUSTAINABILITY (06)

Managing sustainability – functional responses, strategy and leadership issues, linkages with External Stakeholders.
Reporting, Measurements and Standards, Emerging Business Issues in Sustainability.

MODULE – IV: PRODUCT SUSTAINABILITY MANAGEMENT (04)

Life Cycle Thinking, Environmental Life Cycle Assessment, Life Cycle Costing Sustainable Procurement, Supply Chain Sustainability, Product Stewardship, Extended Producer Responsibility.

MODULE – V: SUSTAINABILITY MANAGEMENT KNOWLEDGE AND METHODS (04)

Sustainability Business Modeling and the Circular Economy, Impact measurement and Valuation, Digitalization, Data and Sustainability, Sustainability communication, Corporate sustainability management.

V. TEXT BOOKS:

1. Margaret Robertson, "Dictionary of Sustainability", Routledge, 16th May 2017.
2. Jane Penty, "Product Design and Sustainability Strategies, Tools and Practice", Routledge, 27th August, 2019.
3. John Blewitt, "Understanding Sustainable Development", Routledge, 22nd December 2017.

VI. REFERENCE BOOKS:

1. Margaret Robertson, "Sustainability Principles and Practices", Routledge, 10th February, 2021.
2. RikiTherivel, Graham Wood, "Methods of Environmental and Social Impact Assessment", Routledge, 14th September, 2017.
3. NikoRooda, "Fundamentals of Sustainability Development", Routledge, 30th September, 2020.

VII. WEB REFERENCES:

1. https://www.slideshare.net/PresentationLoad/sustainability-management-ppt-slide-template
2. https://www.slideshare.net/szl/sustainable-development-management
3. https://www.slideshare.net/eccinternational/corporate-sustainability-management

VIII. E-TEXT BOOKS:

1. https://about.jstor.org/librarians/books/sustainability/
2. http://www. ebooktake.in/pdf/title/sustainability management
3. http://all4ryou.blogspot.in/2012/06/becg-sustanability development
4. http://books.google.com/books/about/ corporate sustainability management

BUSINESS ETHICS AND CORPORATE GOVERNANCE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BHSC10	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 able to learn business ethics, ethical value system, conceptual framework of corporate governance, corporate social responsibility

II. COURSE OBJECTIVES:

The students will try to learn:

I. The Business Ethics and to provide best practices of business ethics codes.
II. The values and implement in their careers to guide beliefs, attitudes, and behaviors.
III. The corporate social responsibilities and practice in practical and professional life.
IV. The ethical issues in corporate governance and to adhere to the ethical.
V. The legal framework to protect the ethical practices of organizations.

III. COURSE OUTCOMES:

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

CO 1	understand the business ethics and explore the relationship between ethics and business and economics across different cultural traditions.	Understand
CO 2	Comprehend the relationship between ethics, morals and values in the workplace.	Understand
CO 3	Analyze and understand various ethical philosophies to explain how they contribute to current management practices.	Analyze
CO 4	Analyze the reasons of systematic failure of corporate governance that could spread from individual firms to entire markets or economies.	Analyze
CO 5	Analyze corporate social Responsibility	Analyze

IV. SYLLABUS:

MODULE – I: INTRODUCTION TO BUSINESS ETHICS (06)

Meaning, Principles of Business Ethics, Characteristics of Ethical Organization, Ethics, Ethics of Corporate Governance, Globalization and Business Ethics, Stakeholders' Protection, Corporate Governance and Business Ethics.

MODULE – II: THE ETHICAL VALUE SYSTEM (04)

Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

MODULE – III: LAW AND ETHICS (06)

Relationship between Law and Ethics, Other Bodies in enforcing Ethical Business Behavior, Impact of Laws on Business Ethics; Social Responsibilities of Business.

Environmental Protection, Fair Trade Practices, Fulfilling all National obligations under various Laws, Safeguarding Health and wellbeing of Customers.

MODULE – IV: CONCEPTUAL FRAMEWORK OF CORPORATE GOVERNANCE (04)

Meaning, Governance vs. Good Corporate Governance, Corporate Governance vs. Corporate Excellence, Insider Trading, Rating Agencies, Benefits of Good Corporate Governance, Corporate Governance Reforms, and Initiatives in India.

MODULE – V: CORPORATE SOCIAL RESPONSIBILITY (04)

Meaning, CSR and Corporate Sustainability, CSR and Business Ethics, CSR and Corporate Governance, Environmental Aspect of CSR, CSR Models.

V. TEXT BOOKS:

1. J. P. Sharma, "Corporate Governance, Business Ethics & CSR", Ane Books Pvt. Ltd., New Delhi.
2. Bhanu Murthy, K. V. and Usha Krishna, "Politics Ethics and Social Responsibilities of Business", Pearson Education, New Delhi.
3. D Geeta Rani & R K Mishra, "Corporate Governance-Theory and Practice", Excel Books, New Delhi

VI. REFERENCE BOOKS:

1. Christine A Mallin, "Corporate Governance (Indian Edition)", Oxford University 46 Press, New Delhi.
2. Bob Tricker, "Corporate Governance-Principles, Policies, and Practice (Indian Edition)", Oxford University Press, New Delhi.
3. Andrew Crane Dirk Matten, "Business Ethics (Indian Edition)", Oxford University Press, New Delhi.

VII. WEB REFERENCES:

1. https:// www.slideshare.net/glory1988/business-ethics-corporate -governance
2. https:// thenthata.web4kurd.net/mypdf/ethics-corporate-governance
3. https:// bookshallcold. link/pdfread/business-ethics-corporate-governance
4. https:// www.gvpce.ac.in/syllabi/corporate social responsibility/

VIII. E-Text Books:

1. https:// books.google.co.in/books/about/business ethics and corporate governance
2. http://www. ebooktake.in/pdf/title/laws and ethics
3. http://all4ryou.blogspot.in/2012/06/becg-business ethics
4. http://books.google.com/books/about/business corporate governance

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT AUTONOMY

1. Who grants Autonomy? UGC, Govt., AICTE or University

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

2. Shall IARE award its own Degrees?

No. Degree will be awarded by Jawaharlal Nehru Technological University, Hyderabad with a mention of the name IARE on the Degree Certificate.

3. What is the difference between a Deemed University and an Autonomy College?

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

4. How will the Foreign Universities or other stake – holders know that we are an Autonomous College?

Autonomous status, once declared, shall be accepted by all the stake holders. The Govt. of Telangana mentions autonomous status during the First Year admission procedure. Foreign Universities and Indian Industries will know our status through our website.

5. What is the change of Status for Students and Teachers if we become Autonomous?

An autonomous college carries a prestigious image. Autonomy is actually earned out of our continued past efforts on academic performances, our capability of self- governance and the kind of quality education we offer.

6. Who will check whether the academic standard is maintained / improved after Autonomy? How will it be checked?

There is a built in mechanism in the autonomous working for this purpose. An Internal Committee called Academic Programme Evaluation Committee, which will keep a watch on the academics and keep its reports and recommendations every year. In addition the highest academic council also supervises the academic matters. The standards of our question papers, the regularity of academic calendar, attendance of students, speed and transparency of result declaration and such other parameters are involved in this process.

7. Will the students of IARE as an Autonomous College qualify for University Medals and Prizes for academic excellence?

No. IARE has instituted its own awards, medals, etc. for the academic performance of the students. However for all other events like sports, cultural on co-curricular organized by the University the students shall qualify.

8. Can IARE have its own Convocation?

No. Since the University awards the Degree the Convocation will be that of the University, but there will be Graduation Day at IARE.

9. Can IARE give a provisional degree certificate?

Since the examinations are conducted by IARE and the results are also declared by IARE, the college sends a list of successful candidates with their final Grades and Grade Point Averages

including CGPA to the University. Therefore with the prior permission of the University the college will be entitled to give the provisional certificate.

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

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

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

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

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

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

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

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

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

17. What is a Cumulative Grade Point Average (CGPA)?

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

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

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

18. Is there any Software available for calculating Grade point averages and converting the same into Grades?

Yes, The institute has its own MIS software for calculation of SGPA,CGPA,etc.

19. Will the teacher be required to do the job of calculating SGPAs etc. and convert the same into Grades?

No. The teacher has to give marks obtained out of whatever maximum marks as it is. Rest is all done by the computer.

20. Will there be any Revaluation or Re-Examination System?

No. There will double valuation of answer scripts. There will be a 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 2021-2022 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 concerned HOD / Principal.
11. I hereby acknowledge that I have received a copy of PG21 Academic Rules and Regulations, Syllabus copy and hence, I shall abide by all the rules specified in it.

ACKNOWLEDGEMENT

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

Signature of Student with Date

Signature of Parent with Date
Name & Address with Phone Number