UNIVERSITY OF CALICUT

Abstract

General and Academic - Faculty of Science - Syllabus of MSc Electronics Programme for affiliated colleges under CBCSS PG Regulations 2019 with effect from 2019 Admission onwards - Implemented- Orders Issued

G & A - IV - J

U.O.No. 9166/2019/Admn Dated, Calicut University.P.O, 11.07.2019

Read:-1. U.O No.4487/2019/Admn dated 26.03.2019

2. Item No. 1 in the minutes of the meeting of the Board of Studies in Electronics held on 14.06.2019

3. Item No.I.36 in the minutes of the meeting of Faculty of Science held on 27.06.2019

ORDER

The Regulations for Choice Based Credit and Semester System for Post Graduate (PG) Curriculum-2019 (CBCSS PG Regulations 2019) for all PG Programmes under CBCSS for Affiliated Colleges and SDE/Private Registration w.e.f. 2019 admission has been implemented vide paper read first above.

The meeting of Board of Studies in Electronics held on 14.06.2019 has approved the Scheme and Syllabus of MSc Electronics Programme in tune with the new CBCSS PG Regulations with effect from 2019 Admission onwards, vide paper read second above.

The Faculty of Science at its meeting held on 27.06.2019 has approved the minutes of the meeting of the Board of Studies in Electronics held on 14.06.2019, vide paper read third above.

Under these circumstances , considering the urgency, the Vice Chancellor has accorded sanction to implement the Scheme and Syllabus of MSc Electronics Programme in accordance with the new CBCSS PG Regulations 2019, in the University with effect from 2019 Admission onwards, subject to ratification by the Academic Council.

The Scheme and Syllabus of MSc Electronics Programme for affiliated colleges in accordance with CBCSS PG Regulations 2019, is therefore implemented in the University with effect from 2019 Admission onwards.

Orders are issued accordingly. (Syllabus appended).

Biju George K

Assistant Registrar

To

The Principals of all Affiliated Colleges

Copy to: PS to VC/PA to PVC/ PA to Registrar/PA to CE/JCE I/JCE V/DoA/EX and EG Sections/GA I F/CHMK Library/Information Centres/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT

DEGREE OF

MASTER OF SCIENCE (M.Sc)

IN

ELECTRONICS

AS PER

CHOICE BASED CREDIT AND SEMESTER SYSTEM PG (CBCSS PG –2019)

PROGRAMME CURRICULUM

(FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2019 - 20 ONWARDS)

BOARD OF STUDIES IN ELECTRONICS (PG)

THENHIPALAM, CALICUT UNIVERSITY

P.O KERALA, 673 635,

INDIA.

JUNE, 2019

CONTENTS

REGULATIONS FOR THE DEGREE OF MASTER OF SCIENCE (ELECTRONICS)

EFFECTIVE FROM THE ACADEMIC YEAR 2019 – 20

1. INTRODUCTION

Emerging trends and stimulating developments in the field of science, increasing opportunities and demands at workplace have made it imperative that the Postgraduate science courses be redesigned to cater to the professional aspirations of the students. The present world is in need of professionals who are experts in the respective fields and hence restructuring of any science course should possess components as catalyst to achieve the goals. In response to these changes taking place in society, the University of Calicut has embarked on a major restructuring exercise for its science courses, introducing MSc programme in alternate pattern.

MSc ELECTRONICS Programme is one such course in science stream under Choice Based Credit and Semester System of University of Calicut. This restructured Postgraduate science course provides students with a broad exposure to the critical domains of sciences with adequate background of mathematical sciences. The tools and techniques of computer applications, industry automation, electronics and analytical techniques have a major role in the curriculum.

This programme equip students to create, select, and apply appropriate techniques, resources, modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. We aim to provide in depth knowledge of the subject starting from its basic concepts to the state of art technologies in use today. Students are also provided extensive laboratory training on the course content based on the current requirements of industries and R&D. The course is also designed with a view to catering to the present day requirements in industries, R&D field, higher studies and self-employment.

2. PROGRAMME OBJECTIVES

The course of the MSc Electronics programme is designed with the following objectives:

1. To train and equip the students to meet the requirements of the Electronics industry in the country and outside.
2. To equip students to take up challenging research oriented responsibilities and courses for their higher studies/profession.
3. To motivate and support the students to prepare and qualify challenging competitive examinations such as JRF/NET/JAM/GATE etc.

3. PROGRAMME OUTCOMES

On completion of the MSc Electronics Programme, the student will:

1. Identify, formulate, review research literature, and analyze and design solutions for complex engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences, and engineering sciences.

2. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

3. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

4. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

5. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

6. Be in a position to develop industrial and entrepreneur applications.

4. ADMISSION

1. The admission to all M.Sc Electronics programmes shall be as per the rules and regulations of the University.
2. The eligibility criteria for admission shall be as announced by the University from time to time.
3. Separate rank lists shall be drawn up for reserved seats as per the existing rules.
7. The college shall make available to all the admitted students the information regarding all the courses including electives offered with syllabus and credit for the entire course.
8. There shall be a uniform calendar prepared by the University for the Conduct of the programmes.
9. There shall be provision for inter collegiate and inter University transfer in the 2 nd and 3 rd semester within a period of two weeks from the date of commencement of the semester
10. There shall be provision for credit transfer subject to the conditions specified by the Board of Studies concerned.
    There shall be a uniform calendar prepared by the University for the registration, conduct schedule of the courses, examinations and publication of results.

5. READMISSION

1. There shall be provision for readmission of students.
2. There For readmission, the vacancy should be within the sanctioned strength in the parent college. If there is no vacancy in the junior batch of the parent college, readmission can be taken in another college with the junior batch, if there is vacancy within the sanctioned strength in the concerned college.
3. This readmission is not to be treated as college transfer.
4. There should be a gap of at least one semester for readmission.
5. The candidate seeking readmission to a particular semester should have registered for the previous semester examination.
6. Readmission shall be taken within two weeks from the date of commencement of the semester concerned.

7. The Principal can grant readmission to the student, subject to the above conditions, and inform the matter of readmission to the Controller of Examinations within one month of such readmission.

8. If change in scheme occurs while readmission, provision for credit transfer will be subject to the common guidelines prepared by Board of Studies/ Faculty concerned.

6. DURATION OF THE PROGRAMME

1. The minimum duration for completion of a four semester PG Programme is two years. The maximum period for completion is 4 years.
2. The duration of each semester shall be 90 working days, inclusive of examinations, spread over five months with 5 hours of instruction per day 5-days a week system
3. Odd semesters shall be held from June to October and even semesters from November to March subject the academic calendar of the University.

7. PROGRAMME STRUCTURE

1. The programme includes three types of courses, viz., Core courses (Code C), Elective Courses (Code E) and Audit Courses (Code A).
2. Every student of the MSc Electronics programme shall have to work on a project/dissertation of not less than 8 credits under the supervision of a faculty member as per the curriculum. Project/dissertation shall be treated as Core Courses. Project Work is mandatory for all regular programmes and Comprehensive Viva-voce is optional and these shall be done in the end semester. The combined Credit for the Project Work and Comprehensive Viva-voce shall not be more than 8 (eight) credits subject to a minimum of 4 (four) credit for Project Work. All students have to submit a Project Report/Dissertation in the prescribed structure and format as a part of the Project Work undertaken
3. Total credit for the programme shall be 80 (eighty), this describes the weightage of the course concerned and the pattern of distribution is as detailed below
    i. Total Credit for Core Courses shall not be less than 60 (sixty) and not more than 68 (sixty eight).

ii. Total Credit for Elective Course shall not be less than 12 (twelve) and not more than 20 (Twenty).

iii. Total Credits for Comprehensive Viva-voce and Project Work combined together shall be 8 (eight) subject to a minimum of 4 (four) credit for Project Work.

iv. Total credit in each semester shall vary between 18 to 22.

v. No course shall have less than 2 credits and more than 5 credits.

4. Elective courses shall be spread over either in the Third & Fourth Semesters combined.
5. Audit Courses: There will be two Audit Courses (Ability Enhancement Course & Professional Competency Course) with 4 credits each. These have to be done one each in the first two semesters. The credits will not be counted for evaluating the overall SGPA & CGPA. The colleges shall conduct examination for these courses and have to intimate /upload the results of the same to the University on the stipulated date during the III Semester. Students have to obtain only minimum pass requirements in the Audit Courses.
6. A student shall accumulate a minimum of 80 credits for the successful completion of the programmes.

8. REGISTRATION

1. A student shall be permitted to register for a programme at the time of admission.
2. A student who registers for a programme shall complete it within 4 years.
3. The college shall send a list of students registered for each programme in each semester giving the details of courses registered to the university in the prescribed form within 45 days of the commencement of the semester.
4. The students who have attendance within the limit, but could not register for the semester examinations, have to apply for token registration, within two weeks of the commencement of the next semester.
5. Students shall be normally permitted to register for the examination if they have required minimum attendance. If the student has a shortage of attendance in a semester, the student shall be permitted to move to the next semester and can write the examination for the entire courses of the semester in which shortage of

attendance occurs as supplementary examination only after the completion of the entire programme. In such cases, a request from the student may be forwarded through the Principal of the college to the Controller of Examinations within two weeks of the commencement of the semester. There will not be any Repeat semester in CBCSSPG 2019.

9. ATTENDANCE

1. The students admitted in the PG programmes in affiliated colleges shall be required to attend at least 75 percent of the total number of classes (theory/practical) held during each semester. The students having less than prescribed percentage of attendance shall not be allowed to appear for the University examination.
2. Condonation of shortage of attendance for a maximum of 9 days (10% of the working days in a semester) in the case of single condonation and 18 days (20% of the working days in a semester) in the case of double condonation in a semester subject to a maximum of two times (for single condonation only) during the whole period of Post Graduate programme may be granted by the University as per the existing procedures. In the case of double condonation, only one condonation shall be allowed during the entire programme.
3. Benefit of condonation of attendance will be granted to the students on health grounds, for participating in University Union activities, meeting of the University bodies /Govt. bodies and participation in other extracurricular activities on production of genuine supporting documents, with the recommendation of the Head of the Department concerned.
4. A student who is not eligible for such condonation shall be observed the provisions as per clause 8.4 of this regulation. The principal should intimate the details of these candidates at the commencement of the next semester.
5. Women students can avail maternity leave as per the existing university rules.

10. EXAMINATION

There shall be University examination at the end of each semester.

1. Practical examinations shall be conducted by the University at the end of each semester. There will be one internal and one external examiner for the conduct of End Semester Practical examination.

2. Project Work / Dissertation shall be evaluated at the end of the programme only. There shall be both Internal and External evaluation for the ProjectWork.
3. There shall be one end-semester examination of 3 hours duration for each theory course and practical course.

11. EVALUATION AND GRADING

1. Evaluation: The evaluation scheme for each course shall contain two parts; (a) Internal / Continuous Assessment (CA) and (b) External / End Semester Evaluation (ESE).
2. Of the total, 20% weightage shall be given to Internal evaluation / Continuous assessment and the remaining 80% to External/ESE and the ratio and weightage between Internal and External is 1:4.
4. Primary evaluation for Internal and External shall be based on 6 letter grades (A+, A, B, C, D and E) with numerical values (Grade Points) of 5, 4, 3, 2, 1 & 0 respectively.
5. Grade Point Average: Internal and External components are separately graded and the combined grade point with weightage 1 for Internal and 4 for external shall be applied to calculate the Grade Point Average (GPA) of each course. Letter grade shall be assigned to each course based on the categorization based on Ten point Scale.
6. Evaluation of Audit Courses: The examination and evaluation shall be conducted by the college itself either in the normal structure or MCQ model from the Question Bank and other guidelines provided by the University/BoS. The Question paper shall be for minimum 20 weightage and a minimum of 2 hour duration for the examination. The result has to be intimated / uploaded to the University during the Third Semester as per the notification of the University.

12. INTERNAL EVALUATION-CONTINUOUS ASSESSMENT

1. This assessment shall be based on a predetermined transparent system involving periodic written tests, assignments, seminars and viva-voce in respect of theory courses and based on tests, lab skill and records / viva in respect of practical courses.
2. The criteria and percentage of weightage assigned to various components for internal evaluation are as follows :

    a. Theory: The weightage assigned to various components for internal

evaluation for theory papers is as shown below.

Sl.No	Component	Percentage	Weightage
1	Examination /Test	40%	2
2	Seminars / Presentation	20%	1
3	Assignment	20%	1
4	Attendance	20%	1

b. To ensure transparency of the evaluation process, the internal assessment grade awarded to the students in each course in a semester shall be published on the notice board at least one week before the commencement of external examination. There shall not be any chance for improvement for internal grade.

c. The course teacher shall maintain the academic record of each student registered for the course, which shall be forwarded to the University, through the college Principal.

d. Practical: The mark distribution to award internal continuous assessment marks for practical course should be as follows:

Sl.No	Component	Percentage	Weightage
1	Lab Skill	40%	4
2	Records/viva	30%	3
3	Practical Test	30%	3

Note: All students should have a rough record (observation note book) in which they write all the works to be carried out in the lab prior to his/her entering the lab. (S)he may also note down the input and output that (s)he gives for program verification in the observation note book (rough record).

- All lab works should be neatly recorded in a Laboratory Record Book (Fair Record) in written form. However program results can be pasted in the left hand side of the fare record.
- Chairperson, Board of Examination (PG) has to prepare the modalities of the practical papers (list of experiments to be done, number of minimum experiments required in the practical record, etc) and distributed to all departments concerned, at the beginning of each semester itself. Model lists of experiments are provided with the syllabus for each practical session.
- No candidate will be permitted to attend the end-semester test unless he/she produces certified record of the laboratory.

3. Grades shall be given for the internal evaluation are based on the grades A+, A, B, C, D & E with grade points 5,4,3,2, 1 & 0 respectively. The overall grades shall be as per the Ten Point scale.
4. There shall be no separate minimum Grade Point for internal evaluation.
5. To ensure transparency of the evaluation process, the internal assessment marks awarded to the students in each course in a semester shall be published on the notice board before 5 days of commencement of external examination.
6. There shall not be any chance for improvement of internal marks.
7. The course teacher shall maintain the academic record of each student registered for the course, which shall be forwarded to the University, through the college Principal, after being endorsed by the Head of the Department.
8. For each course there shall be class test/s during a semester. Grades should be displayed on the notice board. Valued answer scripts shall be made available to the students for perusal.
9. Each student shall be required to do assignment/s for each course. Assignments after valuation must be returned to the students. The teacher shall define the expected quality of the above in terms of structure, content, presentation etc. and inform the same to the students. Punctuality in submission is to be considered.
9. Every student shall deliver Seminar / Presentation as an internal component for every course and must be evaluated by the respective course teacher in terms of structure, content, presentation and interaction. The soft and hard copies of the seminar report are to be submitted to the course teacher.

10. All the records of Continuous Assessment (CA) must be kept in the college and must be made available for verification by university, if asked for.

Calculation of overall internal grade for one theory course will be done as shown below:

Components	Weightage (W)	Grade Awarded	Grade Point(GP)	Weighted GP	Overall Grade of the course
Examination /Test	4	A	4	16	Weighted GP/Total Weight 43/10 = 4.30
Seminars / Presentation	3	A+	5	15	
Assignments	3	A	4	12	
Total	10			43	O

Calculation of overall internal grade for one Lab Course will be done as shown below:

Components	Weightage (W)	Grade Awarded	Grade Point(GP)	Weighted GP	Overall Grade of the course
Lab Skill	2	A	4	8	Weighted GP/Total Weight 22/5 = 4.40
Records/viva	1	A+	5	5	
Practical Test	1	A	4	4	
Viva-voce	1	A+	5	5	
Total	5			22	O

13. EXTERNAL/END SEMESTER EVALUATION (ESE)

1. The semester-end examinations in theory courses shall be conducted by the University with question papers set by external experts. The evaluation of the answer scripts shall be done by examiners based on a well-defined scheme of valuation.

2. After the external evaluation, only Grades are to be entered in the space provided in

the answer script for individual questions and calculations need to be done only up to the Cumulative Grade Point (CGP) and all other calculations including grades are to be done by the University.

3. Students shall have the right to apply for revaluation or scrutiny as per rules within the time permitted for it.

4. Photocopies of the answer scripts of the external examination shall be made available to the students for scrutiny on request by them as per rules.

5. The external evaluation shall be done immediately after the examination preferably in a Centralized Valuation Camp.

6. The language of writing the examination shall be English.

7. Pattern of questions for external/ESE (theory courses):

   a. Questions shall be set to assess the knowledge acquired, standard, and application of knowledge, application of knowledge in new situations, critical evaluation of knowledge and the ability to synthesize knowledge. Due weightage shall be given to each module based on content/teaching hours allotted to each module.

   b. It has to be ensured that questions covering all skills are set. The setter shall also submit a detailed scheme of evaluation along with the question paper.

   c. A question paper shall be a judicious mix of short answer type, short essay type / problem solving type and long essay type questions.

   d. The question shall be prepared in such a way that the answers can be awarded A+, A, B, C, D, E Grades.

   e. Weightage: Different types of questions shall be given different weightages to quantify their range given in the following model:

Sl. No.	Type of Questions	Individual weightage	Total Weightage	Number of questions to be answered
1	Short Answer type questions	2	2x4 = 8	4 out of 7

2	Short essay/ problem solving type	3	3x4 = 12	4 out of 7
3	Long Essay type Questions	5	5x2 = 10	2 out of 4
Total			30	18

f. Questions should be asked as far as possible from all modules following a uniform distribution.

A sample ESE evaluation sheet of a theory course is illustrated below:

Type of Question	Qn. No	Grade Awarded	Grade Point	Weightage	Weighted Grade Point	Calculation
Short Answer Type	1	A+	5	2	10	Overall Grade ofthe theory paper = Sum of Weighted Grade Points / Sum of the weightage 115/30 = 3.83 = Grade A+
	2	-	-		-	
	3	A	4	2	8	
	4	C	2	2	4	
	5	-	-	-	-	
	6	A	4	2	8	
	7	-	-	-		
Medium Essay type	8	B	3	3	9	
	9	A+	5	3	15	
	10	-	-	-	-	
	11	-	-	-	-	
	12	-	-	-	-	
	13	A	4	3	12	
	14	B	3	3	9	

Long Essay Type	20	A+	5	5	25
	21	-	-	-	-
	22	-	-	-	-
	23	B	3	5	15
	24	-	-	-	-
TOTAL				30	115

8. End Semester Evaluation in Practical Courses shall be conducted and evaluated by both Internal and External Examiners.

Mark distribution for practical courses shall be as follows:

Component	Weightage
Algorithm/Circuit diagram/Program	6
Implementation	6
Result/ Output	6
Record	6
Viva	6
Total	**30**

A sample ESE evaluation sheet of a theory course is illustrated below:

Type of Question	Grade Awarded	Grade Point	Weightage	Weighted Grade Point	Calculation
Circuit diagram/Algorithm/ Program	A	4	6	24	114/30 = 3.80
Implementation	A	4	6	24	
Result/ Output	B	3	6	18	

Record	A	4	6	24	
Viva	A	4	6	24	
Total			**30**	**114**	**O**

14. EVALUATION OF PROJECT WORK / DISSERTATION

1. There shall be External and Internal evaluation for Project Work done and the grading system shall be followed.
2. One component among the Project Work evaluation criteria shall be Viva-voce (Project Work related) and the respective weightage shall be 40%.
3. Consolidated Grade for Project Work is calculated by combining both the External and Internal in the Ratio of 4:1 (80% & 20%).
4. For a pass in Project Work, a student has to secure a minimum of P Grade in External and Internal examination combined. If the students could not secure minimum P Grade in the Project work, they will be treated as failed in that attempt and the students may be allowed to rework and resubmit the same in accordance with the University exam stipulations. There shall be no improvement chance for Project Work.
5. The External and Internal evaluation of the Project Work shall be done based on the following criteria and weightages as detailed below :

Sl. No	**Criteria**	**% of Weightage**	**Weightage**	
			External	**Internal**
1	Relevance of the topic and Statement of problem, Methodology & Analysis Quality of Report & Presentation	60%	24	6
2	Viva-voce	40%	16	4
Total Weightage		**100%**	**40**	**10**

The first component for 60% weightage can be sub-divided into following project implementation components:

Sl No	Components	Weightage	
		External	Internal
1	Relevance of the Topic, Statement of Objectives, Methodology	2	2
2	Quality of Literature Survey/Product Review	2	
3	Quality of Analysis Phase	2	
4	Quality of Design Phase	2	
5	Quality of Implementation/Simulation	4	2
6	Quality of Testing/Result Analysis	2	
7	Quality of Contributions	2	
8	Identification of Future Work	1	2
9	Quality of Project Report	4	
10	Publications/Presentations out of the Project Work*	1	
11	Quality of Presentation	1	
12	Demonstration of the Project Work	1	
13	General Viva Voce	16	4
	Total	**40**	**10**

15. DIRECT GRADING SYSTEM

1. Direct Grading System based on a 10 – Point scale is used to evaluate the performance (External and Internal Examination of students)
2. For all courses (Theory & Practical)/Semester/Overall Programme, Letter grades and GPA/SGPA/CGPA are given on the following way :

   a. First Stage Evaluation for both Internal and External done by the Teachers concerned in the following Scale :

Grade	Grade Points
A+	5
A	4
B	3
C	2

D	1
E	0

b. The Grade Range for both Internal & External shall be :

Letter Grade	Grade Range	Range of Percentage (%)	Merit Indicator
O	4.25 - 5.00	85.00 - 100.00	Outstanding
A+	3.75 - 4.24	75.00 - 84.99	Excellent
A	3.25 - 3.74	65.00 - 74.99	Very Good
B+	2.75 - 3.24	55.00 - 64.99	Good
B	2.50 - 2.74	50.00 - 54.99	Above Average
C	2.25 - 2.49	45.00 - 49.99	Average
P	2.00 -2.24	40.00 - 44.99	Pass
F	< 2.00	Below 40	Fail
I	0	-	Incomplete
Ab	0	-	Absent

3. No separate minimum is required for Internal evaluation for a pass, but a minimum P Grade is required for a pass in the external evaluation. However, a minimum P grade is required for pass in a course.

4. A student who fails to secure a minimum grade for a pass in a course will be permitted to write the examination along with the next batch.

5. Improvement of Course- The candidates who wish to improve the grade / grade point of the external examination of a course/s they have passed already can do the same by appearing in the external examination of the concerned semester along with the immediate junior batch

6. Betterment Programme One time- A candidate will be permitted to improve the CGPA of the Programme within a continuous period of four semesters immediately following the completion of the programme allowing only once for a particular

semester. The CGPA for the betterment appearance will be computed based on the SGPA secured in the original or betterment appearance of each semester whichever is higher.

16. SEMESTER GRADE POINT AVERAGE (SGPA-CALCULATION)

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses taken by a student.

After the successful completion of a semester, Semester Grade Point Average (SGPA) of a student in that semester is calculated using the formula given below.

Semester Grade Point Average - SGPA (Sj) = Σ(Ci x Gi) / Cr

(SGPA= Total Credit Points awarded in a semester / Total credits of the semester)

Where 'Sj' is the j^{th} semester , 'Gi' is the grade point scored by the student in the i^{th} course 'Ci ' is the credit of the i^{th} course, 'Cr' is the total credits of the semester.

17. CUMULATIVE GRADE POINT AVERAGE (CGPA) - CALCULATION

Cumulative Grade Point Average (CGPA) = **Σ** (Ci x Si) / Cr

(CGPA= Total Credit points awarded in all semesters/Total credits of the programme)

Where C_1 is the credit of the I^{st} semester S_1 is the SGPA of the 1^{st} semester and Cr is the total number of credits in the programme. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme. The SGPA and CGPA shall be rounded off to 2 decimal points.

For the successful completion of a semester, a student should pass all courses and score a minimum SGPA of 2.0. However, the students are permitted to move to the next semester irrespective of their SGPA.

18. GRADE CARD

1. The University shall issue to the students grade card on completion of each semester, which shall contain the following information :
    - Name of University
    - Name of College
    - Title of PG Programme
    - Semester concerned
    - Name and Register Number of student
    - Code number, Title and Credits of each Course opted in the semester including Audit Courses
    - Letter grade in each course in the semester
    - The total credits, total credit points and SGPA in the Semester (corrected to three decimal places)
2. The final Grade card issued at the end of the final semester shall contain the details of all courses taken during the entire programme, including those taken over and above the prescribed minimum credits for obtaining the degree. The final grade card shall show CGPA (corrected to three decimal places), percentage of marks (corrected to two decimal places) and the overall letter grade of a student for the entire programme. The final Grade card will also contain the list of Audit courses.

19. AWARD OF DEGREE

The successful completion of all the courses with P Grade shall be the minimum requirement for the award of the degree.

20. POSITION CERTIFICATE

The University publishes list of top 10 positions for each programme after the publication of the programme results. Position certificates shall be issued to candidates who secure positions from 1st to 10^{th} in the list. The position list shall be finalized after the result of revaluation.

The position list shall be prepared in the order of merit based on the CGPA scored by the students. Grace Grade points awarded to the students shall not be counted for fixing the position.

21. GRIEVANCE REDRESSAL COMMITTEE

Department Level Committee: The college shall form a Grievance Redressal Committee in each department comprising of course teacher, one senior teacher and elected representative of Students (Association Secretary) as members and the Head of the Department as Chairman. The committee shall have initial jurisdiction over complaints against Continuous Assessment.

College Level Committee: There shall be a college level grievance redressal committee comprising of student adviser, two senior teachers , two staff council members (one shall be elected member) and elected representative of students (College Union Chairperson) as members and the Principal as Chairman. This committee shall address all grievances relating to the internal assessment grades of the students.

University level: The University shall form a Grievance Redressal Committee as per the existing norms.

M.Sc ELECTRONICS-PROGRAMME STRUCTURE

LEGEND	
Item	**Description**
C	Credits
E	External Component (%)
I	Internal Component (%)
L	Lecture Hours
P	Practical Hours
T	Total

PROGRAMME STRUCTURE

I SEMESTER

Course	Course Code	Course Title	Internal (%)	External (%)	Credits
Core	ELS1C01	Applied Mathematics	25	75	4
Core	ELS1C02	Microcontroller Based System Design	25	75	4
Core	ELS1C03	Modern Digital and Optical Communication	25	75	4
Core	ELS1C04	Advanced Digital System Design	25	75	4
Practical	ELS1L01	Application Based Programming in Embedded C & Python	25	75	4
Audit	ELS1A01	Introduction to PYTHON Programming	25	75	4
Total Credits (excluding audit course)					**20**

II SEMESTER

Course	Course Code	Course Title	Internal (%)	External (%)	Credits
Core	ELS2C05	High Performance Communication Networks	25	75	4
Core	ELS2C06	Wireless Communication	25	75	4
Core	ELS2C07	Design of Embedded Systems	25	75	4
Core	ELS2C08	Advanced Microcontrollers	25	75	4
Practical	ELS2L02	Embedded Systems Lab	25	75	4
Audit	ELS2A02	Paper Writing and Seminar	25	75	4
Total Credits (excluding audit course)					**20**

III SEMESTER

Semester Course	Course Code	Course Title	Internal (%)	External (%)	Credits
Core	ELS3C09	Soft Computing and Optimization Techniques	25	75	4
Core	ELS3C10	Advanced Digital Signal Processing	25	75	4
Core	ELS3C11	Internet of Things	25	75	4
Elective	ELS3E01	Elective 1	25	75	4
Practical	ELS3LO3	Communication & DSP lab	25	75	4
Total credits					**20**

List of Elective Courses for ELS3E01 (Choose any one)

ELS3E01A	RISC Processor Architecture & Programming
ELS3E01B	Industrial Instrumentation & Automation
ELS3E01C	VLSI Design and VHDL Programming
ELS3E01D	Satellite Communication

IV SEMESTER

Course	Course Code	Course Title	Internal (%)	External (%)	Credits
Core	ELS4C12	Robotics	25	75	4
Elective	ELS4E02	Elective 2	25	75	4
Elective	ELS4E03	Elective 3	25	75	4
Project	ELS4P01	Project	25	75	6
Viva Voce	ELS4V01	Viva Voce	25	75	2
Total credits					20
List of Elective Courses for ELES402 (choose any one)					
ELS4E02A	Cryptography and Network Security				
ELS4E02B	Digital Image Processing				
ELS4E02C	Design of Smart Systems				
ELS4E02D	Verilog Programming				
List of Elective Courses for ELES403 (choose any one)					
ELS4E03A	MEMS and NEMS				
ELS4E03B	Wireless Adhoc and Sensor Networks				
ELS4E03C	Neural networks and Applications				
ELS4E03D	Microwave Electronics				
TOTAL CREDITS					**80**

ELS1C01: APPLIED MATHEMATICS

(Credits –4)

Course objectives:

- *To enable the student to know about the concepts to solve problems in numerical methods.*
- *To find solution to problems in Probability and random variables*

Expected Outcomes:

The students will be able

- *To solve problems using numerical methods .*
- *To learn the basics of Probability and Random variables*

Numerical Methods (20 hrs)

Solution of algebraic and transcendental equations: Bisection method –Secant method – Newton Raphson method, Solution of simultaneous algebraic equations: Gauss elimination method – Gauss Jordan method – Gauss – Seidel method.

Numerical integration and differentiation (15 hrs)

Numerical Integration methods, Initial value problems: Euler's method, Modified Euler's methods, Runge-Kutta method. Trapezoidal rule, Simpson's rule. Improper Integrals and numerical differentiation.

.**Linear programming(20 hrs)**

Formulation – Graphical solution-Simplex method -Transportation problems : balanced and unbalanced transportation problem-initial basic feasible solution : NW CR and VAM- optimality of transportation problem-Assignment models and solutions.

Probability and random variables (20 hrs)

Probability – Axioms of probability – Conditional probability – Bayes' theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distribution

Linear Algebra (15 hrs)

Vector spaces- finite dimensional vector space- bases- linear transformations- matrix representation of linear transformation- rank nullity theorem- Eigen values and eigen vectors and basic properties.

Text & Reference Books:

1. Hoffman.k and kunze.R, " Linear Algebra", Second edition, Printice Hall of India, 1991.

2. *Taha.H.A, "Operations Research an Introduction" 6th Edition, PHI,1997.*

3. Chuchil.R.V, "Operational Mathematics, McGraw Hill, 1972.

4. *Richard A Johnson, Miller and Freund's Probability and Statistics for Engineers, 5th Edition, PHI*

5. S. Narayanan, T.K.Manickvachagam Pillay and G.Ramanaiah, Advanced Mathematics for Engineering Students, Vol.II. S.Viswanathan Pvt. Ltd., 1986

6. Numerical Analysis, Santa Kumar.

7. Numerical Methods, Yengar & Jain.

8."Applied Numerical methods for Digital computation" ML James, GM Smith and JC Walford. Harper & Row

9."Introductory methods of Numerical analysis" Sastry SS, 5th Edition, PHI learning.

ELS1C02: MICROCONTROLLER BASED SYSTEM DESIGN

(Credits -4)

Course objectives:

- *To introduce the knowledge about the interfacing and programming with 8051 and microcontroller based systems.*
- *To familiarize Arduino and Raspberry Pi applications.*

Expected Outcomes:

The students will be able

- *To design and implement micro controller based system for various applications.*
- *To use Arduino and Raspberry Pi boards for various applications.*

INTERFACING OVERVIEW (20 hrs)

Logic devices for Interfacing Tristate devices, buffers-source and sinking currents-fan out, System design issues, encoders, decoders. Memory and I/O interfacing- chip select, memory map and addresses with examples, Absolute and linear select decoding, Input and output interfacing, Interfacing DIP switch and seven segment LED displays, 8051 pinout and its functions, I/O programming, C programming – logical operators-data conversion programs- Data serialization, Accessing code ROM space.

805I BASED SYSTEM DESIGN (20 hrs)

Power On RESET with momentary switch, minimum connection for 89C51 based systems. Test program in assembly and C. 8051 timer and counter programming in Assembly and C. 8051 serial port programming-connection to RS 232-serial port programming in assembly and C. 8051 Interrupts -Programming timer and external hardware Interrupts-Interrupt priority – Interrupt programming in C

8051 INTERFACING (20 hrs)

LCD and Keyboard interfacing, ADC, DAC, sensor Interfacing and signal conditioning, 8051 interfacing to external memory , 8255 and RTC. RTC programming in C. Alarm, SQW and IRQ features of the DS12887chip. Motor control: Relay,PWM,DC and Stepper motors.

ARDUINO (15 hrs)

Arduino IDE- familiarization of Arduino boards- Arduino UNO- pin Descriptions- Technical specifications- Atmega328 -Communication- Embedded C Programming for Arduino and its applications such as interfacing with Key pad, displays,Sensors and motors .

RASPBERRY PI (15 hrs)

Getting Started with Raspberry Pi Zero, Raspberry Pi board- pin Descriptions- Technical specifications. Programming Raspberry Pi Zero- Python programming for Raspberry - Accessing the GPIO Pins on Raspberry Pi Zero- communication- Interfacing Applications.

Text books & References:

1. Microprocessor Architecture, Programming and Applications with8085/8080A: Gaonkar, Wiley Eastern.

2. Microprocessor Interfacing: Douglas Hall, McGraw Hill.

3. The 8051 Microcontroller and Embedded Systems, Muhammed Ali Mazidi and Janice Mazadi, 2000, Prentice Hall.

4. Arduino for dummies by John nussey

5. Arduino Applied Comprehensive Projects for Everyday Electronics, Neil Cameron

6. Beginning C for Arduino-Learn C program for the Arduino, Jack Purdum

7. Programming the Raspberry Pi, Second Edition: Amazon.

8. Getting Started with Raspberry Pi Zero. Richard Grimmett

ELS1C03: MODERN DIGITAL AND OPTICAL COMMUNICATION

(Credits-4)

Course objectives:

- *To give basic idea about system aspects and design concepts of modern digital and fiber optical systems*.

Expected Outcomes:

The students will be able

- *To understand concept of Network Hardware and Software.*
- *To explain Protocol layers.*
- *To explain concept of optical communication*.

NETWORK HARDWARE AND SOFTWARE (20 hrs)

LAN, MAN, WAN, Wireless and Internetworks, Protocol hierarchies, design issues for the layers, interfaces and services, connection oriented and connectionless services, OSI reference model, TCP/IP model, comparison.

PROTOCOL LAYERS AND THEIR FUNCTIONS(20 hrs)

Physical Layer, Data link Layer: Services provided to Network Layer, Medium Access Sub layer, Elementary ideas of framing Network and Transport layers.

LAN HARDWARE AND COMPONENTS (20 hrs)

Bound and Unbound media and its specifications, switches and Hubs, Bridges and Routers, Structured cabling and Passive components.

OPTICAL LINK DESIGN (15 hrs)

BER Calculation, quantum limit, power penalties, Optical Switches - Coupled mode analysis of directional couplers, Electro switches

NON-LINEAR EFFECTS IN FIBER OPTIC LINKS (15 hrs)

Concept of self phase modulation, group velocity dispersion and solution based communication. Optical amplifiers- EDFA, Raman Amplifier and WDM systems.

Text & Reference Books

1. *J.Keiser, Fiber Optic communication, McGraw Hill, 2nd Ed 1992*

2. J.E. Midwinter, Optical Fibers for Transmission, John Wiley 1979

3. H.Dutlon, Understanding Optical Communications, Prentice Hall

4. R.P.Lathi, Modern Digital and analog communication systems

5. Proakis JJ, Digital Communications, McGraw Hill

6. A.S. Tanenbaum, "Computer Networks:, PHI

ELS1C04 : ADVANCED DIGITAL SYSTEM DESIGN

(Credits-4)

Course *objectives:*

- *To introduce the methods to analyze and design digital systems.*
- *To introduce the concepts of sequential logic circuits and PLDs*

Expected Outcomes:

The students will be able

- *To understand Design of sequential logical circuits.*
- *To explain design of PLD and FPGA.*

ADVANCED TOPICS IN BOOLEAN ALGEBRA (20 hrs)

Shannon's expansion theorem, Consensus theorem, Octal designation, Gate expander, Reed Muller expansion, Synthesis of multiple output combinational logic circuits by product map method, design of static hazard free and dynamic hazard free logic circuits.

THRESHOLD LOGIC (20 hrs)

Linear Separability, Unateness, Physical implementation, Dual comparability, Reduced functions, Various theorems in threshold logic, Synthesis of single gate and multigate threshold network. Elementary symmetric functions, partially symmetric and totally symmetric functions, Mc Cluskey decomposition method, Unity ratio symmetric ratio functions, Synthesis of Symmetric function by contact networks.

SEQUENTIAL LOGIC CIRCUITS (20 hrs)

Mealy machine, Moore machine, Trivial/Reversible/Isomorphic sequential machines, State diagrams, State table minimization, Incompletely specified sequential machines, State assignments, Design of synchronous sequential logic circuits working in the fundamental mode and pulse mode, Essential hazards, Unger's theorem.

PROGRAMMABLE LOGIC DEVICES (15 hrs)

Basic concepts, Programming technologies, Programmable Logic Element (PLE) , Programmable Logic Array (PLA), Programmable Array Logic (PAL), Structure of standard PLD's, Complex PLD's (CPLD), System design using PLD's – Design of combinational and sequential circuits using PLD's,

Programming PAL device using PALASM, design of state machine using Algorithmic State Machines (ASM) chart as a design tool.

FIELD PROGRAMMABLE GATE ARRAYS (15 hrs)

Introduction to Field Programmable Gate Arrays – Types of FPGA, Xilinx XC3000 series, Logic Cell array (LCA), Configurable Logic Blocks (CLB), Input/Output Block (IOB)- Programmable Interconnect Point (PIP), Introduction to Actel ACT2 family and Xilinx XC4000 families, Design examples.

Text & Reference Books:

1. William .I.Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India, 1996.

2. James E.Palmer, David E.Perlman, "Introduction to Digital Systems", Tata McGRaw Hill, 1996.

3.*Stephen Brown &ZvonkoVranesic,Fundamentals of Digital Logic with VHDL design*

4. NN Biswas, "Logic Design Theory", Prentice Hall of India, 1993.

5. S. Devadas, A.Ghosh and K.Keutzer, "Logic Synthesis", McGraw Hill, 1994.

ELS1L01: APPLICATION BASED PROGRAMMING IN

EMBEDDED C & PYTHON

(Credits-4)

Course objectives:

- *To enable the student to program and implement Arduino board for various applications.*
- *To understand Python Programming and its Application (Raspberry Pi Applications)*

Expected Outcomes:

The students will be able

- *To Interface various IO devices using Arduino boards*
- *To use Python Programming for Raspberry Pi Applications.*

Embedded C and its Applications for Arduino (Atleast 8 experiments)

1.interfacing LED and Switches

2.Seven Segment display interfacing

3.Matrix Keypad interfacing

4.LCD interfacing

5.ADC interfacing

6.Timer

7.RTC interfacing

8.Sensor Interfacing – Temperature, Humidity, LDR, IR, Hall effect, Sound, Distance, Accelerometer, Gyroscope etc.(at least 4 sensor interfacing experiments)

9.Interfacing – DC motor, Servo or Stepper Motor.

10.Communication Interfacing – TSOP, GPS, Node MCU, GSM etc. (at least 2 experiments)

Python Programming and its Application for Raspberry Pi (At least 8 experiments)

1.Introduction to python programming

2.Interfacing LED and Switches

3.Seven segment Display interfacing

4.Matrix Keypad interfacing

5.LCD interfacing

6.Sensor Interfacing – Temperature, Humidity, LDR, IR, Hall effect, Sound, Distance, Accelerometer, Gyroscope etc.(at least 4 sensor interfacing experiments).

7.DC motor interfacing.

8.Webcam interfacing

9.Wifi interfacing

ELS1A01 – INTRODUCTION TO PYTHON PROGRAMMING

(ABILITY ENHANCEMENT AUDIT COURSE)

(credits -4)

Course Objectives:

- *To write Python programs*
- *To use Python data structures – lists, tuples, dictionaries.*
- *To do input/output with files in Python.*

Expected outcomes:

The students will be able to

- *Read, write, execute by Python programs for solving problems.*
- *Decompose a Python program into functions.*
- *Read and write data from/to files in Python Programs.*

Course Evaluation & Course Credit

The Ability Enhancement Audit Course has 4 credits which will not be counted for evaluating the overall SGPA & CGPA. The College/Department shall conduct examination of 2 Hrs duration with a minimum of 20 weightage before the conclusion of first semester classes and have to intimate /upload the results of the same to the University on the stipulated date during the III Semester. Students have to obtain only minimum pass requirements in this Audit Course.

Course Delivery Mode

This course is an Ability Enhancement Audit Course. The course content is not delivered in the classrooms. Instead, the students have enrol themselves for the online course offered at NPTEL. The online course is available at https://nptel.ac.in/courses/106106145. Students can either view the video module online or can download the video lessons and transcripts to view or read them offline.

SYLLABUS

ELS1A01: PYTHON PROGRAMMING

(credits - 4)

Course Objectives:

- *To write Python programs*
- *To use Python data structures – lists, tuples, dictionaries.*
- *To do input/output with files in Python.*

Expected outcomes:

The students will be able to

- *Read, write, execute by Python programs for solving problems.*
- *Decompose a Python program into functions.*
- *Read and write data from/to files in Python Programs.*

MODULE I (15Hrs)

Introduction to programming, algorithms and data structures viagcd, Downloading and installing Python, gcd in Python: variables, operations, control ow - assignments, condition-als, loops, functions. Python: types, expressions, strings, lists, tuples | Python memory model: names, mutable and immutable values | List

operations: slices etc - Binary search | Inductive function definitions: numerical and structural induction | Elementary inductive sorting: selection and insertion sort | In-place sorting.

MODULE II (15Hrs)

Basic algorithmic analysis: input size, asymptotic, complexity, O() notation | Arrays vs lists | Merge sort | Quicksort | Stable sorting. Dictionaries | More on Python functions: optional arguments, default values | Passing functions as arguments | Higher order functions on lists: map, lter, list comprehension

MODULE III (15Hrs)

Exception handling | Basic input/output | Handling les | String processing. Backtracking: N Queens, recording all solutions | Scope in Python: local, global, nonlocal names | Nested functions | Data structures: stack, queue | Heaps.

MODULE IV(10Hrs)

Abstract data types | Classes and objects in Python | "Linked" lists: find, insert, delete | Binary search trees: find, insert, delete | Height-balanced binary search trees.

MODULE V (15Hrs)

Efficient evaluation of recursive definitions: memorization | Dynamic programming: examples | Other programming languages: C and manual memory management | Other programming paradigms: functional programming.

Reference sites:

1.https://nptel.ac.in/courses/106106145

2.https://www.edx.org/learn/python

Text books & reference:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python“ Revised and updated for Python 3.2, Network Theory Ltd., 2011.

SEMESTER 2

ELS2C05: HIGH PERFORMANCE COMMUNICATIONNETWORKS

(Credits-4)

Course objectives:

- *To give basic idea about system aspects and design concepts of modern digital and fiber optical system*.

Expected Outcomes:

The students will be able

- *To understand concept of basic of networks.*
- *To explain internet and TCP/IP network*
- *To explain optical network and switching*

BASICS OF NETWORKS (20 hrs)

Introduction to wired and wireless networks, networking principles, and digitalization : service integration, network services and layered architecture, traffic characterization and QOS, network services : network elements and network mechanisms.

PACKET SWITCHED NETWORKS (25 hrs)

OSI and IP models: Ethernet (IEEE 802.3) ; token ring (IEEE 802.5), FDDI, DQDB, frame relay: SDMS : internet working with SDMS.

INTERNET AND TCP/IP NETWORKS (20 hrs)

Main features – addressing, signalling and routing: ATM header structure – adaptation layer, management and control; BISDN; Internetworking with ATM, wireless channel, Link level design, channel access; Network design and wireless networks.

OPTICAL NETWORKS AND SWITCHING (25 hrs)

Optical links – WDM systems, cross connects, optical LANs, Optical paths and networks; TDS and SDS; modular switch designs – packet switching, distributes, shared input and output buffers.

Text & Reference Books

1. *Jean Warland and PravinVaraiya, " High PerformanceCommunication Networks", 2nd Ed, Harcourt and Morgan Kauffman,London, 2000.*

2. Leon Garcia, Widjaja, " Communication Networks", Tata McGrawHill, New Delhi, 2000

3. SumitKasera, PankajSethi," ATM Networks", Tata Mc Graw-Hill,New Delhi, 2000.

4. Behrouz A Forouzan, "Data Communication and Networking", TataMc Graw-Hill, New Delhi, 2000.

ELS2C06: WIRELESS COMMUNICATION

(**Credits**-4)

Course objectives:

- *To provide a strong background in the basic and modern wireless mobile communication*
- *To impart knowledge about the various multiple access techniques*

Expected Outcomes:

The students will be able

- *To explain the basics of wireless communications.*
- *To explain mobile radio propagation*
- *To explain concept of multiple access techniques*

INTRODUCTION MOBILE COMMUNICATIONS (15 hrs)

Evolution of mobile radio communication, paging systems, cordless telephone systems, wireless in local loop, WLAN, Bluetooth and personal area networks, overview of WIMAX Technologies.

CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS (20 hrs)

Cellular concept, Channel assignment and handoff, Interface and system capacity: cells splitting, sectoring and microcells, cellular systems design fundamentals, frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity.

WIRELESS PROPAGATION (15 hrs)

Wireless propagation mechanism, free space propagation model, ground reflection model, knife edge diffraction model, path loss prediction in hilly terrain, introduction to fading diversity techniques, introduction to MIMO systems, multiple access techniques FDMA ,TDMA spread spectrum, CDMA, OFDM

MODERN WIRELESS COMMUNICATION SYSTEMS (20 hrs)

Comparison of 1G,2G,3G,4G,5G ,GSM system architecture, Radio link aspects, General packet radio service (GPRS), Digital enhanced cordless telecommunication(DECT), Enhanced data rate for global evolution(EDGE)

MODULATION AND SIGNAL PROCESSING(20hrs)

Analog and digital modulation techniques, Performance of various modulation techniques- Spectral efficiency, error rate, power Amplification, Equalizing Rake receiver concepts, Diversity and space time processing, speech coding and channel coding

Text & Reference Books

1. K.Feher, Wireless digital communications, PHI, New Delhi, 1995

2. T.S.Rappaport, Wireless Digital Communications: Principles and Prentice Hall, NJ, 1996.

3. W.C.Y.Lee, Mobile Communications Engineering: Theory And Applications, Second Edition,

McGraw Hill, New York, 1998.

4. Schiller, Mobile Communications: Pearson Education Asia Ltd, 2000

5. Simon Haykin, Michael Mohar, Modern wireless communication, Pearson education,2008

ELS2C07 : DESIGN OF EMBEDDED SYSTEMS

(Credits-4)

Course objectives:

- *To give ideas about embedded systems and system development*
- *To impart knowledge about real time operating systems and microcontrollers*

Expected Outcomes:

The students will be able

- *To explain basics of embedded systems.*

- *To choose proper processor for different applications.*
- *To explain fundamentals of RTOS*

DESIGN LIFE CYCLE AND SELECTION PROCESS (20hrs)

Introduction, Product specification, Hardware software Partitioning, Iteration and implementation, detailed Design, Hardware software integration and Product testing and release. The selection process- packaging the silicon- Adequate performance- RTOS availability- Tool chain availability- Other issues in the selection process.

PARTITIONING DECISION (20hrs)

Hardware/software Duality, Hardware trends, ASIC Revolution, ASIC and Revision costs. The development environment- execution environment, memory organization- system start up. Special software techniques- Manipulating the hardware- speed and code density- Interrupt and ISRs- watchdog timer- flash memory- design methodology.

BASIC TOOLSET AND TESTING (15hrs)

Host based debugging- remote debuggers and Kernels, ROM emulator, Logic analyzer, Bullet proof Run control. Testing- Choosing test cases- Testing embedded software- Performance testing

RTOS BASED EMBEDDED SYSTEM DESIGN (20 hrs)

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing, Interprocess Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance-comparison of commercial RTOS features - RTOS Lite, Full RTOS, VxWorks, µC/OS-II, RT Linux,

EMBEDDED SYSTEM APPLICATION DEVELOPMENT (15 hrs)

Objectives, different Phases & Modelling of the Embedded product Development Life Cycle (EDLC), Case studies on Digital camera- Smart card- Adaptive Cruise control in a Car - Mobile Phone software for key inputs.

Text books & References:

1. *Embedded system Design:* A unified Hardware/ softwareintroduction, Frank Vahid and Tony Givargis, Wiley2001.

2. *Embedded system- Architecture, programming, Design:* Rajkamal,Tata Mc GrawHill 2003

3. *Fundamentals of Embedded software*- Daniel W Lewis, Prentice Hallof India,2004

4. Embedded systems design- Arnold berger, CMP books

ELS2C08 : ADVANCED MICROCONTROLLERS

(Credits-4)

Course objectives:

- To introduce the basic knowledge about interfacing and programming with PIC microcontroller
- To give an introduction to ARM processors

Expected Outcomes:

The students will be able

- To design and implement pic microcontroller based system
- To explain basics of ARM processor

PIC MICROCONTROLLERS-HISTORY AND FEATURES (15 hrs)

Microcontrollers and embedded processors- Overview of PIC 18 family- Introduction to Embedded C – Development tools in embedded system lab.

PIC MICROCONTROLLER (20 hrs)

PIC Architecture- Registers - WREG register- File register- Using instruction with default access bank- status register, data format and directives, program counter -Addressing modes- RAM and ROM allocation.

PERIPHERALS (15 hrs)

Timers, Interrupts, I/O ports, I2C bus , CCP modules, Flash and EPROMS.

PIC PROGRAMMING (20 hrs)

Instruction set,-Arithmetic, logical, branching- time delay loop- CALL Programming in assembly and Embedded C- Interfacing- LCD, ADC and DAC- PIC timer - serial port programming- interrupt programming- CCP programming.

INTRODUCTION TO ARM (20 hrs)

Advanced RISC Machine- ARM architecture- architectural Inheritance- Core and architectures- Registers- Pipeline- Interrupts- ARM organization. Introduction to ARM programming using embedded C.

Text books& References:

1.) *Muhammad Ali Mazidi-Rolin-D-Muckinlay, Danny Caussey. "*PICMICROCONTROLLER AND EMBEDDED SYSTEM USING ASSEMBLY ANDC FOR PIC 18"

2.) *Dorgan Ibrahim.* "ADVANCED PIC MICROCONTROLLER PROJECTS INC*"*

3.) *John B Beatman. "*DESIGN WITH PIC MICROCONTROLLERS" prentice Hall.

4.) *Steve Furber. "*ARM SYSTEM ON CHIP ARCHITECTURE". Addisionwisley 2nd edition.

5.) *Andrew N.Sloss Dominic Sysmes Chris Wright* "ARM SYSTEM DEVELOPMENT GUIDE"*, Morgan Kaufmann Publishers, Reprinted 2010.*

ELS2L02: EMBEDDED SYSTEMS LAB

(Credits – 4)

Course objectives:

- *To enable the student to program and implement PIC microcontroller based applications.*
- *To understand basics of ARM controllers programming*

Expected Outcomes:

The students will be able

- *To write programs for PIC and ARM microcontrollers*
- *To interface PIC and ARM controllers with different IO devices*.

II) PIC16F87X BASED PROGRAMS (At least 12 experiments)

1) Arithmetic and Logical programs

2) Square wave generation using ports

3) Key & LED interfacing

4)Seven segment LED display Interfacing

5) LCD display interfacing

6) ADC Interface

7) Sensor interfacing

8) DAC Interface

9) DC motor interface

10) Stepper motor control

11) Serial communication using RS232C

12)Temperature monitoring and control

13)DAC interface

14)Traffic Light controller

15)Water level controller

16)RTOS Multitasking

II) ARM LPC 2148 BASED PROGRAMS (At least 4 experiments)

1) Square wave generation using ports

2) Key & LED interfacing

3) ADC Interface

4) DAC Interface

5) DC motor interface

6) Stepper motor control

ELS2A02 : PAPER WRITING AND SEMINAR

(Credits – 4)

Course objectives:

- To introduce the student to the techniques of literature survey.
- To acquaint him/her with the process of presenting his/her work through seminars and technical reports

Course outcomes:

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (atleast 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

The student should give a seminar on his/her work, during the semester, and submit a technical report. Technical report should be prepared in IEEE conference style format.

Course Delivery Mode

Students should be given choice to opt for the supervisor according to his/her area of interest. The Department council will finally decide and distribute the students among the faculty members by accommodating the choice

and interest of the students, as far as possible. The faculty in charge must give proper directions and guidance to the students in carrying out the literature review effectively and systematically.

Course Evaluation & Course Credit

The Professional Competency Audit Course has 4 credits which will not be counted for evaluating the overall SGPA & CGPA. The Department shall conduct the final evaluation of the course based on the following criteria and have to intimate /upload the results of the same to the University on the stipulated date during the III Semester.

Components	Weightage
Publication of the Review Paper in a UGC Listed, Peer Reviewed or other peer reviewed refereed Journals	20% (Maximum weightage must be given to UGC listed Journal and weightage be reduced in other cases)
Presentation in an International/ National/ Regional Conference	20% (Maximum weightage must be given to International Conferences with Proceeding having ISBN and weightage be reduced in other cases
Quality of the Technical Report	40 %
Quality and Effectiveness of the Report presentation	20 %

Students have to obtain only minimum pass requirements in this Audit Course.

REFERENCES

1. Articles from ACM/IEEE/Elsevier/ science direct Journals/Conference proceedings and/or equivalent documents, standard textbooks and web based materials, approved by the supervisor.

SEMESTER 3

ELS3C09: SOFT COMPUTING AND OPTIMIZATION TECHNIQUES

(Credits-4)

Course objectives:

- *To learn various soft computing frame works*
- *To understand the concept of fuzzy logic*
- *To understand various evolutionary optimization techniques.*

Expected Outcomes:

The students will be able

- *To provide basic exposition to the goals and methods of soft computing.*
- *To apply intelligent techniques for problem solving.*

NEURAL NETWORKS (15 hrs)

Machine Learning using Neural Network, Learning algorithms, Supervised Learning Neural Networks – Feed Forward Networks, Radial Basis Function, Unsupervised Learning Neural Networks – Self Organizing map , Adaptive Resonance Architectures, Hopfield network

FUZZY LOGIC (15 hrs)

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making

NEURO-FUZZY MODELING (20 hrs)

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modelling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies.

CONVENTIONAL OPTIMIZATION TECHNIQUES (20 hrs)

Introduction to optimization techniques, Statement of an optimization problem, classification, Unconstrained optimization-gradient search method-Gradient of a function, steepest gradient conjugate gradient, Newton's Method, Marquardt Method, Constrained optimization –sequential linear programming, Interior penalty function method, external penalty function method.

EVOLUTIONARY OPTIMIZATION TECHNIQUES (20 hrs)

Genetic algorithm - working principle, Basic operators and Terminologies, Building block hypothesis, Travelling Salesman Problem, Particle swam optimization, Ant colony optimization.

Text books &References:

1. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison wesley, 2009.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications,Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Edn., 2003.
4. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2003.
5. Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall, 1998.
6. Simon Haykins, Neural Networks: A Comprehensive Foundation, Prentice Hall International Inc, 1999.
7. Singiresu S. Rao, Engineering optimization Theory and practice, John Wiley & sons, inc,Fourth Edition, 2009
8. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997.
9. VenkataRao, Vimal J. Savsani, Mechanical Design Optimization Using Advanced Optimization Techniques, springer 2012

ELS3C10: ADVANCED DIGITAL SIGNAL PROCESSING

(Credits-4)

Course objectives:

- *To learn about various spectrum estimation methods*
- *To introduce the concept of multirate digital signal processing.*

Expected Outcomes:

The students will be able

- *To explain discrete random signal processing and simulate using Matlab*

INTRODUCTION TO DSP (15 hrs)

Signals and system: Operations - Convolution – Correlations, Sampling – Aliasing, Fourier series Fourier transforms- DFT –FFT, Z transforms, Concept of discrete time systems, Concept of filters, IIR and FIR filters

INTRODUCTION TO MATLAB (15 hrs)

Introduction to MATLAB – MATLAB Characteristics – MATLAB Preliminaries– Rules on Variable and Function Names – Special Characters – Basic Arithmetic Operators – Elementary math Intrinsic Functions –File Types.

DISCRETE RANDOM SIGNAL PROCESSING (20 hrs)

Discrete random processes, expectations, variance, co -variance, scalar product, energy of discrete signals- Parseval's theorem, Wiener Khintchine relation- power spectral density-periodogram –sample autocorrelation- sum decomposition theorem, spectral factorization theorem - discrete random signal processing by linear systems - simulation of white noise - low pass filtering of white noise.

SPECTRUM ESTIMATION (20 hrs)

Non-parametric methods-correlation method - co-variance estimator- performance analysis of estimators - unbiased, consistent estimators- windows- periodogram estimator- barlett spectrum estimation - welch estimation- model based approach - ar, ma, arma signal modelling- parameter estimation using Yule - walker method

MULTIRATE DIGITAL SIGNAL PROCESSING (20 hrs)

Mathematical description of change of sampling rate - interpolation and decimation - continuous time model - direct digital domain approach - decimation by an integer factor - interpolation by an integer factor – single and multistage realization - poly phase realization - application to sub band coding - wavelet transform and filter bank implementation of wavelet expansion of signals.

Text books &References:

1. Monson H. Hayes, Statistical Digital Signal Processing And Modeling, John Wiley And Sons, Inc., New York,1996.

2. Hunt, Lipsman, Rosenberg, A Guide To Matlab,Cambridge

3.JohnG.Proakis, DimitrisG.Manolakis, Digital Signal Processing Prentice Hall Of India,1995

4.SanjaySharma,Signals And Systems,KatsonBooks,

5.SopoclesJ.Orfanidis, Optimum Signal Processing,Mcgraw Hill, 1990.

ELS3C11: INTERNET OF THINGS

(Credits-4)

Course objectives:

- *To understand the fundamentals and protocols of internet of things.*
- *To build IOT with ARDUINO and Raspberry pi*

Expected Outcomes:

The students will be able

- *To explain IoT architecture and protocols*
- *To apply IoT in different real world applications.*

INTRODUCTION TO IoT (15 hrs)

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

IoT ARCHITECTURE (15 hrs)

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

IoT PROTOCOLS (20 hrs)

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

BUILDING IoT WITH RASPBERRY PI & ARDUINO (20 hrs)

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

CASE STUDIES AND REAL WORLD APPLICATIONS (20 hrs)

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

Text books &References:

1.ArshdeepBahga, Vijay Madisetti, “Internet of Things A hands-on approach”, Universities press,2015

2.Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.

3.Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012

4.Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.

5.Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012

ELS3E01A: RISC PROCESSOR ARCHITECTURE & PROGRAMMING

(Credits-4)

Course objectives:

- *To study the basic architecture and functions of ARM processors*
- *To learn the designing with ARM microcontrollers*

Expected Outcomes:

The students will be able

- *To explain AVR and ARM architecture*
- *To design with ARM controllers*

AVR MICROCONTROLLER ARCHITECTURE

Architecture – memory organization – addressing modes – I/O Memory – EEPROM – I/O Ports –

SRAM –Timer –UART – Interrupt Structure- Serial Communication with PC – ADC/DAC Interfacing

ARM ARCHITECTURE AND PROGRAMMING

Arcon RISC Machine – Architectural Inheritance – Core & Architectures -- The ARM Programmer's

model -Registers – Pipeline - Interrupts – ARM organization - ARM processor family – Co-processors.

Instruction set – Thumb instruction set – Instruction cycle timings

ARM APPLICATION DEVELOPMENT

Introduction to RT implementation with ARM – –Exception Handling – Interrupts – Interrupt handling schemes- Firmware and bootloader – Free RTOS Embedded Operating Systems concepts –example on ARM core like ARM9 processor.

MEMORY PROTECTION AND MANAGEMENT

Protected Regions-Initializing MPU, Cache and Write Buffer-MPU to MMU-Virtual Memory-Page Tables-TLB-Domain and Memory Access Permission-Fast Context Switch Extension.

DESIGN WITH ARM MICROCONTROLLERS

Assembler Rules and Directives- Simple ASM/C programs- Hamming Code- Division-Negation-Simple Loops – Look up table- Block copy- subroutines-application.

Note: Class room discussions and tutorials can include the following guidelines for improved

teaching /learning process: Discussions/Exercise/Practice on Workbench : *on* Programming practices on the KEIL Work Bench for Simple ASM/C / Input & output interfacing programs with ARM 7/ARM 9/Nuvoton Processors

Text books &References

1. Steve Furber, 'ARM system on chip architecture', Addision Wesley

2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System

3. Developer's Guide Designing and Optimizing System Software', Elsevier 2007.

4. Muhammad Ali Mazidi, SarmadNaimi ,SepehrNaimi' AVR Microcontroller and Embedded

Systems using Assembly and C", Pearson Education 2014.

5. ARM Architecture Reference Manual, LPC213x User Manual

6. www.Nuvoton .com/websites on Advanced ARM Cortex Processors

ELS3E01B : INDUSTRIAL INSTRUMENTATION & AUTOMATION

(Credits-4)

Course Objectives :

- *To impart the knowledge of industrial instrumentation and automation*
- *To understand the programming realization using PLC.*

Expected Outcomes:

The students will be able

- *To explain different industrial measurement.*
- *To explain different data acquisition and intelligent instrumentation*

IBM PC & INTERFACING(20 hrs)

PC architecture, mother board, memory, bus expansion system (ISA, EISA,PCI etc), external interface standards (like Rs 232, Rs485, Centronics, IEEE488 etc), operating systems, device drivers and system programming, plug and play cards. (to be covered, only to the extent to use PC as an

application tool)

SELECTED INDUSTRIAL MEASUREMENTS(15 hrs)

Transducers/sensors for general industrial measurement of temperature, force & weight, torque, pressure, flow, level, displacement, thickness and velocity. Signal conditioning (Linearization of measured variables, amplification etc), various type of transmitters, interfacing, calibration etc.

PC BASED DATA ACQUISITION MODULES(20 hrs)

Analog I/O module, digital I/O modules, counter frequency modules, data conversion techniques, etc. controllers: implementation of on/off feedback& feed forward controllers, cascading & tuning of control loop etc, Actuators /final control elements. Software: tools for virtual instrumentation, soft logic, OLE, SCADA, DCS, HMI etc. PC based data acquisition & control system design

INTELLIGENT INSTRUMENTATION(15 hrs)

Design and implementation of fuzzy logic & neural networks based Controllers, smart sensors and transmitters, field programmers

PROGRAMMABLE LOGIC CONTROLLERS(20 hrs)

PLC system architecture, hardware (CPU module, analog I/O modules, Digital I/O modules, counter/frequency modules etc., programming languages (IEC- 1131 –3 based). Programmable logic controllers based system design

Text books &References :

1. Inside The PC: by: Peter Norton: PHI

2. Standards & Recommended Practices for Instrumentation & Control,Vol 1-3: Instrument Society of America

3. Soft logic: by Robert Carrow: McGraw Hill

4. Essentials of user interface design: by Allan Cooper: Comdex

5. Writing Windows Virtual Device Drivers: by David Thielen; Byran.Addison Wesely

6. Programmable Logic Controllers: by Thomas Hughes; InstrumentSociety of America

7. Instrument Engineers Hand Book, process measurement; by Bela G.Liptak; Instrument Society of Americaa

ELS3E01C : VLSI DESIGN AND VHDL PROGRAMMING

(credits - 4)

Course objectives :

- *To learn about the MOS technology and circuit design.*
- *To study VHDL programming language and an over view of verilog.*

Expected Outcomes:

The students will be able

- *To explain MOS technology and circuits*
- *To implement various digital circuits using HDL*.

MOS TRANSISTOR THEORY (15 hrs)

NMOS and PMOS transistors-CMOS logic, MOS transistor theory introduction, Enhancement mode transistor action, ideal IV characteristics, DC transfer characteristics, threshold voltage- body effect second order effects, Small signal AC characteristics, simple MOS capacitance models, detailed MOS diffusion capacitance model

CMOS TECHNOLOGY AND DESIGN RULE (15 hrs)

CMOS fabrication and layout, CMOS technologies – P-well process, N-well process- twin tub process, stick diagrams and layout diagram- layout design rules, overview of IC fabrication steps.

HDL BASICS (20 hrs)

Concepts of HDL – Verilog & VHDL basic concepts, instructions, syntax of programming using VHDL & Verilog, overview of CAD.

COMBINATIONAL CIRCUIT DESIGN USING VERILOG (20 hrs)

Programming using Verilog – combinational circuits – design and coding Half adder, full adder, half subtractor, full subtractor, multiplexer, demultiplexer, encoder and decoder.

SEQUENTIAL CIRCUIT DESIGN USING VERILOG (20 hrs)

Basics of sequential circuits, state diagram, state table, Meely-Moore machines, design and coding using Verilog – flipflops (S-R, J-K, T and D), counters – up and down counters – shift registers – SISO, SIPO, PIPO, PISO.

References & text books

1.Neil H.E Weste and kamran Eshraghian, " Principles of CMOS VLSI design", pearson education Asia second edition, 2000

2.John.P.Uyemura, " introduction to VLSI circuits and systems", john wiey & sons inc 2002

3.Pucknell, "Basics VLSI design", prentice hall India, publication 1999

4. Samir panikar , "Verilog HDL , A guide to digital design"

5. Peter J Ashenden, The Designer's Guide to VHDL, Harcourt AsiaPrivate Limited & Morgan Kauffman, 1996.

ELS3E01D : SATELLITE COMMUNICATION

(Credits-4)

Course objectives :

- *To learn about the area of satellite communication.*
- *To know about the design constrains of satellite link.*

Expected Outcomes:

The students will be able

- *To explain orbital parameters and link calculations*
- *To explain access techniques and satellite applications*

Orbital Parameters(15 hrs)

Orbital Parameters, Orbital perturbations, Geo-stationary orbits. Low Earth and Medium Earth orbits. Frequency selection, Frequency co-ordination and regulatory services, Sun transit outages, Limits of visibility, Alttitude and Orientation control, spin stabilization techniques, Gimbal platform

Link Calculations(20 hrs)

Space craft Configuration, Payload and supporting subsystems, Satellite uplink- down link, link power budget, C/No, G/T, Noise temperature, system Noise, propagation factor, Rain and Ice effects, Polarization calculations.

Access Techniques(15 hrs)

Modulation and Multiplexing: Voice, Data, Video, Analog and Digital Transmission systems, Multiple access techniques: FDMA, TDMA, T1- T2carrier systems, SPADE, SS-TDMA, CDMA, Assignment methods.

Earth Station Parameters(20 hrs)

Earth Station location, Propagation effect of ground, High power transmitters – Klystron, Crossed field devices. Receivers: Low Noise frontend amplifiers, MIC devices, Antennas: Reflector antennas, Cassegrain feeds, Measurements on G/T and Eb/Na

Satellite Applications(20 hrs)

INTELSAT series, INSAT, VSAT, Remote sensing, Mobile Satellite service: GSM, GPS, INMARSAT, Satellite Navigation System, Direct to Home service(DTH), Special services – E-mail, Video conferencing and internet connectivity.

Text books &References :

1. Bruce R. Elbert, "The Satellite Communication Applications HandBook", Artech House Boston, 1997.

2. Wilbur L. Pritchard, HendriSuyderhood G. Robert A, Nelson,"Satellite Communication System Engineering", II Edition, PrenticeHall, New Jersey, 1993.

3. Dennis Rody, "Satellite Communication", Regents/Prentice Hall,Englewood eliffs, New Jersey, 1989.

4. *Tri.T.Ha, "Digital Satellite Communication", 2nd Edition, McGraw Hill,New York, 1990.*

5. Feher K,: Digital Communication Satellite / Earth StationEngineering ", Prentice Hall Inc.

ELS3L03: COMMUNICATION AND DSP LAB

(Credits-4)

Course objectives:

- *To develop and implement Matlab based programes*
- *To design implement various modulation schemes*

Expected Outcomes:

The students will be able

- *To write programs using Matlab for DSP applications*
- *To implement different modulation schemes.*

DSP LAB (at least 12 experiments)

1. Familiarization to MATLAB
2. Matrix Addition
3. Matrix Subtraction
4. Inverse Of The Matrix
5. Linear Convolution
6. Circular Convolution
7. Discrete Time Signals And Systems
8. DTFT
9. DFT
10. Impulse Response
11. FFT Operation
12. IFFT Operation
13. Verification Of Sampling Theorem
14. Design Of FIR Filters

15. Design Of IIR Filters

16. Z Transforms

17. Familiarization of DSP Trainer Kit From Texas Instrument TMS320 Series

COMMUNICATION LAB (at least 4 experiments)

1. Introduction to Simulink

2. AM- Modulation and Demodulation

3. FM - Modulation and Demodulation

4. Digital Modulation

    i. PAM

    ii. BFSK

    iii. MSK

5. Familiarization of Optical Fibre Trainer Kit & Fundamentals of Fibre Optic Communications

SEMESTER 4

ELS4C12: ROBOTICS

(Credits-4)

Course objectives :

- *To learn about the basics of robot kinematics.*
- *To learn about the concepts of robotic sensors, vision and applications*.

Expected Outcomes:

The students will be able

- *To explain robot hardware and its organizations*
- *To explain robot control applications*

Robot Organization(15 hrs)

Coordinate transformation, kinematics and inverse kinematics. Trajectory planning and remote manipulation

Robot Hardware(15 hrs)

Robot sensors, Proximity sensors, Range sensors, Visual sensors, Audity sensors, Robot manipulators, Manipulatory dynamics, manipulator control, Wrists, End efforts, Robot grippers.

Robot and Artificial Intelligence(20 hrs)

Principles of AI. Basics of learning, Planning movement, Basics of knowledge representations, Robot programming languages.

Robotic Vision Systems(20 hrs)

Principles of edge detection, Determining optical flow and shape, image segmentation, Pattern recognition, model directed scene analysis.

Robot Control Application(20 hrs)

Overview of robot applications, Prosthetic devices .Robot in material handling, processing assembly and storage. Industrial applications of Robots, Mobile robots, Micro robots, Recent developments in Robotics.

Text & Reference Books:

1. Koren. " Robotics for Engineers", McGraw Hill InternationalCompany, Tokyo, 1995.

2. Vokopravotic, " Introduction to Robotics", Springer, 1988.

3. Rathmill.K. "Robot Technology and Application", Sringer, 1985.

4. Charniak and McDarmott, "Introduction to Artificial Intelligence",McGraw Hill, 1986.

5. K.S.Fu. RC.Gonzally, C.S>G.Lee, "Robotics Control, Sensing, Visionand Intelligence", McGraw Hill Book Company, 1997.

6. Barry Leatham, Jones, "Elements of Industrial Robotics", PittmanPublishing, 1987

7. Mikell P Groover, Mitchell Weiss, Roger. N.Nagel, Nocholas G.Odrey, "Industrial Robotic Technology Programming andApplications", McGraw Hill Book Company, 1986.

8. S.R Deb &Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw-Hill Education.

ELS4E02A : CRYPTOGRAPHY AND NETWORK SECURITY

(Credits-4)

Course Objectives:

- *To impart the basic concepts of network security*
- *To develop understanding about various cryptography schemes and securingnetworks.*

Expected Outcomes:

The students will be able

- *To understand basics of cryptography*
- *To apply various authentication schemes*

INTRODUCTION TO CRYPTOGRAPHY (15 hrs)

Overview: Services, Mechanisms and attacks, OSI security architecture, Model for network security.

Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor machine, Steganography, Problems.

Block Ciphers and DES (Data Encryption Standards): Simplified DES, Block cipher principles, DES, Strength of DES, Block cipher design principles, Block cipher modes of operation, Problems.

PUBLIC KEY CRYPTOSYSTEMS (20 hrs)

Public Key Cryptography and RSA: Principles of public key cryptosystems, RSA algorithm, Problems.

Other Public Key Crypto Systems and Key Management: Key management, Diffie- Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, Problems.

AUTHENTICATION AND SECURITY (20 hrs)

Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MAC's, Problems.

Digital Signature and Authentication Protocol: Digital signature, Authentication protocols, Digital signature standard.

EMAIL SECURITY (15 hrs)

Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generator.

IP SECURITY (20 hrs)

IP Security: Overview, IP security architecture, Authentication header, ESP (encapsulating security pay load), Security associations, Key management, Problems.)

Firewalls: Firewall design principles; Trusted systems, Problems.

Text books & References:

1. William Stallings, "Cryptography and Network Security", 3rd Ed, Pearson Education (Asia)/ Prentice Hall of India, 2003.

2. C. Kaufman, R. Perlman, and M. Speciner, "Network Security: Private Communication in a Public World", 2nd edition, Pearson Education (Asia) Pte.Ltd., 2002.

3. AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2003.

4. Eric Maiwald, "Fundamentals of Network Security", McGraw- Hill, 2003.

ELS4E02B : DIGITAL IMAGE PROCESSING

(Credits-4)

Course objectives :

- *To learn about elements of Digital image processing.*
- *To study Image transforms, Enhancement and Restoration.*

Expected Outcomes*:*

The students will be able

- *To explain different terminologies used in DIP.*
- *To explain concepts of Digital image processing*

DIGITAL IMAGE FUNDAMENTALS (15 hrs)

Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries.

IMAGE TRANSFORMS (15 hrs)

1D DFT, D transforms – DFT, DCT, Discrete Sine, Walsh, Hadamard, Slant, Haar, KLT, SVD, Wavelet transform.

IMAGE ENHANCEMENT AND RESTORATION (20 hrs)

Histogram modification, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic and Yp mean filters. Image restoration – degradation model, Unconstrained and Constrained restoration, Inverse filtering removal

of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations, Gray-Level interpolation.

IMAGE SEGMENTATION (20 hrs)

Image segmentation – Edge detection, Edge linking and boundary detection, Region growing, Region splitting and merging,

IMAGE RECOGNITION (20 hrs)

Image Recognition – Patterns and pattern classes, Matching by minimum distance classifier, Matching by correlation. Neural networks-Back propagation network and training, Neural network to recognize shapes.

TEXT BOOKS AND REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, ' Digital Image Processing', Pearson Education, Inc., Second Edition, 2004

2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.

3. Anil K. Jain, ' Fundamentals of Digital Image Processing', Pearson Education, Inc., 2002.

4. D.E. Dudgeon and R.M. Mersereau, 'Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.

5. William K. Pratt, ' Digital Image Processing', John Wiley, NewYork, 2002.

6. Milan Sonka et al, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999,

ELS4E02C : DESIGN OF SMART SYSTEMS

(credits - 4).

Course objectives :

- *To introduce smart system designs.*
- *To introduce concept of mobile embedded system and home automation*
- *To introduce smart appliances and energy management*

Expected Outcomes:

The students will be able

- *To explain working of smart system*
- *To explain home automation*

SMART SYSTEM OVERVIEW (15 hrs)

Overview of smart system design and requirements- Hardware and software selection & co-design- Communications-smart sensors and actuators-Open-source resources for embedded system- androidfor embedded system- android for embedded system - Embedded system for Ecommerce- Embedded system for Smart card design and development –Recent trends.

MOBILE EMBEDDED SYSTEM (20 hrs)

Design requirements-Hardware platform- OS and Software development platform- Mobile Apps development-Applications: heart beat monitoring, blood pressure monitoring, mobile banking and appliances control.

HOME AUTOMATION (15 hrs)

Home Automation System Architecture-Essential Components- Linux and Raspberry Pi – design and real time implementation.

SMART APPLIANCES AND ENERGY MANAGEMENT (20 hrs)

Overview- functional requirements-Embedded and Integrated Platforms for Energy Management-Energy Measurement Techniques for Smart Metering-Smart Embedded Appliances Networks – Security Considerations.

EMBEDDED SYSTEMS AND ROBOTICS (20 hrs)

Robots and Controllers-components - Aerial Robotics -Mobile Robot Design- Three-Servo Ant Robot-Autonomous Hexacopter System.

Text books &References :

1. Thomas Bräunl, Embedded Robotics ,Springer, 2003.

2. Grimm, Christoph, Neumann, Peter, Mahlknech and Stefan, Embedded Systems for Smart

Appliances and Energy Management , Springer 2013.

3. Raj Kamal, *Embedded Systems* - Architecture,. Programming and Design" , McGraw- Hill, 2008

4. NilanjanDey, AmartyaMukherjee, Embedded Systems and Robotics with Open Source Tools,

CRC press, 2016.

5. KarimYaghmour, Embedded Android , O'Reilly, 2013.

6. Steven Goodwin ,Smart Home Automation with Linux and Raspberry Pi, Apress, 2013

ELS4E02D: VERILOG PROGRAMMING

(credits- 4)

Course objectives :

- *To learn about the basics of Verilog programming*.

Expected outcomes:

Student will be able

- *To design and develop the circuits using Verilog*

CMOS CIRCUITS (15 hrs)

Introduction to CMOS circuits, MOS transistors, operations, ideal I-V characteristics, non ideal I-V characteristics, DC transfer characteristics.

VERILOG BASICS (15 hrs)

Verilog background and basic concepts, instructions, syntax for programming and programming concepts.

COMBINATIONAL CIRCUITS (20 hrs)

Programming using verilog- combinational circuits, half adder, full adder, half substractor

, multiplexer, demultiplexer, encoder and decoder

SEQUENTIAL CIRCUITS (20 hrs)

Sequential circuits using verilog – fliflops (SR, JK, T, D), up/down counter, shift registers- serial input serial output, serial input parallel output, parallel input parallel output.

DESIGN AND IMPLEMENTATION (20 hrs)

CMOS technologies, layout design rules, stick diagram, implementation of basic gates using CMOS transistors, hazards and types of hazards.

Text books & references:

1. Navabi.Z, VHDL Analysis and Modeling of Digital Systems, McGraw Hill 1993.

2. Mohammed Ismail and Terri Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 1994.

3. Peter J Ashenden, The Designer's Guide to VHDL, Harcourt Asia Private Limited & Morgan Kauffman, 1996

ELS4E03A : MEMS AND NEMS

(credits- 4)

Course objectives :

- *To introduce the concepts of micro electromechanical devices.*
- *To familiarize concepts of quantum mechanics and nano systems***.**

Expected Outcomes:

The students will be able

- *To explain MEMS fabrication technologies*
- *To explain micro sensors and actuators*
- *To explain Nano systems*

OVERVIEW (15 hrs)

New trends in Engineering and Science: Micro and Nano scale systems, Introduction to Design of MEMS and NEMS, MEMS and NEMS – Applications, Devices and structures. Materials for MEMS: Silicon, silicon compounds, polymers, metals.

MEMS FABRICATION TECHNOLOGIES(20 hrs)

Micro system fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect- Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

MICRO SENSORS (15 hrs)

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Micro sensors. Case study: Piezo-resistive pressure sensor.

MICRO ACTUATORS (20 hrs)

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators.

NANOSYSTEMS AND QUANTUM MECHANICS (20 hrs)

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

Text books & References:

1. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006.

2. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997

3. Stephen D. Senturia," Micro system Design", Kluwer Academic Publishers,2001

4. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRC Press, 2002.

5. Tai Ran Hsu ,"MEMS and Microsystems Design and Manufacture" ,Tata McGraw Hill, 2002.

ELS4E03B: WIRELESS ADHOC AND SENSOR NETWORKS

(credits - 4)

Course Objectives:

- *To understand the basics of Ad-hoc & Sensor Networks.*
- *To understand various security practices and protocols of Ad-hoc and Sensor networks.*

Corse outcomes:

The students will be able to

- *To analyze protocols developed for adhoc and sensor networks.*
- *To identify and address the security threats in ad hoc and sensor networks.*

MAC & TCP IN AD HOC NETWORKS (15 hrs)

Fundamentals of WLANs – IEEE 802.11 Architecture - Self configuration and Auto configuration-Issues in Ad-Hoc Wireless Networks – MAC Protocols for Ad-Hoc Wireless Networks – Contention Based Protocols - TCP over Ad-Hoc networks-TCP protocol overview - TCP and MANETs – Solutions for TCP over Ad-Hoc Networks.

ROUTING IN AD HOC NETWORKS (15 hrs)

Routing in Ad-Hoc Networks- Introduction-Topology based versus Position based Approaches-Proactive, Reactive, Hybrid Routing Approach-Principles and issues – Location services - DREAM – Quorums based location service – Grid – Forwarding strategies – Greedy packet forwarding – Restricted directional flooding- Hierarchical Routing- Issues and Challenges in providing QoS.

MAC, ROUTING & QOS IN WIRELESS SENSOR NETWORKS (20 hrs)

Introduction – Architecture - Single node architecture – Sensor network design considerations – Energy Efficient Design principles for WSNs – Protocols for WSN – Physical Layer : Transceiver Design considerations – MAC Layer Protocols – IEEE 802.15.4 Zigbee – Link Layer and Error Control issues - Routing Protocols – Mobile Nodes and Mobile Robots - Data Centric & Contention Based Networking – Transport Protocols & QOS – Congestion Control issues – Application Layer support.

SENSOR MANAGEMENT (20 hrs)

Sensor Management - Topology Control Protocols and Sensing Mode Selection Protocols - Time synchronization - Localization and positioning – Operating systems and Sensor Network programming – Sensor Network Simulators.

SECURITY IN AD HOC AND SENSOR NETWORKS (20 hrs)

Security in Ad-Hoc and Sensor networks – Key Distribution and Management – Software based Anti-tamper techniques – water marking techniques – Defense against routing attacks - Secure Adhoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS.

Text books & References:

1. *Adrian Perrig, J. D. Tygar, "Secure Broadcast Communication: In Wired and Wireless Networks", Springer, 2006.*

2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition), World Scientific Publishing, 2011

3. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.

4. C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002.

5. Erdal Çayırcı , Chunming Rong, "Security in Wireless Ad Hoc and Sensor Networks", John Wiley and Sons, 2009.

6. Holger Karl, Andreas willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Inc .2005.

7. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, "Ad Hoc Mobile Wireless Networks", Auerbach Publications, 2008.

8. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley and Sons, 2010.

ELS4E03C : NEURAL NETWORKS & APPLICATIONS

(Credits-4)

Course objectives:

- *To familiarize with the concepts of neural network.*

Course outcomes:

The students will be able

- *To analyse the neural networks*

Introduction to Artificial Neural Networks (15 hrs)

Neuro - physiology – General Processing Element – ADALINE – LMS learning rule – MADALINE – MR2 training algorithm

BPM and BAM (20 hrs)

Back Propagation Network – updating of output and hidden layer weights- application of BPN – associative

Memory – Bi-directional Associative memory- Hopfield memory – travelling sales man problem

Simulated Annealing and CPN (15 hrs)

Annealing, Boltzmann machine – learning – application – counter Propagation network – architecture – training – Applications

SOM and ART (20 hrs)

Self organization map - learning algorithm – feature map classifier – applications – architecture of Adaptive Resonance Theory – pattern matching in ART network

Neocognitron (20 hrs)

Architecture of Neocognitron – Data processing and performance of architecture of spacio – temporal networks for speech recognition.

Text & Reference Books

1. *J.A. Freeman and B.M. Skapura, " Neural Networks, Algoriths Applications and Programming Techniques", Addison – Wesely, 1990.*

2. Laurene Fausett, "Fundamentals of Neural Networks : Archtecture, Algorithms and Applications", Prentice Hall, 1994

ELS4E03D : MICROWAVE ELECTRONICS

(Credits-4)

Course objectives:

- *To understand the concepts of Wave guides, Transmission line, RF components and Antennas*

Course Outcomes:

The student should be able

- *To explain the concepts of Wave guides, Transmission line, RF components, Antennas and measurements*

Introduction to microwave (15 hrs)

Microwave region and band designation, Advantages, Application. Wave guides-TE, TM, TEM mode field patterns, Guide wavelength, Group velocity, Phase velocity. Microwave components- waveguides, solution of wave equations in rectangular waveguides, structural dispersion, Wave guide Tees – E plane Tee - H plane Tee, E plane Tee, EH plane Tee, Magic Tee, Scattering parameters

Transmission line (20 hrs)

Transmission Line Analysis Importance, Examples of transmission line-Two wire line, Coaxial line. Transmission line parameters, Transmission line equation, Lossless line, Distortion less line, Input impedance, Standing wave ratio, power, Shorted line, Open circuit line, Matched line, Smith chart , analysis of dual transmission lines, introduction to metamaterials

RF Components (15 hrs)

Active RF Components Schottky contact, RF diodes, Schottky diode, PIN diode, Varactor diode, IMPATT diode, Tunnel diode, TRAPATT,BARRITT and Gunn diode, RF transistor (Book 3-Chapter 8)

Antennas (20 hrs)

Introduction, Types of antenna-Wire antenna, Aperture antenna, Microstrip, Array, Reflector, Lens antenna. Antenna parameters-Radiation power density, Radiation intensity, Directivity, Radiation pattern, Bandwidth, Gain, Input impedance, Efficiency, Near field to far field transformations.

Microwave Measurements (20 hrs)

Microwave benches, Frequency measurements, Power measurements, Attenuation measurements, Phase shift measurements, VSWR measurements, Impedance measurements, introduction to vector network analyzers and measurements.

Text & Reference Books

1."Microwave and Radar Engineering" M Kulkarni,1st edition, Umesh Publications

2."Principles of Electromagnetics" Matthew N.O Sadiku,4th edition, Oxford University Press 3."Microwave Devices and Circuits" Samuel Y Liao,3rd edition, Prentice-Hall, Inc

4."Antenna Theory Analysis and Design" Constantine A Balanis, 2 nd edition, John Wiley and Sons

5. Liao, Samuel Y. *Microwave devices and circuits*. Pearson Education India, 1989.

6."RF Circuit Design-Theory and Applications" Reinhold Ludwig & Powel Bretchko, 1 st edition,

Pearson Education Ltd.

7."Microwave Engineering" David M Pozar, 2 nd edition, John Wiley and Sons, inc

APPENDIX A

GUIDELINES FOR PROJECT REPORT & LAYOUT

OBJECTIVES

A Project Report is a documentation of a Post Graduate student's project work—a record of the original work done by the student. It provides information on the student's research work to the future researchers. The Department is committed to preserve a proper copy of the student's report for archiving and cataloguing it in the Departmental Library, making it available to others for academic purpose.

Standardization, readability, conformance to ethical norms, and durability are the four overriding criteria for an acceptable form of a report.

GENERAL INSTRUCTIONS

1. Students have to take care that only chapters/sections relevant to their work are tobe included in their report.
2. Instead of merely replicating the definitions for these sections from standard text books of Electronics Engineering, the student has to describe the information related to his/her work (For eg., Feasibility study should be about how the proposed work is technically/economically/operationally feasible).
3. Figures and tables are to be clear and legible.
4. Citations are to be provided wherever necessary.

Important code, screenshots, report formats and glossary of technical terms are to be attached as Appendices A, B, C and D respectively.

PROJECT REPORT

Paper Size

1. The standard size of paper of a Report is 21.5 cm (8½ inch) wide and 28 cm (11 inches) long.
2. Oversized figures and tables, if any, should be reduced to fit with the size of the report but the reduction should not be so drastic as to impair clarity of their contents. One may also fold these pages to fit with the report size.
3. It is suggested that the report be printed on one side of the paper.

Non-Paper Material

4. Digital or magnetic materials, such as CDs and DVDs, may be included in the report. They have to be given in a closed pocket in the inside of the back cover page of the report. It should be borne in mind that their formats may become obsolete due to rapid change in technology, making it impossible for the Library to guarantee their preservation and use.

5. All non-paper materials, as above, must have a label each indicating the name of the student, enrolment number, the date of submission, and the copyright notice.

Page Numbering

6. Page numbers for the prefacing materials of the report shall be in small Roman numerals and should be centred at the bottom of the pages.

7. Page numbers for the body of the report should be in Arabic numerals and should be centred at the bottom of the pages. The pagination should start with the first page of Chapter 1 and should continue throughout the text (including tables, figures, and appendices).

Binding

8. The report submitted for examination has to be soft bound and printed on both sides.

FORMAT FOR THE REPORT

After the text of the report is written, it is to be formatted in an appropriate manner for printing. The following guidelines are provided to format the report for easy readability.

Font

9. The preferred font size of the text in the report is 12 point, but in no case should it be less than 11-point. The minimum font size of materials within a table or a figure can be 8 point, however.

10. The preferred font type is **Times New Roman**.

Margins

11. A margin of 3.75 cm (1½ inch) is to be given on the binding edge while on the other sides it is to be 2.5 cm (1 inch). The text of the report, including headings, figures, tables, and notes, but excluding page numbers, must be accommodated within the page area.

Line Spacing

12. The line spacing in the main text must be between one-and-a-half and two. Single line spacing should be given for quotations, abstract, declaration, report approval, figure captions, table titles, figure legends, footnotes, and references.

13. Equations, tables, figures, and quotations should be set off from the main text with adequate space (not less than the normal line spacing adopted for the main text).
14. Two consecutive paragraphs should be separated by a spacing which must be larger than the line spacing adopted for the text.

15. The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc., and subsections as 2.2.3, 2.5.1 etc.

16. The chapter number (font size 16) must be left justified. Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14. The body or the text of the report should have font size 12.

17. The figures and tables must be numbered chapter wise for e.g.: Fig. 2.1 Block diagram of a serial binary adder, Table 3.1 Primitive flow table, etc.

Cover Page & First Page

<<TITLE>>

A PROJECT REPORT

SUBMITTED BY

<<NAME OF THE STUDENT>>

FOR THE AWARD OF THE

DEGREE OF MASTER OF SCIENCE
(M.Sc.)IN ELECTRONICS

(UNIVERSITY OF CALICUT)

<<COLLEGE EMBLEM>>

<<NAME OF THE DEPARTMENT>>

<<NAME OF THE INSTITUTION>>

(AFFILIATED TO THE UNIVERSITY OF CALICUT)

<<ADDRESS>>

MONTH YEAR

Acknowledgement

ACKNOWLEDGEMENT

I would like to thank …….

Date: Name of the Student

Declaration by the Student

DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person or material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

Date: Signature:

Name:

Reg. No.:

Certificate from Guide & HoD

CERTIFICATE

This is to certify that the project report entitled <<TITLE HERE>> submitted by <<Name of the Student>> (Register Number: << Reg No>>) to University of Calicut for the award of the degree of Master of Science (M.Sc.) in Computer Science is a bonafide record of the project work carried out by him/her under my supervision and guidance. The content of the report, in full or parts have not been submitted to any other Institute or University for the award of any other degree or diploma.

Signature

<<Name Project Guide>>

<<Designation>>

Signature

<<Name of theHOD>>

<<Designation>>

Place:

Date:

PROJECT EVALUATION REPORT OF THE EXAMINERS

Certified that the candidate was examined by us in the Project Viva Voce Examination held on ..... and his/her Register Number is .....

Examiners:

1.

2.

Contents

CONTENTS

Abstract

ABSTRACT

The abstract is a very brief summary of the report's contents. It should be about half a page long. Somebody unfamiliar with your project should have a good idea of what it's about having read the abstract alone and will know whether it will be of interest to them.

An abstract is a section at the beginning of a report, dissertation, thesis or paper summarising the contents, significant results and conclusions of said document. It allows people to rapidly ascertain the documents purpose and if the document will be useful for them to read.

The abstract is not the same as a summary in the sense you are think of. It is a standalone account of the document giving purpose of the work (objectives), method used, scope of the work, results, conclusions and recommendations.

The abstract, although it comes first logistically, always should be written at the completion of the other chapters of the project report. It needs to be written last because it is the essence of your report, drawing information from all of the other sections of the report. It explains why the experiment was performed and what conclusions were drawn from the results obtained.

A general guideline for an abstract has five sections or areas of focus: why the experiment was conducted; the problem being addressed; what methods were used to solve the problem; the major results obtained; and the overall conclusions from the experiment as a whole.

Do not be misled, however, from this list into thinking that the abstract is a long section. In fact, it should be significantly shorter than all of the others. All of this information should be summarized in a clear but succinct manner if the abstract is going to be successful. An estimated average length for all of this information is only a single paragraph. Although this may seem as though it is a short length to contain all of the required information, it is necessary because it forces you to be accurate and yet compact, two essential qualities.

List of Figures

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

This is a general introduction about the project. Briefly summarize the relevance and background information about the proposed work. It should have the following sections.

1. General Background,
2. Objective,
3. Scope,
4. scheme of project work
5. About the Organization – to whom the Project Work is carried out.
6. Major Contributions of the Project Work.

CHAPTER II

LITERATURE SURVEY / REVIEW

CHAPTER III

REQUIREMENT ANALYSIS AND SPECIFICATION

This chapter includes the following subsections.

1. Requirement Analysis
2. Existing System
3. Proposed System
4. Requirement Specification
    a. Functional Requirements
    b. Non-functional Requirements
    c. Environmental Details (Hardware & Software Requirements)
5. Feasibility Study
    a. Technical Feasibility
    b. Economical Feasibility
    c. Operational Feasibility
6. Project Planning and Scheduling

CHAPTER IV

METHODOLOGY/ THEORY /DESIGN/MODELING

This chapter may include Results of Analytical / Design / Modeling and Simulation / Experimental study and discussion. This chapter must include necessary block diagrams, circuit diagrams , Flowcharts etc. (If both theoretical/computational and experimental works are there explain them in separate chapters).

CHAPTER V

IMPLEMENTATION AND TESTING

This chapter is about the realization of the concepts and ideas developed earlier. It can also describe any problems that may have arisen during implementation and how you dealt with them.

Do not attempt to describe all the code in the system, and do not include large pieces of code in this section.

You should also mention any unforeseen problems you encountered when implementing the system and how and to what extent you overcame them. Include PCB layout and Photographs of project

A seemingly disproportionate amount of project time can be taken up in dealing with such problems. The Implementation section gives you the opportunity to show where that time has gone.

Complete source code should be provided separately as an appendix. This chapter includes the following subsections.

1. Brief description about the Processor, sensors used
2. Software Tools for simulation and Implementation

CHAPTER VI

CONCLUSION , RECOMMENDATIONS, SCOPE FOR FURTHER WORK etc.

The purpose of this section is to provide a summary of the whole thesis or report. In this context, it is similar to the Abstract, except that the Abstract puts roughly equal weight on all report chapters, whereas the Conclusion chapter focuses primarily on the findings, conclusions and/or recommendations of the project.

There are a couple of rules for this chapter:

- All material presented in this chapter must have appeared already in the report; no new material can be introduced in this chapter (rigid rule of technical writing).
- Usually, you would not present any figures or tables in this chapter (rule of thumb).

Conclusions section can have the following (typical) content. These contents must not be given in bulleted format.

- Re-introduce the project and the need for the work though more briefly than in the introduction.
- Summarize the major findings and recommendations of your work.

Future Enhancements.

Identify further works that can be added to make your system to meet the challenges of tomorrow. You can also include whatever requirements you could not fully due to the scarcity of time/resources.

BIBLIOGRAPHY

PUBLICATIONS OUT OF THE PROJECT WORK

A list of publications made or communicated out of the work done in the project is to be included here.