Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

BDA Outer Ring Road, Mallathalli,Bengaluru-56

Board Of Studies 2023-24

Approved
UG Scheme and Syllabus
For
Academic Year 2023-24

Submitted by

Department of Electronics and Communication Engineering

To

DEAN (Academic)

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.

(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

Ref. No: AIT /EC /BOS / /2023-24 **Date**: 12-08-2023

To
Dean (Academic)
Dr Ambedkar Institute of Technology
Bengaluru-56

Sir,

Sub: Regarding the details of the BOS meeting held on 12-08-2023

The External BOS 2023-24 meeting was held in blended mode in the department of the Electronics and communication Engineering and through Google meet link: https://meet.google.com/iun-vhbc-tfs on Saturday, 12-08-2023 10:30 am.

The BOS committee has approved the following:

1. NEP based Scheme and I & II semester syllabus of UG Courses of the 2023 Batch Students.
2. NEP based Scheme and III & IV semester syllabus of UG Courses of the 2022 Batch Students.
3. NEP Based Scheme and V & VI semester Syllabus of UG Courses of the 2021 Batch Students.
4. VII & VIII semester Syllabus of UG Courses of the 2020 Batch Students.
5. Skill Lab for 2023 batch students.
6. Scheme and Syllabus of I and II-year PG course.
7. The List of BOE members.
8. The list of Valuers / Examiners.

Thanking you

CHAIRMAN BOS
Dept. of ECE

Enclosures:

1. List of Members of BOS.
2. Curriculum Design –UG
3. Minutes of the BOS Meeting.
4. Scheme & Syllabus of I/II Semester Basic Electronics and Communication Engineering for the academic year 2023-24.
5. Scheme & Syllabus of 3rd and 4th Semesters for the academic year 2023-24.
6. Scheme & Syllabus of 5th and 6th Semesters for the academic year 2023-24.
7. Scheme & Syllabus of 7th and 8th Semesters for the academic year 2023-24.
8. List of BOE Members.
9. List of valuers / Examiners.

Members of BOS:

Sl No.	*CATEGORY*	*Nomination of the Committee*	*Name of the Person with Designation*
1	Head of the Department	**Chairperson**	Dr. Mahalinga V Mandi, Dean (P&D), Professor & Head, Department of ECE, Dr. AIT, Bengaluru-56
2	Faculty Members at Different Levels Bearing Different Specializations	**Member 1.**	Dr. Umadevi H. Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 2.	Dr. Ramesh S, Dean (Exam), Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 3.	Smt. Sudha B S. Associate Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 4.	Dr. Shivaputra Assistant Professor Department of ECE, Dr. AIT, Bengaluru-56
		Member 5.	Dr. Meenakshi.L.R. Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 6.	Mr. Mohan Kumar V Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
		Member 7.	Dr. Jambunath S Baligar Associate Professor Department of ECE, Dr. AIT, Bengaluru-56
		Member 8.	Dr. Chetan. S Assistant Professor, Department of ECE, Dr. AIT, Bengaluru-56
3	Subject Experts from outside the College Nominated by Academic Council	**Member 1.**	Dr. Devendra Jalihal Professor, EEE department IIT Madras, Chennai-600 036

		Member 2.	Prof. Santanu Mahapatra Professor, Department of Electronic Systems Engineering, Indian Institute of Science Bangalore, Bengaluru- 560012
		Member 3.	Dr. Mandeep Singh Professor, Department of ECE, NITK, Surathkal
		Member 4.	Prof. P.Nagaraju Associate Professor, Dept. of TCE, RVCE, Bengaluru-560 059
4	Expert from outside College, Nominated by Vice Chancellor (VTU)	**VTU Nominee**	Dr. Manajanaik N Professor, Department of ECE, UBDT, Davangere, Karnataka
5	Representative from Industry /Corporate Sector/Allied area related to Placement Nominated by Academic council	**Member 1.**	Mr. Kubendra.K Senior Design Engineer VLSI Group, Samsung India,Outer ring Road, Near Marathahalli, Bengaluru
		Member 2.	Mr. Somshekar H Mobileum India Pvt ltd., Director of Engineering.
		Member 3.	Mr. Sampath Kumar Srinivas Mitel, Senior Staff Software Engineer Manyata Tech Park, Bangalore
6	Post Graduate Meritorious alumnus nominated by Principal	**Member**	Mr. Premkumar M N Senior Manager, Intel, India Bengaluru

CHAIRMAN

BOS Dept. of ECE

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

MINUTES OF THE MEETING OF THE BOARD OF STUDIES 2023-24

DATED: Saturday, 12th August 2023

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics & Communication Engineering

BOS Meeting Notice

Sub: Board of Studies Meeting is convened on 12-08-2023

With reference to the above subject, External Board of Studies Meeting of the department is convened on Saturday, the 12th August 2023 at 10:30 a.m. in Department of ECE for finalizing the scheme and syllabus of UG in B.E. (E & C) and PG, M.Tech in VLSI Design and Embedded Systems for the academic year 2023-24 with the following agenda.

Agenda:

1. Approval of the NEP Scheme and Syllabus of 1st to 8th Semesters B.E (E &C) for the Batch-2023
2. Approval of the NEP Scheme and Syllabus of 3rd to 8th Semester B.E(E & C) for the Batch -2022
3. Approval of the NEP Scheme and Syllabus of 5th to 8th Semester B.E(E & C) for the Batch-2021
4. Approval of the Scheme and Syllabus of 7th to 8th Semester B.E(E & C) for the Batch-2020
5. Approval of Basic IoT Skill Lab for the Batch-2023 students.
6. Approval of the Scheme and Syllabus for the 1st and 2nd Semester PG for the Batch-2023
7. Approval of the Scheme and Syllabus for the 3rd and 4th Semester PG for the Batch-2022.
8. Approval of the courses for the Major, Minor Degree
9. Approval of List of Examiners

Minutes of Board of Studies (BOS) Meeting:

The Meeting of Board of Studies (BOS) for Department of Electronics and Communication Engineering was held on 12-08-2023 at 10:30 a.m. under the Chairmanship of the Dr. Mahalinga V. Mandi, Dean (P&D), Professor and Head, Department of Electronics and Communication Engineering in the department of Electronics and Communication engineering and through Google meet link: https://meet.google.com/iun-vhbc-tfs.

At the very outset, the Chairman welcomed all the Internal and External members of BOS to the meeting and gave a preliminary presentation on the agenda items with reference to the scheme and syllabus of UG and PG for the academic year 2023-24

The chairman along with BOS coordinators gave a detailed presentation of the courses to be offered to the students in both Core and Elective subjects in semester wise at the Under Graduate level and Post Graduate level, also briefed the members about the Curriculum Design of the Department for the UG and PG Courses.

PROCEEDINGS/RESOLUTIONS:

The following are the Suggestions of the members of BOS with reference to the presentations:

I and II semester for 2023 batch:

- Subject Expert Devendra Jalihal Suggested to reduce the syllabus for "Basic electronics" (Module 1) for ECE
  Sol. Internal BOS members clarified that most of the topics will be dealt up to Remembering & Understand level (L1, L2)

- Subject Expert Mandeep Singh **s**uggested to include recent edition text books for the course Introduction to Electronics Engineering (22EST104C/204C).
  Sol. Recent edition text books prescribed for subject Introduction to Electronics Engineering (22EST104C/204C).

III and IV Semesters for 2022 batch:

- Subject Expert Devendra Jalihal suggested to rearrange the contents of the topic Fourier Transforms in the subject "Signals and Systems".
  Sol. Topic Fourier Transforms in the subject "Signals and Systems" is rearranged as per the suggestions.

- Subject Expert Dr. Nagaraju P remarked regarding the IPCC subject Analog Electronic Circuits (21ECT303) that JFET experiment was added in practical component while only concepts of MOSFET were dealt in theory.
  Sol. JFET experiments in practical component is replaced by MOSFET experiments.

- Subject Expert Dr. Nagaraju P suggested to reduce the contents of 7th and 8th experiments in Analog and Digital Electronics Lab (22ECL305).
  Sol. Redundant experiments are removed as per suggestions.

- Subject Expert Dr. Nagaraju P suggested to include Proportional controller concept in module 3 in the IPCC subject Modern Control Systems as these concepts were included in practical component.
  Sol. Proportional Controller Concepts included in module 3.

V and VI Semesters for 2021 batch:

- Industry Expert Sampath Kumar Srinivas seek clarification regarding the duration for mini project.
- Industry Expert Sampath Kumar Srinivas suggested to include IPV6 concept in **Computer Communication Networks (21ECT503)**.
  Sol. IPV6 concept included as per suggestion.

- Subject Expert Dr. Nagaraju P **s**uggested to include recent edition books for the subject Microwave and Antenna.
  Sol. Prescribed Textbooks updated to recent editions.

- Industry Expert Kubendra suggested to include RISC V concepts in Microprocessor and Microcontroller subject.
  Sol. RISCV concepts included as Module 4 and Module 5 in Microprocessor and Microcontroller subject.

- Subject Expert Dr. Nagaraju P **s**uggested to include Embedded C experiments instead of Assembly Programs in the subject CO & ARM Processor.
  Sol. Assembly Programs replaced with embedded C programs.

- Subject Expert Dr. Nagaraju P **s**uggested to update prescribed text books for the subject ANN
  Sol. Prescribed text books updated to recent editions.

- Discussed about the Scheme and syllabus of 7th and 8th semester for 2020 batch
- No comments on final year subjects, so retained same syllabus.
- Discussed about the Scheme and syllabus of 1st and 2nd year PG program.
- Subject Expert Devendra Jalihal remarked that the number of electives are more.
  Sol. PG coordinator clarified that scheme and syllabus is framed as per VTU guidelines**.**
- Subject Expert Dr. Nagaraju P suggested to include recent edition text books.
  Sol. Recent edition text books are prescribed**.**

- The meeting was ended with vote of thanks by Dr. Mahalinga V. Mandi, Dean (P&D), Professor and Head, Department of ECE.

Finally, the BOS members approved the following after incorporating the suggested modifications

- Approved the Curriculum Design for the semesters I to VIII of UG Course for the students of the Batch 2023
- Approved the NEP Based Syllabus of Basic Electronics and Communication Engineering for the semesters I/II of UG Course for the academic year 2023-24.
- Approved the NEP Based Scheme and syllabus for semesters III and IV of UG Course for the academic year 2023-24.
- Approved the NEP Based Scheme and syllabus for semesters V and VI of UG Course for the academic year 2023-24.
- Approved the Scheme and syllabus for semesters VII and VIII of UG Course for the academic year 2023-24.
- Approved Basic IoT Skill Lab for 2023 batch students.
- Approved I and II-year scheme and syllabus of PG Course for academic year 2023-24.
- Approved the courses for the Major, Minor Degree
- Approved the List of BOE members.
- Approved the list of Valuers / Examiners.

CHAIRMAN

BOS Dept. of ECE

BOS Coordinators **Signatures**

1. **Prof. B. S. Sudha**
2. **Mr. Anand H D**

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY, BEGALURU – 560056.
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Department of Electronics & Communication Engineering

List of BOE Members:

SL. NO.	NAME AND ADDRESS
1.	Dr. Mahalinga V. Mandi, Dean (P & D), Professor and Head, Department of ECE
External BOE members:	
1.	Dr. Dinesh P., Professor and Dean, Department of ECE, DSCE, Bengaluru
2.	Prof. Nagraju P, Associate Professor, Department of TCE, RVCE, Bengaluru
3.	Dr. Rajeshwari Hegade, Professor and Head, Department of TCE, BMSCE, Bengaluru-19
4.	Dr. Revanna, Associate Professor, Department of ECE, Govt. Engineering College, Ramanagara
Internal BOE Members:	
1.	Dr. Umadevi H., Professor
2.	Smt. Sudha B. S., Associate Professor
3.	Dr. Shivaputra, Assistant Professor
4.	Smt. Meenakshi L. Rathod, Assistant Professor
5.	Mr. Mohankumar V., Assistant Professor
6.	Smt. Girija S., Assistant Professor

CHAIRMAN

BOS Dept. of ECE

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2022 Scheme for ECE/EI/ET

(Applicable to 2023 batch)

Chemistry Cycle **SEMESTER: I**

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SDA	Total	Duration(Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	22MAU101D	Mathematics- I	Maths	2	2	2	0	4+2	03	50	50	100	04
2	ASC(IC)	22CHU102B	Applied Chemistry	Chemistry	3	0	2	0	3+2	03	50	50	100	04
3	ESC	22MED103	Computer Aided Engineering Drawing	Civil/Mech.	2	2	0	0	3	03	50	50	100	03
4	ESC-1	22ESX104x	Engineering Science Course-I	Respective Engg. dept	3	0	0	0	3	03	50	50	100	03
5	ETC-1	22ETT105x	Programming Language Course - I	Any Engg. Dept	3	0	0	0	3	03	50	50	100	03
6	AEC	22ENT106	Communicative English	Humanities	1	0	0	0	1	02	50	50	100	01
7	HSS	22CIT1O7	Constitution of India	Humanities	1	0	0	0	1	02	50	50	100	01
8	HSS	22SFH108	Scientific Foundation of Health	Any dept.	1	0	0	0	1	02	50	50	100	01
9	MC	22CDN109	Career Development skill-I	Placement cell	2	0	0	0	2	-	50	---	---	NP/ PP
									Total	**25**		**450**	**400**	**800**	**20**

D/PSB- Teaching Department / Paper Setting Board, **SS**-Self Study, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSS**-Humanity and Social Science Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit**	04- Credits courses are to be designed for 50 hours of Teaching-Learning Session 04- Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03- Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01- Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to B.E. day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers **#-**
22CHU102B SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
ESC or ETC, of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
All 01 Credit- courses shall have the SEE **of 02 hours duration and the pattern of the question paper shall be MCQ**

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code 22ESX104x	**Title**	**L**	**T**	**P**	**Code 22ETT105x**	**Title**	**L**	**T**	**P**
22EST104A	Introduction to Civil Engineering	3	0	0	22ETT1051	Introduction to Cyber Security	3	0	0
22EST104B	Introduction to Electrical Engineering	3	0	0	22ETT1052	Introduction to Internet of Things (IOT)	3	0	0
22EST104C	Introduction to Electronics Engineering	3	0	0	22ETT1053	Renewable Energy Sources	3	0	0
22EST104D	Introduction to Mechanical Engineering	3	0	0	22ETT1054	Waste Management	3	0	0
22ESU104E	Introduction to C Programming	2	0	2	22ETT1055	Green Buildings	3	0	0
					22ETT1056	Smart Materials and Systems	3	0	0
					22ETT1057	Introduction to Nano Technology	3	0	0
					22ETT1058	Introduction to Sustainable Engineering	3	0	0
					22ETT1059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					**Applied Science Course(ASC)**				
Code 22PLU105x	**Title**	**L**	**T**	**P**	**Code**	**Title**			
22PLU105A	Introduction to Web Programming	2	0	2	**22MAU101D**	Mathematics – I for EE stream			
22PLU105B	Introduction to Python Programming	2	0	2	**22CHU102B**	Applied Chemistry for EE stream			
22PLU105C	Basics of JAVA programming	2	0	2					
22PLU105D	Introduction to C++ Programming	2	0	2					
The course 22ESU104E: Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-I group except, **22ESU104C - Introduction to Electronics Engineering**
- The students must opt for the courses from ESC group without repeating the course either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2022 Scheme: ECE/EI/ET
(Applicable to 2023 batch)

Physics Cycle **SEMESTER : II**

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SDA	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	22MAU201D	Mathematics	Maths	2	2	2	0	4+2	3	50	50	100	4
2	ASC(IC)	22PHU202D	Applied Physics	Physics	3	0	2	0	3+2	3	50	50	100	4
3	ESC	22ECT203	Basic Electronics	EEE	3	0	0	0	3	3	50	50	100	3
4	ESC-II	22ESX204x	Engineering Science Course-II	Respective Enggdept	3	0	0	0	3	3	50	50	100	3
5	ETC-II	22ETT205X	Emerging Technology Course - II	Any Engg. Dept	2	0	2	0	4	3	50	50	100	3
6	AEC	22ENT206	Professional writing skill	Humanities	1	0	0	0	1	2	50	50	100	1
7	HSS	22SKT207/ 22BKT207	Samskrutika/ Balake Kannada	Humanities	1	0	0	0	1	2	50	50	100	1
8	HSS	22IDT208	Innovation and Design Thinking	Humanities	1	0	0	0	1	2	50	50	100	1
9	MC	22CDN209	Career Development skill-II	Humanities	2	0	0	0	2	-	50	---	---	NP/ PP
								Total	**26**		**450**	**400**	**800**	**20**

TD/PSB- Teaching Department / Paper Setting Board, **SS**-Self Study, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSS**-Humanity and Social Science Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit**	04- Credits courses are to be designed for 50 hours of Teaching-Learning Session 04- Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03- Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 02- Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to B.E. day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers

#- 22PHU202D SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.

ESC or ETC, of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.

All 01 Credit- courses shall have the SEE **of 02 hours duration and the pattern of the question paper shall be MCQ**

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code 22ESX104x	**Title**	**L**	**T**	**P**	**Code 22ETT105x**	**Title**	**L**	**T**	**P**
22EST204A	Introduction to Civil Engineering	3	0	0	22ETT2051	Introduction to Cyber Security	3	0	0
22EST204B	Introduction to Electrical Engineering	3	0	0	22ETT2052	Introduction to Internet of Things (IOT)	3	0	0
22EST204C	Introduction to Electronics Engineering	3	0	0	22ETT2053	Renewable Energy Sources	3	0	0
22EST204D	Introduction to Mechanical Engineering	3	0	0	22ETT2054	Waste Management	3	0	0
22ESU204E	Introduction to C Programming	2	0	2	22ETT2055	Green Buildings	3	0	0
					22ETT2056	Smart Materials and Systems	3	0	0
					22ETT2057	Introduction to Nano Technology	3	0	0
					22ETT2058	Introduction to Sustainable Engineering	3	0	0
					22ETT2059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					**Applied Science Course(ASC)**				
Code 22PLU105x	**Title**	**L**	**T**	**P**	**Code**	**Title**			
22PLU205A	Introduction to Web Programming	2	0	2	**22MAU201D**	Mathematics – I for EE/EC/EI/ET			
22PLU205B	Introduction to Python Programming	2	0	2	**22PHU202D**	Applied Physics for EE/EC/EI/ET			
22PLU205C	Basics of JAVA programming	2	0	2					
22PLU205D	Introduction to C++ Programming	2	0	2					
The course 22ESU104E: Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-II group.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-II group except, **22ESU204C - Introduction to Electronics Engineering**
- The students have to opt for the courses from ESC group without repeating the course either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education (OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	22MAT301xx	Maths for AV Communication	Maths	3	2	0		03	50	50	100	4
2	IPCC	22ECU302	Digital System Design using Verilog	ECE	3	0	2		03	50	50	100	4
3	IPCC	22 ECU303	Analog Electronic Circuits	ECE	3	0	2		03	50	50	100	4
4	PCC	22ECT304	Network Analysis	ECE	3	0	0		03	50	50	100	3
5	PCCL	22ECL305	Analog and Digital Electronics Laboratory	ECE	0	0	2		03	50	50	100	1
6	ESC	22ECT306x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
7	UHV	22HST307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	22ECT308x or 22ECL308x	Ability Enhancement Course/Skill Enhancement Course – III	ECE	If the course is a Theory: 1	0	0		01	50	50	100	1
					If a course is a laboratory: 0	0	2		02				
9	HS	22CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	22NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		22PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON310	Yoga	Yoga Teacher									
									Total	550	350	900	21

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. K: This letter in the course code indicates common to all the streams of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC) 22ECT306x			
22ECT306A	**Signals and system**	**22ECT306C**	**Computer Organization and Architecture**
22ECT306B	**Sensors and Instrumentation**	**22ECT306D**	**Applied Numerical methods**
Ability Enhancement Course – III 22ECT308x OR 2ECL308x			
22ECL308A	**LICs Lab using PSPICE**	**22ECL308C**	**Digital Engineering Course (NASSCOM)**
22ECL308B	**Simulink Programming Basics**	**22ECL308D**	**IOT for Smart Infrastructure**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22ECT401	Engineering Electromagnetics	ECE	3	0	0		03	50	50	100	3
2	IPCC	22ECU402	Principles of Communication Systems	ECE	3	0	2		03	50	50	100	4
3	IPCC	22ECU403	Modern Control systems	ECE	3	0	2		03	50	50	100	4
4	PCCL	22ECL404	Communication laboratory	ECE	0	0	2		03	50	50	100	1
5	ESC	22ECT405x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
6	AEC/ SEC	22ECT406x or 22ECL406x	Ability Enhancement Course/Skill Enhancement Course- IV	ECE	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
7	BSC	22BIT407	Biology For Engineers	TD / PSB: BT, CHE,	2	0	0		03	50	50	100	2
8	UHV	22HST408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	HS	22CDN409	Aptitude and Verbal Ability Skill-II	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN410	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN410	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON410	Yoga	Yoga Teacher									
									Total	500	400	900	19

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.

Engineering Science Course (ESC/ETC/PLC) 22ECT405x OR 22ECL405x			
22ECT405A	**8051 Microcontroller**	**22ECT405C**	**Operating Systems**
22ECT405B	**Power Electronics**	**22ECT405D**	**Engineering Statistics and Linear Algebra**
Ability Enhancement Course / Skill Enhancement Course – IV 22XXT405x OR 22XXL406x			
22ECL406A	**C++ Basics**	**22ECL406C**	**LabVIEW Programming**
22ECL406B	**Electronic Devices**	**22ECL406D**	**Risk Management in IOT Implementation**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of Degree.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	22ECT501	This course is to be as per the requirement of the concerned program. However ,the title of the course should have the word Management and the syllabus has to have management topic/s		3	0	0		03	50	50	100	3
2	IPCC	22ECU502	Digital Communication Systems	ECE	3		2		03	50	50	100	4
3	IPCC	22ECU503	Signal Processing	ECE	3	0	2		03	50	50	100	4
4	PCCL	22ECL504	Signal Processing Laboratory	ECE	0	0	2		03	50	50	100	1
5	PEC	22ECT505x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3
6	PROJ	22ECM506	Mini Project	ECE	0	0	4		03	100		100	2
7	AEC	22RMT507	Research Methodology and IPR	EEE department	2	2	0		02	50	50	100	3
8	MC	22CVT508	Environmental Studies	TD: CV PSB: CV	2	0	0		02	50	50	100	2
9	HS	22CDN509	Aptitude and Verbal Ability Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN510	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	PP/ NP
		22PEN510	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON510	Yoga	Yoga Teacher									
									Total	500	300	800	22

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study CIE: Continuous Internal Evaluation, SEE:Semester End Evaluation. K : The letter in the course code indicates common to al the stream of Engineering. PROJ: Project /Mini Project. PEC: Professional Elective Course

Professional Elective Course 22ECT505x

22ECT505A	**Data Structures using C++**	**22ECT505C**	**Artificial Neural Networks**
22ECT505B	**Cryptography**	**22ECT505D**	**Cloud Computing and IOT Analytics**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or amultidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ECU601	ARM Microcontroller	ECE	3	0	2		03	50	50	100	4
2	PCC	22ECT602	VLSI Design and Testing	ECE	3	2	0		03	50	50	100	4
3	PEC	22ECT603x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3
4	OEC	22ECT604x	Open Elective Course	ECE	3	0	0		03	50	50	100	3
5	PROJ	22ECP605	Major Project Phase I	ECE	0	0	4		03	100	--	100	2
6	PCCL	22ECL606	VLSI Laboratory	ECE	0	0	2		03	50	50	100	1
7	AEC/SDC	22XXT607x OR 22XXL607x	Ability Enhancement Course/Skill Development Course V	ECE	If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	HS	22CDN608	Analytical and Reasoning Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
9	MC	22NSN609	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN609	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON609	Yoga	Yoga Teacher									
									Total	500	300	800	18

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, **S**= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to all the stream of Engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course.

Professional Elective Course 22ECT603x			
22ECT603A	**Satellite Communication**	**22ECT603C**	**Machine Learning**
22ECT603B	**Networks and Cyber Security**	**22ECT603D**	**Digital Image Processing**
Open Elective Course 22ECT604x			
22ECT604A		**22ECT604C**	
22ECT604B		**22ECT604D**	

Ability Enhancement Course / Skill Enhancement Course-V 22ECT607x OR 22ECL607x			
22ECL607A	**Automotive Electronics**	**22ECL607C**	**Introduction to Quantum Computing**
22ECL607B	**Introduction to E-Vehicles**	**22ECL607D**	**Soft Computing**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they canopt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under theguidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

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Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self Study	Duration hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ECU701	Communication Networks		3	0	2		03	50	50	100	4
2	IPCC	22ECU702	Antenna and Wave Propagation		3	0	2		03	50	50	100	4
3	PCC	22ECT703	Wireless Cellular and LTE 4G Broadband		3	2	0		03	50	50	100	4
4	PEC	22ECT704x	Professional Elective Course		3	0	0		03	50	50	100	3
5	OEC	22ECT705x	Open Elective Course		3	0	0		01	50	50	100	3
6	PROJ	22ECP706	Major Project Phase-II		0	0	12		03	100	100	200	6
										400	300	700	24

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Professional Elective Course 22ECT704x			
22ECT704A	**Wireless Sensor Networks**	**22ECT704C**	**Advanced VLSI**
22ECT704B	**5G Fundamentals and Architecture**	**22ECT704D**	**Soft Computing Techniques**
Open Elective Course 22ECT705x			
22ECT705A		**22ECT705C**	
22ECT705B		**22ECT705D**	

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2)Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they canopt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under theguidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21XXP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.

(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.

(iii) To impart flexibility and adaptability.

(iv) To inspire team working.

(v) To expand intellectual capacity, credibility, judgment and intuition.

(vi) To adhere to punctuality, setting and meeting deadlines. To install responsibilities to oneself and others.

(vii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	22ECT801x	Professional Elective (Online Courses)		3	0	0		-	-	-	-	3
2	OEC	22ECT802x	Open Elective (Online Courses)		3	0	0		-	-	-	-	3
3	INT	22ECI803	Internship (Industry/Research) (14 - 20 Weeks)		0	0	12		03	100	100	200	10
										200	200	400	16

L: Lecture, **T**: Tutorial, **P**: Practical S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship.

Professional Elective Course (Online courses) 22ECT801x			
22ECT801A		22ECT801C	
22ECT801B		22ECT801D	
Open Elective Courses (Online Courses) 22ECT802x			
22ECT802A		22ECT802C	
22ECT802B		22ECT802D	

Note: VII and VIII semesters of IV years of the program Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester**.**
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 Weeks. The internship shall be considered as a head of passing and shall be considered for the award of a Degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their Degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize,appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

- With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their home town (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.
  University/Institute shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2022 Scheme for ECE/EI/ET

Chemistry Cycle **SEMESTER: I**

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SDA	Total	Duration(Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	22MAU101D	Mathematics- I	Maths	2	2	2	0	4+2	03	50	50	100	04
2	ASC(IC)	22CHU102B	Applied Chemistry	Chemistry	3	0	2	0	3+2	03	50	50	100	04
3	ESC	22MED103	Computer Aided Engineering Drawing	Civil/Mech.	2	2	0	0	3	03	50	50	100	03
4	ESC-1	22ESX104x	Engineering Science Course-I	Respective Engg. dept	3	0	0	0	3	03	50	50	100	03
5	ETC-1	22ETT105x	Programming Language Course - I	Any Engg. Dept	3	0	0	0	3	03	50	50	100	03
6	AEC	22ENT106	Communicative English	Humanities	1	0	0	0	1	02	50	50	100	01
7	HSS	22CIT1O7	Constitution of India	Humanities	1	0	0	0	1	02	50	50	100	01
8	HSS	22SFH108	Scientific Foundation of Health	Any dept.	1	0	0	0	1	02	50	50	100	01
9	MC	22CDN109	Career Development skill-I	Placement cell	2	0	0	0	2	-	50	---	---	NP/ PP
								Total	**25**		**450**	**400**	**800**	**20**

D/PSB- Teaching Department / Paper Setting Board, **SS**-Self Study, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSS**-Humanity and Social Science Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit**	04- Credits courses are to be designed for 50 hours of Teaching-Learning Session 04- Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03- Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01- Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to B.E. day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers **#-**
22CHU102B SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
ESC or ETC, of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
All 01 Credit- courses shall have the SEE **of 02 hours duration and the pattern of the question paper shall be MCQ**

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code 22ESX104x	**Title**	**L**	**T**	**P**	**Code 22ETT105x**	**Title**	**L**	**T**	**P**
22EST104A	Introduction to Civil Engineering	3	0	0	22ETT1051	Introduction to Cyber Security	3	0	0
22EST104B	Introduction to Electrical Engineering	3	0	0	22ETT1052	Introduction to Internet of Things (IOT)	3	0	0
22EST104C	Introduction to Electronics Engineering	3	0	0	22ETT1053	Renewable Energy Sources	3	0	0
22EST104D	Introduction to Mechanical Engineering	3	0	0	22ETT1054	Waste Management	3	0	0
22ESU104E	Introduction to C Programming	2	0	2	22ETT1055	Green Buildings	3	0	0
					22ETT1056	Smart Materials and Systems	3	0	0
					22ETT1057	Introduction to Nano Technology	3	0	0
					22ETT1058	Introduction to Sustainable Engineering	3	0	0
					22ETT1059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					**Applied Science Course(ASC)**				
Code 22PLU105x	**Title**	**L**	**T**	**P**	**Code**	**Title**			
22PLU105A	Introduction to Web Programming	2	0	2	**22MAU101D**	Mathematics – I for EE stream			
22PLU105B	Introduction to Python Programming	2	0	2	**22CHU102B**	Applied Chemistry for EE stream			
22PLU105C	Basics of JAVA programming	2	0	2					
22PLU105D	Introduction to C++ Programming	2	0	2					
The course 22ESU104E: Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-I group except, **22ESU104C - Introduction to Electronics Engineering**
- The students must opt for the courses from ESC group without repeating the course either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2022 Scheme: ECE/EI/ET

Physics Cycle **SEMESTER : II**

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SDA	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	22MAU201D	Mathematics	Maths	2	2	2	0	4+2	3	50	50	100	4
2	ASC(IC)	22PHU202D	Applied Physics	Physics	3	0	2	0	3+2	3	50	50	100	4
3	ESC	22ECT203	Basic Electronics	EEE	3	0	0	0	3	3	50	50	100	3
4	ESC-II	22ESX204x	Engineering Science Course-II	Respective Enggdept	3	0	0	0	3	3	50	50	100	3
5	ETC-II	22ETT205X	Emerging Technology Course - II	Any Engg. Dept	2	0	2	0	4	3	50	50	100	3
6	AEC	22ENT206	Professional writing skill	Humanities	1	0	0	0	1	2	50	50	100	1
7	HSS	22SKT207/ 22BKT207	Samskrutika/ Balake Kannada	Humanities	1	0	0	0	1	2	50	50	100	1
8	HSS	22IDT208	Innovation and Design Thinking	Humanities	1	0	0	0	1	2	50	50	100	1
9	MC	22CDN209	Career Development skill-II	Humanities	2	0	0	0	2	-	50	---	---	NP/ PP
								Total	**26**		**450**	**400**	**800**	**20**

TD/PSB- Teaching Department / Paper Setting Board, **SS**-Self Study, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSS**-Humanity and Social Science Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit**	04- Credits courses are to be designed for 50 hours of Teaching-Learning Session 04- Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03- Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 02- Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to B.E. day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers

#- 22PHU202D SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.

ESC or ETC, of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.

All 01 Credit- courses shall have the SEE **of 02 hours duration and the pattern of the question paper shall be MCQ**

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code 22ESX104x	**Title**	**L**	**T**	**P**	**Code 22ETT105x**	**Title**	**L**	**T**	**P**
22EST204A	Introduction to Civil Engineering	3	0	0	22ETT2051	Introduction to Cyber Security	3	0	0
22EST204B	Introduction to Electrical Engineering	3	0	0	22ETT2052	Introduction to Internet of Things (IOT)	3	0	0
22EST204C	Introduction to Electronics Engineering	3	0	0	22ETT2053	Renewable Energy Sources	3	0	0
22EST204D	Introduction to Mechanical Engineering	3	0	0	22ETT2054	Waste Management	3	0	0
22ESU204E	Introduction to C Programming	2	0	2	22ETT2055	Green Buildings	3	0	0
					22ETT2056	Smart Materials and Systems	3	0	0
					22ETT2057	Introduction to Nano Technology	3	0	0
					22ETT2058	Introduction to Sustainable Engineering	3	0	0
					22ETT2059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					**Applied Science Course(ASC)**				
Code 22PLU105x	**Title**	**L**	**T**	**P**	**Code**	**Title**			
22PLU205A	Introduction to Web Programming	2	0	2	**22MAU201D**	Mathematics – I for EE/EC/EI/ET			
22PLU205B	Introduction to Python Programming	2	0	2	**22PHU202D**	Applied Physics for EE/EC/EI/ET			
22PLU205C	Basics of JAVA programming	2	0	2					
22PLU205D	Introduction to C++ Programming	2	0	2					
The course 22ESU104E: Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-II group.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-II group except, **22ESU204C - Introduction to Electronics Engineering**
- The students have to opt for the courses from ESC group without repeating the course either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education (OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 batch)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	22MAT301xx	Maths for AV Communication	Maths	3	2	0		03	50	50	100	4
2	IPCC	22ECU302	Digital System Design using Verilog	ECE	3	0	2		03	50	50	100	4
3	IPCC	22 ECU303	Analog Electronic Circuits	ECE	3	0	2		03	50	50	100	4
4	PCC	22ECT304	Network Analysis	ECE	3	0	0		03	50	50	100	3
5	PCCL	22ECL305	Analog and Digital Electronics Laboratory	ECE	0	0	2		03	50	50	100	1
6	ESC	22ECT306x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
7	UHV	22HST307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	22ECT308x or 22ECL308x	Ability Enhancement Course/Skill Enhancement Course – III	ECE	If the course is a Theory: 1	0	0		01	50	50	100	1
					If a course is a laboratory: 0	0	2		02				
9	HS	22CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	22NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		22PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON310	Yoga	Yoga Teacher									
									Total	550	350	900	21

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. K: This letter in the course code indicates common to all the streams of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC) 22ECT306x			
22ECT306A	**Signals and system**	**22ECT306C**	**Computer Organization and Architecture**
22ECT306B	**Sensors and Instrumentation**	**22ECT306D**	**Applied Numerical methods**
Ability Enhancement Course – III 22ECT308x OR 2ECL308x			
22ECL308A	**LICs Lab using PSPICE**	**22ECL308C**	**Digital Engineering Course (NASSCOM)**
22ECL308B	**Simulink Programming Basics**	**22ECL308D**	**IOT for Smart Infrastructure**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 batch)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22ECT401	Engineering Electromagnetics	ECE	3	0	0		03	50	50	100	3
2	IPCC	22ECU402	Principles of Communication Systems	ECE	3	0	2		03	50	50	100	4
3	IPCC	22ECU403	Modern Control systems	ECE	3	0	2		03	50	50	100	4
4	PCCL	22ECL404	Communication laboratory	ECE	0	0	2		03	50	50	100	1
5	ESC	22ECT405x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
6	AEC/ SEC	22ECT406x or 22ECL406x	Ability Enhancement Course/Skill Enhancement Course- IV	ECE	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
7	BSC	22BIT407	Biology For Engineers	TD / PSB: BT, CHE,	2	0	0		03	50	50	100	2
8	UHV	22HST408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	HS	22CDN409	Aptitude and Verbal Ability Skill-II	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN410	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN410	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON410	Yoga	Yoga Teacher									
									Total	500	400	900	19

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.

Engineering Science Course (ESC/ETC/PLC) 22ECT405x OR 22ECL405x			
22ECT405A	**8051 Microcontroller**	**22ECT405C**	**Operating Systems**
22ECT405B	**Power Electronics**	**22ECT405D**	**Engineering Statistics and Linear Algebra**
Ability Enhancement Course / Skill Enhancement Course – IV 22XXT405x OR 22XXL406x			
22ECL406A	**C++ Basics**	**22ECL406C**	**LabVIEW Programming**
22ECL406B	**Electronic Devices**	**22ECL406D**	**Risk Management in IOT Implementation**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of Degree.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 batch)

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	22ECT501	This course is to be as per the requirement of the concerned program. However ,the title of the course should have the word Management and the syllabus has to have management topic/s		3	0	0		03	50	50	100	3
2	IPCC	22ECU502	Digital Communication Systems	ECE	3		2		03	50	50	100	4
3	IPCC	22ECU503	Signal Processing	ECE	3	0	2		03	50	50	100	4
4	PCCL	22ECL504	Signal Processing Laboratory	ECE	0	0	2		03	50	50	100	1
5	PEC	22ECT505x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3
6	PROJ	22ECM506	Mini Project	ECE	0	0	4		03	100		100	2
7	AEC	22RMT507	Research Methodology and IPR	EEE department	2	2	0		02	50	50	100	3
8	MC	22CVT508	Environmental Studies	TD: CV PSB: CV	2	0	0		02	50	50	100	2
9	HS	22CDN509	Aptitude and Verbal Ability Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN510	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	PP/ NP
		22PEN510	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON510	Yoga	Yoga Teacher									
									Total	500	300	800	22

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study CIE: Continuous Internal Evaluation, SEE:Semester End Evaluation. K : The letter in the course code indicates common to al the stream of Engineering. PROJ: Project /Mini Project. PEC: Professional Elective Course

Professional Elective Course 22ECT505x			
22ECT505A	**Data Structures using C++**	**22ECT505C**	**Artificial Neural Networks**
22ECT505B	**Cryptography**	**22ECT505D**	**Cloud Computing and IOT Analytics**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or amultidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 batch)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ECU601	ARM Microcontroller	ECE	3	0	2		03	50	50	100	4
2	PCC	22ECT602	VLSI Design and Testing	ECE	3	2	0		03	50	50	100	4
3	PEC	22ECT603x	Professional Elective Course	ECE	3	0	0		03	50	50	100	3
4	OEC	22ECT604x	Open Elective Course	ECE	3	0	0		03	50	50	100	3
5	PROJ	22ECP605	Major Project Phase I	ECE	0	0	4		03	100	--	100	2
6	PCCL	22ECL606	VLSI Laboratory	ECE	0	0	2		03	50	50	100	1
7	AEC/SDC	22XXT607x OR 22XXL607x	Ability Enhancement Course/Skill Development Course V	ECE	If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	HS	22CDN608	Analytical and Reasoning Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
9	MC	22NSN609	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN609	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON609	Yoga	Yoga Teacher									
									Total	500	300	800	18

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, **S**= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K :** The letter in the course code indicates common to all the stream of Engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**:

Project Phase -I, **OEC**: Open Elective Course.			
Professional Elective Course 22ECT603x			
22ECT603A	**Satellite Communication**	**22ECT603C**	**Machine Learning**
22ECT603B	**Networks and Cyber Security**	**22ECT603D**	**Digital Image Processing**
Open Elective Course 22ECT604x			
22ECT604A		**22ECT604C**	
22ECT604B		**22ECT604D**	

Ability Enhancement Course / Skill Enhancement Course-V 22ECT607x OR 22ECL607x			
22ECL607A	**Automotive Electronics**	**22ECL607C**	**Introduction to Quantum Computing**
22ECL607B	**Introduction to E-Vehicles**	**22ECL607D**	**Soft Computing**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they canopt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under theguidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 batch)

VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self Study	Duration hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22ECU701	Communication Networks		3	0	2		03	50	50	100	4
2	IPCC	22ECU702	Antenna and Wave Propagation		3	0	2		03	50	50	100	4
3	PCC	22ECT703	Wireless Cellular and LTE 4G Broadband		3	2	0		03	50	50	100	4
4	PEC	22ECT704x	Professional Elective Course		3	0	0		03	50	50	100	3
5	OEC	22ECT705x	Open Elective Course		3	0	0		01	50	50	100	3
6	PROJ	22ECP706	Major Project Phase-II		0	0	12		03	100	100	200	6
										400	300	700	24

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Professional Elective Course 22ECT704x			
22ECT704A	**Wireless Sensor Networks**	**22ECT704C**	**Advanced VLSI**
22ECT704B	**5G Fundamentals and Architecture**	**22ECT704D**	**Soft Computing Techniques**
Open Elective Course 22ECT705x			
22ECT705A		**22ECT705C**	
22ECT705B		**22ECT705D**	

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2)Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of Engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they canopt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under theguidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK (21XXP75): The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.

(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.

(iii) To impart flexibility and adaptability.

(iv) To inspire team working.

(v) To expand intellectual capacity, credibility, judgment and intuition.

(vi) To adhere to punctuality, setting and meeting deadlines. To install responsibilities to oneself and others.

(vii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 batch)

VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	22ECT801x	Professional Elective (Online Courses)		3	0	0		-	-	-	-	3
2	OEC	22ECT802x	Open Elective (Online Courses)		3	0	0		-	-	-	-	3
3	INT	22ECI803	Internship (Industry/Research) (14 - 20 Weeks)		0	0	12		03	100	100	200	10
										200	200	400	16

L: Lecture, **T**: Tutorial, **P**: Practical S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship.

Professional Elective Course (Online courses) 22ECT801x			
22ECT801A		22ECT801C	
22ECT801B		22ECT801D	
Open Elective Courses (Online Courses) 22ECT802x			
22ECT802A		22ECT802C	
22ECT802B		22ECT802D	

Note: VII and VIII semesters of IV years of the program Swapping Facility

- Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester**.**
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 Weeks. The internship shall be considered as a head of passing and shall be considered for the award of a Degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their Degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize,appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

- With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their home town (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.
  University/Institute shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization

Dr. Ambedkar Institute of Technology, Bengaluru-560056

Outcome Based Education(OBE) and Choice Based Credit System (CBCS) (As per NEP2020)

(Applicable to 2021 batch)

Scheme of Teaching and Examination for I /II Semester B.E., (Common to all B.E. Programmes) Academic Year:2022-23

Physics Cycle : I/II Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	BS	21MAT101	Calculus and Linear Algebra	Mathematics	3	2	0	0	5	3	50	50	100	4
		21MAT201	Advanced Calculus and Numerical methods											
2	BS	21PHT102/ 21PHT202	Engineering Physics	Physics	3	0	0	0	3	3	50	50	100	3
3	ES	21EET103/ 21EET203	Basic Electrical Engineering	Electrical	2	2	0	0	4	3	50	50	100	3
4	ES	21CVT104/ 21CVT204	Elements of Civil Engineering & Mechanics	Civil	3	0	0	0	3	3	50	50	100	3
5	ES	21MED105/ 21MED205	Computer aided Engineering Drawing	Mechanical	2	0	2	0	4	3	50	50	100	3
6	BS	21PHL106/ 21PHL206	Engineering Physics Lab	Physics	0	0	2	0	2	3	50	50	100	1
7	ES	21EEL107/ 21EEL207	Basic Electrical lab	Electrical	0	0	2	0	2	3	50	50	100	1
8	HS	21HST108	Communicative English	Humanities	1	0	1*	0	2	2	50	50	100	1
		21HST208	Professional writing skills in English											
9	AE	21HST109	Health and Wellness	Humanities	1	0	1*	0	2	2	50	50	100	1
		21CVT209	Rural Development	Civil										
10	MC	21HSN110	Career Development skill-I	Humanities	1	0	1*	0	2	--	50	-	PP/NP	0
		21HSN210	Career Development skill-II											
									Total	29		500	450	900	20

Note: BS: Basic Science Course, ES: Engineering Science Course, HS: Humanities & Social Science Course,
AE: Ability Enhancement Course, MC: Mandatory Course, * No practical evaluation,
L: Lecture, T:Titorial, P:Practical/drawing, S:Self study, CIE: Continuous Internal Evaluation, SEE: Semester End Examination

Dr. Ambedkar Institute of Technology, Bengaluru-560056

Outcome Based Education(OBE) and Choice Based Credit System (CBCS) (As per NEP2020)

Scheme of Teaching and Examination for I /II Semester B.E., (Common to all B.E. Programmes) Academic Year:2022-23

Chemistry Cycle: I/II Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	BS	21MAT101 / 21MAT201	Calculus and Linear Algebra / Advanced Calculus and Numerical methods	Mathematics	3	2	0	0	5	3	50	50	100	4
2	BS	21CHT102/ 21CHT202	Engineering Chemistry	Chemistry	3	0	0	0	3	3	50	50	100	3
3	ES	21CST103/ 21CST203	Problem solving through Programming	Computer Science	2	2	0	0	4	3	50	50	100	3
4	ES	21ECT104/ 21ECT204	Basic Electronics and Communication Engineering	Electronics	3	0	0	0	3	3	50	50	100	3
5	ES	21MET105/ 21MET205	Elements of Mechanical Engineering	Mechanical	2	2	0	0	4	3	50	50	100	3
6	BS	21CHL106/ 21CHL206	Engineering Chemistry Laboratory	Chemistry	0	0	2	0	2	3	50	50	100	1
7	ES	21CSL107/ 21CSL207	Computer Programming Laboratory	Computer Science	0	0	2	0	2	3	50	50	100	1
8	HS	21HST108 / 21HST208	Communicative English / Professional writing skills in English	Humanities	1	0	1*	0	2	2	50	50	100	1
9	AE	21CVT109 / 21HST209	Rural Development / Health and Wellness	Civil / Humanities	1	0	1*	0	2	2	50	50	100	1
10	MC	21HSN110 / 21HSN210	Career Development skill-I / Career Development skill-II	Humanities	1	0	1*	0	2	----	50	--	PP/NP	0
								Total	30		500	450	900	20

Note: BS: Basic Science Course, ES: Engineering Science Course, HS: Humanities & Social Science Course, AE: Ability Enhancement Course, MC: Mandatory Course, * No practical evaluation,
L: Lecture, T:Titorial, P:Practical/drawing, S:Self study, CIE: Continuous Internal Evaluation, SEE: Semester End Examination

Note –At the end of the second-semester summer internship shall be carried out – based on inter/intra institutional activities credited in the third semester. University /Institutions may swap few courses between a FIRST and SECOND semester to balance the workload teaching and laboratory schedule

Summer Internship - I: All the students admitted shall have to undergo a mandatory summer internship of 03 weeks during the vacation of II semesters. Summer Internship shall include Inter / Intra Institutional activities. Internship A University Viva-voce examination shall be conducted during III semesters and the prescribed credit shall be included in III semesters. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

Dr. Ambedkar Institute of Technology, Bengaluru-560056

Outcome Based Education(OBE) and Choice Based Credit System (CBCS) (As per NEP2020)

B.E. Electronics & Communication Engineering

Scheme of Teaching and Examination effective from the Academic Year 2022-23

(Applicable to 2021 batch)

III Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	BSC	21MAT301	Transform Calculus, Fourier Series and Numerical Techniques	Mathematics	2	2	0	0		03	50	50	100	3
2	IPCC	21ECT302	Digital System Design Using Verilog	ECE	3	0	2			03	50	50	100	4
3	IPCC	21ECT303	Basic Signal Processing	ECE	3	0	2			03	50	50	100	4
4	PCC	21ECT304	Analog Electronic Circuits	ECE	3	0	0	1		03	50	50	100	3
5	PCC	21ECL305	Analog & Digital Electronics Lab	ECE	0	0	2			03	50	50	100	1
6	UHV	21HST306	Social Connect and Responsibility		0	0	1			01	50	50	100	1
7	HSSC	21HST307	Samskrutika Kannada		1	0	0			01	50	50	100	1
		21HST307	Balake Kannada											
		OR												
		21HST308	Constitution of India and Professional Ethics											
8	AEC	21ECT309X	Ability Enhancement Course - III							01	50	50	100	1
9	HSSC	21HSN310	Professional Skills		1	0	0	1		02	50	----	PP/NP	0
Total											400	400	800	18
10	Scheduled activities from III to VIII semesters	21HSHS803	National Service Scheme (NSS)	NSS	All students have to register for any one of the course namely National Service Scheme, Physical Education (PE)(Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of III semester. The activities shall be carried out between III semester to VIII semester (for 5 semesters). SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE and Yoga activities.									
		21HSN803	Physical Education (PE) (Sport and activities)	PE										
		21HSN803	Yoga	Yoga										

Course Prescribed to Lateral Entry Diploma Holders Admitted to III Semester B.E. Program

11		**21MAN311**	**Additional Mathematics-I**	**Maths**	**1**	**0**	**0**	**1**		**02**	**50**	**----**	**PP/NP**	**0**

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course. **L** –Lecture, **T** – Tutorial, **P**- Practical/ Drawing, **S** – Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD** Teaching Department, **PSB:** Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 **Balake Kannada** is for non-Kannada speaking, reading, and writing students

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2021-22 may be referred.

21INT49Inter/Intra Institutional Internship: All the students admitted to engineering programs under the lateral entry category shall have to undergo a mandatory 21INT49 Inter/Intra Institutional Internship of 03 weeks during the intervening period of III and IV semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the IV semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequently after satisfying the internship requirements. The faculty coordinator or mentor shall monitor the students' internship progress and interact with them for the successful completion of the internship.

Non–credit mandatory courses (NCMC):

(A) Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) Placement Training: These courses are prescribed for I to IV semesters respectively to the students of BE programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an **NP (not pass)** grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.			
Ability Enhancement Course - III			
21ECL3091	LD Lab using Pspice / MultiSIM	**21ECL3093**	LIC Lab using Pspice / MultiSIM
21ECL3092	AEC Lab using Pspice / MultiSIM	**21ECL3094**	LabVIEW Programming Basics

Dr. Ambedkar Institute of Technology, Bengaluru-560056

Outcome Based Education(OBE) and Choice Based Credit System (CBCS) (As per NEP2020)

B.E. Electronics & Communication Engineering

Scheme of Teaching and Examination effective from the Academic Year 2022-23

(Applicable to 2021 batch)

IV Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	BSC	21MAT401	Maths for Communication Engineers	Mathematics						03	50	50	100	3
2	IPCC	21ECT402	Digital Signal Processing	ECE	3	0	2			03	50	50	100	4
3	IPCC	21ECT403	Circuit analysis and control systems	ECE	3	0	2			03	50	50	100	4
4	PCC	21ECT404	Communication Theory	ECE	3	0	0	1		03	50	50	100	3
5	PCC	21ECL405	Communication Laboratory I	ECE	0	0	2			03	50	50	100	1
6	AEC	21ECT406	Biology For Engineers		0	0	1			02	50	50	100	2
7	HSSC	21HST407	Samskrutika Kannada		1	0	0			01	50	50	100	1
		21HST407	Balake Kannada											
		OR												
		21HST408	Constitution of India and Professional Ethics											
8	AEC	21ECT409X	Ability Enhancement Course - IV							01	50	50	100	1
9	HSSC	21HSN410	Professional Skills	HSS	1	0	1	0		02	50	----	PP/NP	0
10	UHV	21HSN412	Universal Human Values	Any Department	1	0	0	1		01	50	50	100	1
11	INT	21ECI413	Inter/Intra Institutional Internship	Evaluation By the appropriate authorities	Completed during the intervening period ofII and III semesters by students admitted to first year of BE./B.Tech and during the intervening period of III and IV semesters by Lateral entry students admitted to III semester.					03	100		100	2
									Total		550	450	1000	22
Course Prescribed to Lateral Entry Diploma Holders Admitted to III Semester B.E. Program														
12		21MAN411	Additional Mathematics-II	Maths	1	0	0	1		02	50	----	PP/NP	0

Note: BSC: Basic Science Course, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course, **INT** –Internship, **HSMC:** Humanity and Social Science & Management Courses, **AEC**–Ability Enhancement Courses. **UHV:** Universal Human Value Course. **L** –Lecture, **T** – Tutorial, **P**- Practical/ Drawing, **S** – Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.**TD** Teaching Department, **PSB:** Paper Setting department

21KSK37/47 Samskrutika Kannada is for students who speak, read and write Kannada and 21KBK37/47 **Balake Kannada** is for non-Kannada speaking, reading, and writing students

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2021-22 may be referred.

Non–credit mandatory courses (NCMC):

(A) Additional Mathematics I and II:

(1) These courses are prescribed for III and IV semesters respectively to lateral entry Diploma holders admitted to III semester of B.E./B.Tech., programs. They shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the Continuous Internal Evaluation (CIE). In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks. These courses are slated for CIE only and have no SEE.

(2) Additional Mathematics I and II shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

(3) Successful completion of the courses Additional Mathematics I and II shall be indicated as satisfactory in the grade card. Non-completion of the courses Additional Mathematics I and II shall be indicated as Unsatisfactory.

(B) National Service Scheme/Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequent semester/s to earn the qualifying CIE marks.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Internship of 04 weeks during the intervening period of IV and V semesters; 21INT68Innovation/ Entrepreneurship/ Societal based Internship.

(1) All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the VI semester grade card.The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be considered under F (fail) grade and shall have to complete during subsequently after satisfying the internship requirements.

(2) Innovation/ Entrepreneurship Internship shall be carried out at industry, State and Central Government /Non-government organizations (NGOs), micro, small and medium enterprise (MSME), Innovation centres or Incubation centres. Innovation need not be a single major breakthrough; it can also be a series of small or incremental changes. Innovation of any kind can also happen outside of the business world. Entrepreneurship internships offers a chance to gain hands on experience in the world of entrepreneurship and helps to learn what it takes to run a

small entrepreneurial business by performing intern duties with an established company. This experience can then be applied to future business endeavours. Start-ups and small companies are a preferred place to learn the business tack ticks for future entrepreneurs as learning how a small business operates will serve the intern well when he/she manages his/her own company. Entrepreneurship acts as a catalyst to open the minds to creativity and innovation. Entrepreneurship internship can be from several sectors, including technology, small and medium-sized, and the service sector.

(3) Societal or social internship. Urbanization is increasing on a global scale; and yet, half the world's population still resides in rural areas and is devoid of many things that urban population enjoy. Rural internship is a work-based activity in which students will have a chance to solve/reduce the problems of the rural place for better living. As proposed under the AICTE rural internship programme, activities under Societal or social internship, particularly in rural areas, shall be considered for 40 points under AICTE activity point programme.

Ability Enhancement Course – IV			
21ECL4091	Embedded C Basics	**21ECL4093**	Octave / Scilab for signals
21ECL4092	C++ Basics	**21ECL4094**	DAQ using LabVIEW

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B.E. Electronics & Communication Engineering

Tentative Scheme of Teaching and Examination effective from the Academic Year 2022-23

(Applicable to 2021 batch)

V Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	PCC	21ECT501	Digital Communication	ECE	3	0	0			3	50	50	100	3
2	IPCC	21ECT502	Microprocessor & Microcontrollers	ECE	3	0	2		3	3	50	50	100	4
3	PCC	21ECT503	Computer Communication Networks	ECE	3	0	0		3	3	50	50	100	3
4	PCC	21ECT504	Microwave Theory & Antennas	ECE	3	0	0		3	3	50	50	100	3
5	PCC	21ECL505	Communication Lab II	ECE	0	0	2		3	3	50	50	100	1
6	AEC	21ECT506	Research Methodology & Intellectual Property Rights	Any Department	2	0	0		2	2	50	50	100	2
7	HSSC	21CV507	Environmental Studies	Civil/Chemistry	1	0	0			1	50	50	100	1
8	AEC	21ECT508	Ability Enhancement Course-V	ECE						1/2	50	50	100	1
9	HSSC	21HSN509	Aptitude and Verbal ability skills		1	0	1	0		2	50	--	PP/NP	0
										Total	450	400	800	18

Ability Enhancement Course - V

21ECL5081	Computer Communication Networks Lab	**21ECL5083**	Antenna Design & Testing
21ECL5082	Communication Simulink Toolbox	**21ECL5084**	Microwaves toolbox

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B.E. Electronics & Communication Engineering

Tentative Scheme of Teaching and Examination effective from the Academic Year 2022-23

(Applicable to 2021 batch)

VI Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	HSSC	21ECT601	Technological Innovation Management and Entrepreneurship								50	50	100	03
2	IPPC	21ECT602	Computer Organization & ARM Microcontrollers	ECE	2	2			4	3	50	50	100	04
3	PCC	21ECT603	VLSI Design & Testing	ECE	3				3	3	50	50	100	03
4	PEC	21ECE604X	Professional Elective -I	ECE	3				3	3	50	50	100	03
5	OEC	21ECE605X	OpenElective-I	ECE	3				3	3	50	50	100	03
6	PCC	21ECL606	VLSI Laboratory	ECE			2		2		50	50	100	01
7	MP	21ECM607	Mini Project	ECE			2		2		50	50	100	03
8	INT	21ECI608	Innovation/Entrepreneurship /Societal Internship								50	50	100	03
9	HSSC	21HSN609	Analytical & Reasoning skills	Placement Cells	2	0	0-		02	--	50	--	PP/NP	00
								Total			500	450	900	22

Research/Industrial Internship - At the End of the sixth / Seventh semester (in two cycles to accommodate all the students of the University) Research/Industrial Internship shall be carried out – Based on industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo a mandatory internship of 24 weeks during the vacation of VI/VII semesters. A University Viva-Voce examination shall be conducted during VII/VIII semester and the prescribed credit shall be included in VII/VIII semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. Research internship Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give you the flavour of current research going on on a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Industry internships: This is an extended period of work experience undertaken by university/Institute students looking to supplement their degree with professional development. The students are allowed to prepare themselves for the workplace and develop practical skills as well as academic ones. It also helps them learn to overcome

unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with "unexpected contingencies" helps students recognize, appreciate, and adapt to organization realities by tempering knowledge with practical constraints.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or a group having not more than 4 students. (or Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications) CIE procedure for
Mini-project: (i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. SEE for Mini-project: (i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester-end examination (SEE) conducted at the department. (ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester-end examination (SEE) conducted separately at the departments to which the student/s belongs
Open Elective Courses: Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives). Selection of an open elective shall not be allowed if, • The candidate has studied the same course during the previous semesters of the program. • The syllabus content of open electives is similar to that of the Departmental core courses or professional electives. • A similar course, under any category, is prescribed in the higher semesters of the program. • Registration to electives shall be documented under the guidance of the Programme Coordinator/ Advisor/Mentor

Professional Elective Courses-I		**Open Elective Courses-I**	
Subject Code	**Title**	**Subject Code**	**Title**
21ECE6041	Artificial Neural Networks (L:T:P :: 2:2:0)	**21ECE6051**	Communication Engineering (L:T:P :: 3:0:0)
21ECE6042	Cryptography (L:T:P :: 2:2:0)	**21ECE6052**	Microcontrollers (L:T:P :: 3:0:0)
21ECE6043	Python Programming (L:T:P :: 2:0:2)	**21ECE6053**	Basic VLSI Design (L:T:P :: 3:0:0)
21ECE6044	Micro Electro Mechanical Systems (L:T:P :: 3:0:0)	**21ECE6054**	Electronic Circuits with Verilog (L:T:P :: 2:0:2)
		21ECE6055	Sensors & Actuators (L:T:P :: 3:0:0)

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B.E. Electronics & Communication Engineering

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(Applicable to 2021 batch)

VII Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	PCC	21ECE701	Advanced VLSI	ECE	3	0	0		3	3	50	50	100	3
2	PCC	21ECE702	Optical & Wireless Communication	ECE	2	0	0		3	3	50	50	100	2
3	PEC	21ECE703X	Professional elective Course-II	ECE	3	0	0		3	3	50	50	100	3
4	PEC	21ECE704X	Professional elective Course-III	ECE	3	0	0		3	3	50	50	100	3
5	OEC	21ECE705X	Open elective Course-II		3	0	0		3	3	50		100	3
6	Project	21ECP706	Project work	ECE						3	100	50	200	10
								Total			350	450	700	24

Professional Elective Courses-II		Professional Elective Courses-III		Open Elective Courses-II	
Subject Code	Title	Subject Code	Title	Subject Code	Title
21ECE7031	Advanced Design Tools for VLSI (L:T:P :: 2:0:2)	21ECE7041	IoT & Wireless Sensor Networks (L:T:P :: 3:0:0)	21ECE7051	Optical & Satellite Communication (L:T:P :: 3:0:0)
21ECE7032	Digital Image Processing (L:T:P :: 2:0:2)	21ECE7042	Network Security (L:T:P :: 3:0:0)	21ECE7052	ARM Embedded Systems (L:T:P :: 3:0:0)
21ECE7033	DSP Algorithms & Architecture (L:T:P :: 3:0:0)	21ECE7043	Fabrication technology (L:T:P :: 3:0:0)	21ECE7053	Basic Digital Image Processing (L:T:P :: 2:0:2)
21ECE7034	Biomedical Signal Processing (L:T:P :: 3:0:0)	21ECE7044	Machine Learning with Python (L:T:P :: 2:0:2)	21ECE7054	Basic Digital Signal Processing (L:T:P :: 2:0:2)
21ECE7035	Speech Signal Processing (L:T:P :: 3:0:0)	21ECE7045	Multimedia Communication (L:T:P :: 2:0:2)	21ECE7055	E-waste Management (L:T:P :: 3:0:0)

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VIII Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week				Examination				Credits
					L	T	P	S	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	Seminar	21ECS801	Technical Seminar		One contact hour /week for interaction between the faculty and students				--	100	---	100	01
2	Research Internship/ Industry Internship	21ECI802	Research/Industry Internship*		Two contact hours /week for interaction between the faculty and students.				3 (Batch wise)	100	100	200	15
3	NCMC	21EC803	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.				--	50	50	100	--
		21EC803	Physical Education (PE) (Sports & Athletics)	PE									
		21EC803	Yoga	Yoga									
									Total	250	150	400	16

Note: (1) University /Institutions may swap 7th and 8th Semester Course work to accommodate industry/research internship at the end of sixth semester /at the end of seventh semester to balance the workload. (2) Credits earned for the course prescribed will be accounted in 8th semester

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SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

I Semester (Physics Group)

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Board Paper Setting	Teaching Hours / Week			Examination				Credits
						Theory Lecture (L)	Tutorial (T)	Drawing / Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	BC	18MA11	Differential Equations & Complex Variables	MAT	Science	03	02	--	03	050	050	100	04
2	BC	18PH12	Engineering Physics	PHY	Science	03	02	--	03	050	050	100	04
3	ES	18EE13	Basic Electrical Engineering	EE	EE	02	02	--	03	050	050	100	03
4	ES	18CV14	Civil Engineering and Mechanics	EC/EI/TC	CIV	02	02	--	03	050	050	100	03
5	ES	18MEL15	Engineering Graphics and Design	ME,IEM	ME	02	--	02	03	050	050	100	03
6	BC	18PHL16	Engineering Physics Laboratory	PHY	Science	--	--	02	03	050	050	100	01
7	ES	18EEL17	Basic Electrical Engineering Laboratory	EE	EE	--	--	02	03	050	050	100	01
8	HS	18HS11/ 18HS12	English/Kannada	HS	HS	01	--	02	02	050	050	100	01
			Total			**13**	**08**	**08**	**23**	**400**	**400**	**800**	**20**

Note: BC: Basic Course, ES: Engineering Science. HS: Humanities, EE: Electrical & Electronics Engineering, ME: Mechanical Engineering, CS: Computer Science and Engineering, PHY: Physics, CIV: Civil Engineering

BOS Chairman Dean(Academics) Principal

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SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

II Semester(Chemistry Cycle)

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Board Paper Setting	Teaching Hours / Week			Examination				Credits
						Theory Lecture (L)	Tutorial (T)	Drawing/ Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	BC	18MA21	Calculus and Linear Algebra	MAT	Science	03	02	--	03	050	050	100	04
2	BC	18CH22	Engineering Chemistry	CHE	Science	03	02	--	03	050	050	100	04
3	ES	18CS23	Programming for Problem Solving	CS	CS	02	02	--	03	050	050	100	03
4	ES	18EC24	Basic Electronics	EC/EI/TC	ECE	02	02	--	03	050	050	100	03
5	ES	18ME25	Elements of Mechanical Engineering	ME,IEM	ME	02	02	--	03	050	050	100	03
6	BC	18CHL26	Engineering Chemistry Laboratory	CHE	Science	--	--	02	03	050	050	100	01
7	ES	18CSL27	Computer Programming Laboratory	CS	CS	--	--	02	03	050	050	100	01
8	HS	18HS21/ 18HS22	English/Kannada	HS	HS	01	--	02	02	050	050	100	01
			Total			**13**	**10**	**06**	**23**	**400**	**400**	**800**	**20**

Note: BC: Basic Course, ES: Engineering Science. HS: Humanities, ECE: Electronics and Communication Engineering, EI: Electronics and Instrumentation, TC: Telecommunication Engineering, ME: Mechanical Engineering, CS: Computer Science and Engineering, CHE: Chemistry, MAT: Mathematics

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B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

III Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing/ Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	BC	18MA31	Transforms & Applications	MAT	02	02	--	03	050	050	100	03
2	PC	18EC31	Electronics devices	EC	04	--	--	03	050	050	100	04
3	PC	18EC32	Digital System Design	EC	04	--	--	03	050	050	100	04
4	PC	18EC33	Network Theory	EC	04	--	--	03	050	050	100	04
5	PC	18EC34	Engineering Statistics	EC	03	--	--	03	050	050	100	03
6	PC	18EC35	Power Electronics & Instrumentation	EC	03	--	--	03	050	050	100	03
7	PC	18ECL36	Electronic Devices & Instrumentation Laboratory	EC	--	--	02	03	050	050	100	01
8	PC	18ECL37	Digital System Design Laboratory	EC	--	--	02	03	050	050	100	01
9	HS	18HS31/32	Constitution of India Professional Ethics and Cyber law /Environmental Studies	HS	01	--	--	02	050	050	100	01
10	MC	18HS33	Soft skills (MC)	HS	04	--	--	03	050	---	050	00
Total					**25**	**02**	**04**	**29**	**500**	**450**	**950**	**24**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

11.	MC	18MAD41	Advance Mathematics - I	MAT	02	02	--	03	50	--	--	00

a.) The mandatory non – credit courses Advance Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of BE programs shall compulsorily be registered during respective semesters to complete all the formalities of the course and appear for SEE examination.

b.) The mandatory non – credit courses Basic Engineering Mathematics I and II, prescribed to lateral entrant Diploma holders admitted to III and IV semester of BE programs, are to be completed to secure eligibility to VII semester. However, they are not considered for vertical progression from II year to III year of the programme but considered as head of passing along with credit courses of the programme to eligibility to VII semester.

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SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

IV Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing / Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1.	BC	18MA41	Probability, Numerical and Optimization Technique	MAT	02	02	--	03	050	050	100	03
2.	PC	18EC41	Analog Circuits	EC	04	--	--	03	050	050	100	04
3.	PC	18EC42	Principles of Communication Systems	EC	03	--	--	03	050	050	100	03
4.	PC	18EC43	Computer Organization and Architecture	EC	04	--	--	03	050	050	100	03
5.	PC	18EC44	Verilog HDL	EC	04	--	--	03	050	050	100	04
6.	PC	18EC45	Signals and Systems	EC	04	--	--	03	050	050	100	04
7.	PC	18ECL46	Analog Circuits and Communication Laboratory	EC	--	--	02	02	050	050	100	01
8.	PC	18ECL47	HDL Lab	EC	--	--	02	02	050	050	100	01
9.	CIV	18HS41/ 42	Constitution of India Professional Ethics and Cyber law/ Environmental Studies	HS/CIV	01	--	--	02	050	050	100	01
10.	MC	18HS43	Soft skills (NCMC)	HS	04	--	--	03	050	--	050	00
				Total	**26**	**02**	**04**	**27**	**500**	**450**	**950**	**24**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

11.	MC	18MAD41	Advance Mathematics - II	MAT	02	02	--	03	50	--	--	00

a.) The mandatory non – credit courses Advance Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of BE programs shall compulsorily be registered during respective semesters to complete all the formalities of the course and appear for SEE examination.

b.) The mandatory non – credit courses Basic Engineering Mathematics I and II, prescribed to lateral entrant Diploma holders admitted to III and IV semester of BE programs, are to be completed to secure eligibility to VII semester. However, they are not considered for vertical progression from II year to III year of the programme but considered as head of passing along with credit courses of the programme to eligibility to VII semester.

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SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

V Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week				Examination			Credits
					Theory Lecture (L)	Tutorial (T)	Drawing / Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PC	18HS51	IPR	HS	03	--	--	03	050	050	100	03
2	PC	18EC51	Electromagnetic Waves	EC	04	--	--	04	050	050	100	03
3	PC	18EC52	Digital Signal Processing	EC	04	--	--	04	050	050	100	04
4	PC	18EC53	Digital Communication	EC	04	--	--	04	050	050	100	04
5	PC	18EC54	Microprocessor and Microcontroller	EC	03	--	--	04	050	050	100	03
6	PE	18EC55X	Professional Elective-1	EC	03	--	--	03	050	050	100	03
7	OE	18EC56X	Open-Elective A		03	--	--	03	050	050	100	03
8	PC	18ECL57	Microcontroller Laboratory	EC	--	--	02	02	050	050	100	01
9	PC	18ECL58	Digital Signal Processing Laboratory	EC	--	--	02	02	050	050	900	01
				Total	**24**	**00**	**04**	**29**	**400**	**450**	**800**	**25**

18EC55x_Professional Elective – 1		
Sl. No.	**Course Code**	**Course Title**
1	18EC551	Digital Switching System
2	18EC552	Programming with Python
3	18EC553	Artificial Neural Networks
4	18EC554	Object Oriented Programming with C++
5	18EC555	Control Systems

Open Elective-A(OE-A)		
Sl. No.	**Course Code**	**Course Title**
1	18EC561	Real Time Operating System(CS,IS, EI, ML)
2	18EC562	Mechatronics (CS,IS, EI, ML, ME, IEM, EEE)
3	18EC563	Television Engineering (TE, EI, ML)
4	18EC564	Sensors (CS, IS, ML, TC)

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SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

VI Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing/ Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PC	18HS61	Management and Entrepreneurship	EC	03	--	--	03	050	050	100	03
2	PC	18EC61	CMOS VLSI Design	EC	04	--	--	03	050	050	100	04
3	PC	18EC62	Embedded Systems	EC	03	--	--	03	050	050	100	03
4	PC	18EC63	Computer Communication Network	EC	04	--	--	03	050	050	100	04
5	PC	18EC64x	Professional Elective – 2	EC	03	--	--	03	050	050	100	03
6	OE	18EC65x	Open Elective –B	EC	03	--	--	03	050	050	100	03
7	PC	18ECL66	Embedded Systems Laboratory	EC	--	--	02	02	050	050	100	01
8	PC	18ECL67	VLSI Laboratory	EC	--	--	02	02	050	050	100	01
9	M	18ECM68	Mini Project					03	050	050	100	02
10	INT	18ECI69	Industry Internship	To be carried out during the intervening vacations of VI an VII semesters				--	--	--	--	--
				Total	**20**	**00**	**04**	**27**	**450**	**450**	**900**	**24**

18EC65x_Professional Elective – 2 (PECEL 2)		
Sl. No.	**Course Code**	**Course Title**
1	18EC641	Semiconductor Fabrication
2	18EC642	Cryptography
3	18EC643	Information Theory & Coding
4	18EC644	System Verilog for verification
5	18EC645	Internet of Things

Open Elective-B(OE-B)		
Sl. No.	**Course Code**	**Course Title**
1	18EC651	Automotive Safety Measurements(ME,IEM,EE)
2	18EC652	Nano Electronics (CS,IS,ML,TC)
3	18EC653	Wireless Sensor Networks(EE,ML,EI)
4	18EC654	Robotics and Machine vision systems(ME,EI,EE,ML)

Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

VII Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing / Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	MC	18HS71	Cost Management of Engg Projects	HS	03	--	--	03	050	050	100	02
2	PC	18EC71	Wireless Communication	EC	04	--	--	03	050	050	100	04
3	PC	18EC72	Microwave and Antenna	EC	04	--	--	03	050	050	100	04
4	PE	18EC73X	Professional Elective-3	EC	03	--	--	03	050	050	100	03
5	PE	18EC74X	Professional Elective-4	EC	03	--	--	03	050	050	100	03
6	OE	18EC75X	Open Elective-C	EC	03	--	--	03	050	050	100	03
7	PC	18ECL76	Advance Communication Lab	EC	--	--	02	02	050	050	100	01
8	PC	18ECL77	Computer Communication Network Lab	EC	--	--	02	02	050	050	100	01
9	Project	18ECP78	Project work phase-1	EC	--	--	02	02	050	050	100	02
10	INT	18ECI79	Internship	--	--	--	--	---	---	---	--	--
			Total		**20**	**--**	**06**	**24**	**400**	**400**	**800**	**23**

Internship: All the students admitted to III year of BE have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters. A University examination will be conducted during VIII semester and prescribed credit are added to VIII semester. Internship is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the internship will be declared as failed and have to complete during subsequent University examination after satisfy the internship requirements

Note: : PC: Professional Core. PE: Professional Elective, OE: Open Elective. MC: Mandatory Course, PRJ: Project work, INT: Internship

Select **ANY ONE** of the Professional Elective. Open Elective-A: Students can select any one of the open electives (Please refer to consolidated list of Dr AIT for open electives) offered by any Department

Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

Professional Elective-3(PE-3)		
Sl. No.	**Course Code**	**Course Title**
1	18EC731	5G Technology
2	18EC732	Virtual Reality
3	18EC733	Real Time Operating systems
4	18EC734	DSP Algorithm and architecture
5	18EC735	Network and Cyber Security
6	18EC736	Optical Fibre Communication

Professional Elective-4(PE-4)		
Sl. No.	**Course Code**	**Course Title**
1	18EC741	Analog and Mixed Mode VLSI
2	18EC742	Operating systems
3	18EC743	Satellite Communication
4	18EC744	Real Time Embedded Systems
5	18EC745	Operations Research
6	18EC746	Adaptive Signal Processing

Open Elective-C (OE-C)		
Sl. No	**Course Code**	**Course Title**
1	18EC751	Internet of Things (CS, IS, EI, TE, ML, ME, IEM, EEE, CV)
2	18EC752	Cryptography (CS, IS, ML,TE, EI,EEE)
3	18EC753	Mobile Communication (EI, EE, ML)
4	18EC754	Bio Mechatronics (CS, IS, EI, TE, ML, ME, IEM, EEE, CV)
5	18EC755	Introduction to Unmanned Aerial Vehicle (UAV) (CS,IS, EI, TE,ML, ME, IEM, EEE,CV)

Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

VIII Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing/ Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	MC	18HS81	Occupational and Safety and Health administration	CV	03	--	--	03	050	050	100	02
2	Project	18ECP81	Project Work Phase-2	EC	--	--	03	03	050	050	100	10
3	Seminar	18ECS82	Technical Seminar	EC	--	--	03	03	050	050	100	01
4	INT	18ECI83	Internship	EC	--	--	03	03	050	050	100	02
Total					**03**	**--**	**09**	**12**	**250**	**250**	**500**	**15**

Internship: Those, who have not pursued /completed the internship will be declared as failed and have to complete during subsequent SEE examination after they satisfy the internship requirements.

Note: : PC: Professional Core. PE: Professional Elective, OE: Open Elective. MC: Mandatory Course, PRJ: Project work, INT: Internship

Select **ANY ONE** of the Professional Elective and Open Elective subject

Students can select any one of the open electives (Please refer to consolidated list of Dr. AIT open electives) offered by any Department.
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives. Registration to electives shall be documented under the guidance of Programme Coordinator/ Mentor.

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

BDA Outer Ring Road, Mallathalli,Bengaluru-56

Board Of Studies 2023-24

Approved
Scheme and Syllabus of
I & II Semester
For
2023 Batch

Submitted by

Department of Electronics and Communication Engineering

To

DEAN (Academic)

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2022 Scheme for ECE/EI/ET

(Applicable to 2023 batch)

Chemistry Cycle **SEMESTER: I**

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SDA	Total	Duration(Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	22MAU101D	Mathematics- I	Maths	2	2	2	0	4+2	03	50	50	100	04
2	ASC(IC)	22CHU102B	Applied Chemistry	Chemistry	3	0	2	0	3+2	03	50	50	100	04
3	ESC	22MED103	Computer Aided Engineering Drawing	Civil/Mech.	2	2	0	0	3	03	50	50	100	03
4	ESC-1	22ESX104x	Engineering Science Course-I	Respective Engg. dept	3	0	0	0	3	03	50	50	100	03
5	ETC-1	22ETT105x	Programming Language Course - I	Any Engg. Dept	3	0	0	0	3	03	50	50	100	03
6	AEC	22ENT106	Communicative English	Humanities	1	0	0	0	1	02	50	50	100	01
7	HSS	22CIT1O7	Constitution of India	Humanities	1	0	0	0	1	02	50	50	100	01
8	HSS	22SFH108	Scientific Foundation of Health	Any dept.	1	0	0	0	1	02	50	50	100	01
9	MC	22CDN109	Career Development skill-I	Placement cell	2	0	0	0	2	-	50	---	---	NP/ PP
									Total	**25**		**450**	**400**	**800**	**20**

D/PSB- Teaching Department / Paper Setting Board, **SS**-Self Study, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSS**-Humanity and Social Science Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit**	04- Credits courses are to be designed for 50 hours of Teaching-Learning Session 04- Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03- Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01- Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to B.E. day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers **#-**
22CHU102B SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
ESC or ETC, of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
All 01 Credit- courses shall have the SEE **of 02 hours duration and the pattern of the question paper shall be MCQ**

(ESC-I) Engineering Science Courses-I					(ETC-I) Emerging Technology Courses-I				
Code 22ESX104x	**Title**	**L**	**T**	**P**	**Code 22ETT105x**	**Title**	**L**	**T**	**P**
22EST104A	Introduction to Civil Engineering	3	0	0	22ETT1051	Introduction to Cyber Security	3	0	0
22EST104B	Introduction to Electrical Engineering	3	0	0	22ETT1052	Introduction to Internet of Things (IOT)	3	0	0
22EST104C	Introduction to Electronics Engineering	3	0	0	22ETT1053	Renewable Energy Sources	3	0	0
22EST104D	Introduction to Mechanical Engineering	3	0	0	22ETT1054	Waste Management	3	0	0
22ESU104E	Introduction to C Programming	2	0	2	22ETT1055	Green Buildings	3	0	0
					22ETT1056	Smart Materials and Systems	3	0	0
					22ETT1057	Introduction to Nano Technology	3	0	0
					22ETT1058	Introduction to Sustainable Engineering	3	0	0
					22ETT1059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					**Applied Science Course(ASC)**				
Code 22PLU105x	**Title**	**L**	**T**	**P**	**Code**	**Title**			
22PLU105A	Introduction to Web Programming	2	0	2	**22MAU101D**	Mathematics – I for EE stream			
22PLU105B	Introduction to Python Programming	2	0	2	**22CHU102B**	Applied Chemistry for EE stream			
22PLU105C	Basics of JAVA programming	2	0	2					
22PLU105D	Introduction to C++ Programming	2	0	2					
The course 22ESU104E: Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-I group.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-I group except, **22ESU104C - Introduction to Electronics Engineering**
- The students must opt for the courses from ESC group without repeating the course either 1st or 2nd semester
- The students must select one course from either ETC-I or PLC-I group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Scheme of Teaching and Examination for I/II Semester B.E. CBCS 2022, Academic Year-2023-24
2022 Scheme: ECE/EI/ET
(Applicable to 2023 batch)

Physics Cycle **SEMESTER : II**

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours/Week					Examination				Credits
					L	T	P	SDA	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	ASC(IC)	22MAU201D	Mathematics	Maths	2	2	2	0	4+2	3	50	50	100	4
2	ASC(IC)	22PHU202D	Applied Physics	Physics	3	0	2	0	3+2	3	50	50	100	4
3	ESC	22ECT203	Basic Electronics	EEE	3	0	0	0	3	3	50	50	100	3
4	ESC-II	22ESX204x	Engineering Science Course-II	Respective Enggdept	3	0	0	0	3	3	50	50	100	3
5	ETC-II	22ETT205X	Emerging Technology Course - II	Any Engg. Dept	2	0	2	0	4	3	50	50	100	3
6	AEC	22ENT206	Professional writing skill	Humanities	1	0	0	0	1	2	50	50	100	1
7	HSS	22SKT207/ 22BKT207	Samskrutika/ Balake Kannada	Humanities	1	0	0	0	1	2	50	50	100	1
8	HSS	22IDT208	Innovation and Design Thinking	Humanities	1	0	0	0	1	2	50	50	100	1
9	MC	22CDN209	Career Development skill-II	Humanities	2	0	0	0	2	-	50	---	---	NP/ PP
								Total	**26**		**450**	**400**	**800**	**20**

TD/PSB- Teaching Department / Paper Setting Board, **SS**-Self Study, **ASC**-Applied Science Course, **ESC**- Engineering Science Courses, **ETC**- Emerging Technology Course, **AEC**- Ability Enhancement Course, **HSS**-Humanity and Social Science Course, **CIE** –Continuous Internal Evaluation, **SEE**- Semester End Examination, **IC** – Integrated Course (Theory Course Integrated with Practical Course)

Credit Definition: 1-hour Lecture **(L)** per week=**1Credit** 2-hoursTutorial**(T)** per week=**1Credit** 2-hours Practical / Drawing (**P**) per week=**1Credit**	04- Credits courses are to be designed for 50 hours of Teaching-Learning Session 04- Credits (IC) are to be designed for 40 hours' theory and 12-14 hours of practical sessions 03- Credits courses are to be designed for 40 hours of Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 02- Credit courses are to be designed for 12-15 hours of Teaching-Learning sessions

Student's Induction Program: Motivating (Inspiring) Activities under the Induction program – The main aim of the induction program is to provide newly admitted students a broad understanding of society, relationships, and values. Along with the knowledge and skill of his/her study, students' character needs to be nurtured as an essential quality by which he/she would understand and fulfill the responsibility as an engineer. The following activities are to be covered in 21 days. Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to Local areas, Familiarization with Department/Branch and Innovation, etc. For details, refer the ANNEXUREI of Induction Programs notification of the University published at the beginning of the 1st semester.

AICTE Activity Points to be earned by students admitted to B.E. day college program (For more details refer to Chapter 6, AICTE Activity Point Program, Model Internship Guidelines): Over and above the academic grades, every regular student admitted to the 4 years Degree program and every student entering 4 years Degree programs through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Program. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, any time during the semester weekends, and holidays, as per the liking and convenience of the student from the year of entry to the program. However, the minimum hour's requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth Semester Grade Card shall be issued only after earning the required activity points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

22MAU101D Shall have the 03 hours of theory examination(SEE), however, practical sessions question shall be included in the theory question papers

#- 22PHU202D SEE shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.

ESC or ETC, of 03 credits Courses shall have only a theory component (L:T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L:T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.

All 01 Credit- courses shall have the SEE **of 02 hours duration and the pattern of the question paper shall be MCQ**

(ESC-II) Engineering Science Courses-II					(ETC-II) Emerging Technology Courses-II				
Code 22ESX104x	**Title**	**L**	**T**	**P**	**Code 22ETT105x**	**Title**	**L**	**T**	**P**
22EST204A	Introduction to Civil Engineering	3	0	0	22ETT2051	Introduction to Cyber Security	3	0	0
22EST204B	Introduction to Electrical Engineering	3	0	0	22ETT2052	Introduction to Internet of Things (IOT)	3	0	0
22EST204C	Introduction to Electronics Engineering	3	0	0	22ETT2053	Renewable Energy Sources	3	0	0
22EST204D	Introduction to Mechanical Engineering	3	0	0	22ETT2054	Waste Management	3	0	0
22ESU204E	Introduction to C Programming	2	0	2	22ETT2055	Green Buildings	3	0	0
					22ETT2056	Smart Materials and Systems	3	0	0
					22ETT2057	Introduction to Nano Technology	3	0	0
					22ETT2058	Introduction to Sustainable Engineering	3	0	0
					22ETT2059	Introduction to Embedded System	3	0	0
(PLC-I) Programming Language Courses-I					**Applied Science Course(ASC)**				
Code 22PLU105x	**Title**	**L**	**T**	**P**	**Code**	**Title**			
22PLU205A	Introduction to Web Programming	2	0	2	**22MAU201D**	Mathematics – I for EE/EC/EI/ET			
22PLU205B	Introduction to Python Programming	2	0	2	**22PHU202D**	Applied Physics for EE/EC/EI/ET			
22PLU205C	Basics of JAVA programming	2	0	2					
22PLU205D	Introduction to C++ Programming	2	0	2					
The course 22ESU104E: Introduction to C Programming, and all courses under PLC and ETC groups can be taught by faculty of ANY DEPARTMENT									

- The student has to select one course from the ESC-II group.
- ME/AE/IEM stream Engineering Students shall opt for any one of the courses from the ESC-II group except, **22ESU204C - Introduction to Electronics Engineering**
- The students have to opt for the courses from ESC group without repeating the course either 1st or 2nd semester
- The students must select one course from either ETC-II or PLC-II group.
- If students study the subject from ETC-I in 1st semester he/she has to select the course from PLC-II in the 2nd semester and vice-versa.

Assessment and Evaluation method

Chemistry Cycle:

- **22MAU101D/22MAU201D Shall** have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers
- **22CHU102D/22CHU202D SEE** shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
- **ESC or ETC, of 03 credits Courses** shall have only a theory component (L: T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L: T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
- **All 01 Credit** courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ
- **Integrated courses** will have 50 marks CIE and 50 Marks SEE.
- **Non-integrated courses** have 50 marks CIE (including 5 marks Assignment and 5 marks Group Activity) and 50 Marks SEE.

Physics Cycle:

- **22MAU101D/22MAU201D Shall** have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers
- **22PHU102D/22PHU202D SEE** shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
- **ESC or ETC, of 03 credits Courses** shall have only a theory component (L: T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L: T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
- **All 01 Credit-** courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ
- **Integrated courses** will have 50 marks CIE and 50 Marks SEE.
- **Non-integrated courses** have 50 marks CIE (including 5 marks Assignment and 5 marks Group Activity) and 50 Marks SEE.

I/II Semester

BASIC ELECTRONICS			
Course Code:	22ECT103/203	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1.Operation of Semiconductor diode, Zener diode and Special purpose diodes and their applications.
2. Biasing circuits for transistor (BJT) as an amplifier.
3. Study of linear Op-amps and its applications.
4. Logic circuits and their optimization.
5. Principle of basic communication system.

Module-1	**08 Hrs**

Semiconductor Diodes: Introduction, PN Junction diode, Characteristics and Parameters- Forward and Reverse Characteristics, Diode Parameters, Diode Approximations-Ideal Diodes and Practical Diodes, Piecewise Linear Characteristics, DC Equivalent Circuits, DC Load Linear analysis-DC load line- Q-Point, Calculating Load Resistance and Supply Voltage (Text 1)

Diode Applications: Introduction, Half-Wave Rectification-Positive Half-Wave Rectifier, Negative Halfwave Rectifier, Full-Wave Rectification-Two-Diode Full-Wave Rectifier, Bridge Rectifier. Rectifier circuit with RC and LC Filters. (Text 1) (Simple Numerical Examples excluding Derivations)

Zener Diodes: Zener diode Characteristics and Parameters, Equivalent Circuit, Zener Diode Voltage Regulators, Regulator Circuit with No Load, Loaded Regulator, Regulator Performance (Text 1)
(Simple Numerical Examples excluding Derivations)

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-2	**08 Hrs**

Bipolar Junction Transistors: Introduction, BJT Operation- PNP and NPN Transistors and Operation, Bipolar Devices, BJT Voltages and Currents, Terminal Voltages, Transistor Currents.

BJT Amplification-Current Amplification, Voltage Amplification. Common Base, Common-Emitter and Common Collector Characteristics- Circuit, Input and output characteristics, Current Gain Characteristics. (Text 1)

Field Effect Transistor: Junction Field Effect Transistor - n-channel and p-channel FET, JFET Characteristics-Depletion regions, Drain Characteristics, Transfer Characteristics, MOSFETs Enhancement and Depletion MOSFETs (Text 1)

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-3	**08 Hrs**

Signal Generators: BJT Phase Shift Oscillator, BJT Colpitts Oscillator, BJT Hartley Oscillator. (Text 1)

Operational Amplifiers: Introduction, The Operational Amplifier, Block Diagram Representation of Typical Op-Amp, Schematic Symbol. (Text 2)

Op-Amp Parameters-Gain, input resistance, Output resistance, CMRR, slew rate, Bandwidth, input offset voltage, input bias Current and Input Offset Current, The Ideal Op-Amp, Equivalent Circuit of Op-Amp, Open Loop Op-Amp configurations- Inverting Amplifiers, Non-Inverting Amplifiers, Differential

Amplifiers. (Text 2)	
Teaching Learning Method: **RBT Level:**	Chalk and Talk, power point presentation, animations, videos L1, L2
Module-4	**08 Hrs**
Boolean Algebra and Logic Circuits: Binary Systems – Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Complements, Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates (Text 3) **Combinational logic:** Introduction, Design procedure, Adder, Subtractor (Text 3)	
Teaching Learning Method: **RBT Level:**	Chalk and Talk, power point presentation, animations, videos L1, L2
Module-5	**08 Hrs**
Synchronous Sequential Logic: Introduction, Flip-flops (SR, D, JK, T): working and Truth Table, Counters (JK) and Memory Unit Introduction, Registers, Shift registers (SISO), MOD-4 Ripple Counters. (Text 3) **Communications:** Introduction to communication, Block Diagram of Communication System, Modulation-Description, Need for modulation, Amplitude Modulation – Amplitude Modulation theory, Representation of AM, Frequency Modulation - Theory of Frequency and Phase Modulation. (Text 4)	
Teaching Learning Method: **RBT Level:**	Chalk and Talk, power point presentation, animations, videos L1, L2
Course outcomes: **At the end of the course the student will be able to:** **CO1.** Summarize the operation, characteristics of diodes, diode application, zener diode Characteristics and its applications. **CO2.** Explain the operation of BJT and JFET with their characteristics and applications. **CO3.** Interpret oscillators and operational amplifiers. **CO4.** Analyze and simplify digital circuits or digital gates. **CO5.** Illustrate the concepts of various sequential logic circuits and their working principles; explain the different modulation schemes.	
Suggested Learning Resources: **Text Books:** **1:** Electronic Devices and Circuits, David A Bell, 5th Edition, Oxford, 2016. **2:** Op-amps and Linear Integrated Circuits, Ramakanth A Gayakwad, Pearson Education, 4th Edition. **3:** Digital Logic and Computer Design, M. Morris Mano, PHI Learning, 2008, ISBN-978-81-203-0417-8 **4:** Electronic Communication Systems, George Kennedy, 4th Edition, TMH **Reference Books (if required)** **1:** Mitchel E. Schultz, 'Grob's Basic Electronics', 11th Edition, McGraw-Hill, 2011. **2:** Electronic Instrumentation and Measurements (3rd Edition) – David A. Bell, Oxford University Press, 2013. **Web Links:** https://onlinecourses.nptel.ac.in/noc21_ee55/preview	
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		1	2				1			1	2	
CO2	3	2	3		2	1				1			1	2	
CO3	3	2	3		3				1	1			1	2	
CO4	3	1	1		2	1			1	1		1	1	2	
CO5	3	1	1		2	1			1	1		1	1	2	

High-3, Medium-2, Low-1

I/II Semester

INTRODUCTION TO ELECTRONICS ENGINEERING			
Course Code:	22EST104C/204C	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1.To prepare students with fundamental knowledge/ overview in the field of Electronics and Communication Engineering.

2. To equip students with a basic foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems.

3. Professionalism & Learning Environment: To inculcate in first-year engineering students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Module-1	**08 hrs**

Power Supplies –Block diagram, Half-wave rectifier, Full-wave rectifiers and filters, Voltage regulators, Voltage multipliers. (Numerical on Rectifiers & Regulators)

Amplifiers – Bipolar Junction Transistor-Current components and Voltages, Amplifying action, BJT as a switch: Cut-off and saturation modes. (Text 1)

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-2	**08 hrs**

Operational amplifiers - Ideal op-amp; characteristics of ideal and practical op-amp; Practical op- amp circuits: Inverting and non-inverting amplifiers, voltage follower, summer, Subtractor, integrator, differentiator. (Text 1) Numerical

Oscillators – Barkhausen criterion, Ladder network oscillator, Wein bridge oscillator, Crystal controlled oscillators

(Only Concepts, working, and waveforms. No mathematical derivations) Numerical

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-3	**08 hrs**

Binary Systems: Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Complements (1's, 2's, 9's and 10's complements).

Boolean Algebra and Logic Circuits: Basic definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates (Text 2)

Combinational logic: Introduction, Design procedure, Adders- Half adder, Full adder (Text 2)

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-4	**08 hrs**

Embedded Systems: Definition, Embedded systems vs general computing systems, Classification of Embedded Systems, Major application areas of Embedded Systems, Elements of an Embedded System, Core of the Embedded System, Microprocessor vs Microcontroller, RISC vs CISC (Text 3)
Sensors and Interfacing: Instrumentation and control systems, Transducers, Sensors, Actuators, LED, 7-Segment LED Display. (Text 3)

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-5	**08 hrs**

Analog Communication Schemes: Modern communication system scheme, Information source and input transducer, Transmitter, Channel or Medium – Hardwired and Soft wired, Noise, Receiver, Types of communication systems. Types of modulation (only concepts) – AM, FM, PM.
Concept of Radio wave propagation (Ground, space, sky).
Digital Modulation Schemes: Advantages of digital communication over analog communication, ASK, FSK, PSK, Multiple access techniques: TDMA, FDMA, CDMA. (Text 4)

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Course outcomes:

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

CO1. Understand the diode based and transistor-based circuits like Power supplies and Amplifiers.
CO2. Analyse and design transistor-based Oscillators and Operational amplifiers.
CO3. Apply the digital electronics knowledge to build arithmetic blocks for digital systems.
CO4. Understand the basics of microprocessor, microcontroller, RISC, CISC and Sensors based circuits.
CO5. Explain the operation and applications of modern communication systems.

Suggested Learning Resources:

Text Books:

1: Mike Tooley, 'Electronic Circuits, Fundamentals & Applications', 4th Edition, Elsevier, 2015. DOI https://doi.org/10.4324/9781315737980.
2: Digital Logic and Computer Design, M. Morris Mano, 2nd Edition, PHI Learning, 2008. ISBN-978-81-203- 0417-84.
3: K V Shibu, 'Introduction to Embedded Systems', 2nd Edition, McGraw Hill Education (India) Private Limited, 2016.
4: S L Kakani and Priyanka Punglia, 'Communication Systems', New Age International Publisher,2017. https://elib4u.ipublishcentral.com/pdfreader/communication-systems

Reference Books:

1: Mitchel E. Schultz, 'Grob's Basic Electronics', 11th Edition, McGraw-Hill, 2011.

Web Links: https://onlinecourses.nptel.ac.in/noc21_ee55/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		1			1	1	1		3	1	2	
CO2	3	2	2		1			1	1	1		3	1	2	
CO3	3	2	2		1			1	1	1		3	1	2	
CO4	3		1		1			1	1	1		3	1	2	
CO5	3		1		1			1	1	1		3	1	2	

High-3, Medium-2, Low-1

Semester: I/II

INTRODUCTION TO EMBEDDED SYSTEMS			
Course Code:	22ETT1059/22ETT2059	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the basic concepts of Embedded Systems.
2. Identify a typical Embedded System building blocks and describe role of embedded firmware.
3. Familiarize the characteristics and quality attributes of Embedded Systems.
4. Introduction of Embedded System Software and Hardware development.
5. Exposure to trends of embedded industry.

Module-1	**07 hrs**

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems v/s General Computing Systems, History, Classification, Major Application areas, Purpose of Embedded Systems. Application specific embedded system: Washing machine, Domain specific: Embedded system in the automotive domain, Wearable devices: The Innovative bonding of lifestyle with embedded technologies. **TEXT 1**

Teaching Learning Method:	Chalk & white board, PowerPoint presentation
RBT Level:	L1, L2

Module-2	**10 hrs**

Typical Embedded System: Core of the Embedded System, Memory, Sensors and Actuators – Light Emi ting Diode (LED), 7-Segment LED Display, Keyboard, Communication Interface – Inter Integrated Circuit (I2C) Bus, Serial Peripheral Interface (SPI) Bus, Universal Serial Bus (USB), Infrared (IrDA), Bluetooth (BT), Wi-Fi, Embedded Firmware, Other System Components, PCB and Passive Components. **TEXT 1**

Teaching Learning Method:	Chalk & white board, PowerPoint presentation
RBT Level:	L1, L2

Module-3	**07 hrs**

Characteristics and Quality Attributes of Embedded Systems: Characteristics and Quality attributes of Embedded Systems.

Hardware Software Co-Design and Program Modelling:

Hardware Software Co-Design concept, Typical Embedded product design and development approach, Computational Models in Embedded Design. Electronic Design Automation (EDA) Tools. **TEXT 1**

Teaching Learning Method:	Chalk & white board, PowerPoint presentation
RBT Level:	L1, L2

Module-4	**07 hrs**

Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages, Integration of Hardware and Firmware, The embedded system development environment, The Integrated Development Environment (IDE). **TEXT 1**

Teaching Learning Method:	Chalk & white board, PowerPoint presentation
RBT Level:	L1, L2

Module-5	07 hrs
Trends in the Embedded Industry: Processor trends in embedded system, Embedded OS trends, Development Language Trends, Open Standards, Frameworks and Alliances, Bottlenecks, Development Platform Trends, Cloud, Internet of Things (IoT) and Embedded Systems – The Next Big Thing. **Design Case Studies**: Digital camera, Smart Card Reader, Automated Meter Reading System. **TEXT 1**	
Teaching Learning Method:	Chalk & white board, PowerPoint presentation, seminars
RBT Level:	L1, L2

Course outcomes:

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

CO1. understand the basic concepts of embedded systems.

CO2. identify different elements of a typical embedded system.

CO3. acquire knowledge about characteristics, quality enhancing factors of Embedded system.

CO4. highlight different concepts of Embedded Firmware Design and Development.

CO5. analyse different trends followed in embedded industry and conduct case studies.

Suggested Learning Resources:

Text Books:

1: Shibu K V, "Introduction to Embedded Systems", First Edition, Tata McGraw Hill Education Private Limited, 2017.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Conduction of Case studies

2: Presentation about current trends in Embedded industries.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1			1									
CO2	3	2	1			1									
CO3	3	2	1			1									
CO4	3	2	1			1									
CO5	3	2	1			1									

High-3, Medium-2, Low-1

I/II Semester

Introduction to Internet of Things (IOT)			
Course Code:	22ETC10511/22ETC20511	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the fundamentals of IoT and its building blocks along with their characteristics.
2. Gain knowledge of various sensors and actuators for IoT applications.
3. Understand the IoT protocols for processing and communication.
4. Gain insights about current trends of associated IoT technologies and IoT Analytics.
5. Insight into the recent application domains of IoT in everyday life.

Module-1	**08 hrs**
Basics of Networking: Introduction, Network Types, Layered network models, Addressing. **Emergence of IoT:** Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT. **Textbook 1:** Chapter 1- 1.1 to 1.4 Chapter 4 – 4.1 to 4.5.	
Teaching Learning Method: Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2	
Module-2	**08 hrs**
IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, SensingTypes, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics. **Textbook 1:** Chapters 5–5.1 to 5.9.	
Teaching Learning Method: Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3	
Module-3	**08 hrs**
IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading. **IoT Connectivity technologies:** IEEE 802.15.4, ZigBee, RFID, NFC, LoRa, Wi-Fi, Bluetooth. **Textbook 1:** Chapter 6–6.1 to 6.5, Chapter 7–7.2,7.3,7.7, 7.8, 7.13, 7.15,7.16	
Teaching Learning Method: Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2	
Module-4	**08 hrs**
Associated IoT Technologies: Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service. **Textbook 1:** Chapter 10–0.1 to 10.6.	
Teaching Learning Method: Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2	
Module -5	**08 hrs**
IOT Case Studies and Future Trends: Vehicular IoT and IoT Analytics – Introduction. Agricultural IoT and Healthcare IoT – Introduction and Case studies. **Textbook 1:** Chapter 12-12.1-12.2, 13– 13.1, 14- 14.1-14.2, 17- 17.1.	
Teaching Learning Method: Chalk and Talk, Power Point Presentation **RBT Level:** L1, L2, L3	
Course outcomes:	

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

CO1. Describe the evolution of IoT, IoT networking components, and addressing strategies in IoT.

CO2. Classify various sensing devices and actuator types.

CO3. Illustrate the architecture of IoT applications and communication

CO4. Explain associated IoT Technologies.

CO5. Demonstrate the processing in IoT.

Suggested Learning Resources:

Text Books:

1: Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021.

Reference Book:

1: S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things.and Industry 4.0.CRC Press.

2: Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014.

3: Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

Online Resources: https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Group activity for a group of 4 or 5 students -5 marks

Activity 2: Two assignments are evaluated for 5 marks: Assignment1 – From Unit 1 and 2, Assignment2 from units 3,4 and 5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											1	2	
CO2	3	2	2	2									1	2	
CO3	3	2	2										1	2	
CO4	3	2	2	2									1	2	
CO5	3	2	2	2		2	1	1	2	3			1	2	

High-3, Medium-2, Low-1

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

BDA Outer Ring Road, Mallathalli,Bengaluru-56

Board Of Studies 2023-24

BASIC IoT SKILL LAB

For 2023 Batch

Submitted by

Department of Electronics and Communication Engineering

To

DEAN (Academic)

SEM : I

Basic IOT Lab

SL.NO	CONTENT	DURATION	BTL
1	Introduction to Different Sensors working principle	6 hrs	L1,L2,
2	Introduction to Output devices (Actuators) working principle	6 hrs	L1,L2
3	Role of sensors and output devices(Actuators) in IOT,	6 hrs	L1,L2
4	Introduction to classification of processors and 8051 Microcontroller.Hands on Kiel version-3 software	6 hrs	L1,L2,L3
5	Role of Processors and Microcontrollers in IOT.Hands on using Tinkercad Tool	6 hrs	L1,L2,L3
	Total	**30 hrs**	

SEM : II

Basic IOT Lab

SL.NO	CONTENT	DURATION	BTL
1	Introduction to Embedded system	6 hrs	L1,L2
2	Types of memory and memory organization	6 hrs	L1,L2
3	Simulation programs using Kiel version-3 software	6 hrs	L1,L2,L3
4	Simulation programs using Kiel version-5 software	6 hrs	L1,L2,L3
5	Hands on interfacing programs using LPC 1768 MCB	6 hrs	L1,L2,L3
	Total	**30 hrs**	

HOD,ECE

SEM : III

Basic IOT Lab

SL.NO	CONTENT	DURATION	BTL
1	Introduction to IOT	6 hrs	L1,L2
2	Basics of IOT networking	6 hrs	L1,L2
3	Connectivity Technology	6 hrs	L1,L2
4	Sensor networks	6 hrs	L1,L2
5	Hands on using Tinker cad tool	6 hrs	L1,L2,L3
	Total	**30 hrs**	

SEM : IV

Basic IOT Lab

SL.NO	CONTENT	DURATION	BTL
1	Interoperability on Internet of Things	6 hrs	L1,L2
2	Introduction to Arduino	6 hrs	L1,L2
3	Integration of Sensors with Arduino	6 hrs	L1,L2,L3
4	Integration of Actuators with Arduino	6 hrs	L1,L2,L3
5	Hands on using Tinker cad tool	6 hrs	L1,L2,L3
	Total	**30 hrs**	

HOD,ECE

SEM : V

Basic IOT Lab

SL.NO	CONTENT	DURATION	BTL
1	Introduction to Raspberry Pi	6 hrs	L1,L2
2	Implementation of IoT with Raspberry Pi	6 hrs	L1,L2,L3
3	Cloud Computing- Fundamentals	6 hrs	L1,L2
4	Sensor - Cloud	6 hrs	L1,L2,L3
5	Hands on using Thing Speak tool	6 hrs	L1,L2,L3
	Total	**30 hrs**	

SEM : VI

Basic IOT Lab

SL.NO	CONTENT	DURATION	BTL
1	Data Handling and Analytics	6 hrs	L1,L2
2	Case Study: Agriculture	6 hrs	L1,L2
3	Case Study: Healthcare	6 hrs	L1,L2
4	Activity Monitoring (Case Study)	6 hrs	L1,L2,L3
5	Activity Monitoring (Case Study)	6 hrs	L1,L2,L3
	Total	**30 hrs**	

HOD,ECE

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

BDA Outer Ring Road, Mallathalli,Bengaluru-56

Board Of Studies 2023-24

Approved
Scheme and Syllabus of
III & IV Semester

For

2022 Batch

Submitted by

Department of Electronics and Communication Engineering

To

DEAN (Academic)

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education (OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 batch)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	22MAT301xx	Maths for AV Communication	Maths	3	2	0		03	50	50	100	4
2	IPCC	22ECU302	Digital System Design using Verilog	ECE	3	0	2		03	50	50	100	4
3	IPCC	22 ECU303	Analog Electronic Circuits	ECE	3	0	2		03	50	50	100	4
4	PCC	22ECT304	Network Analysis	ECE	3	0	0		03	50	50	100	3
5	PCCL	22ECL305	Analog and Digital Electronics Laboratory	ECE	0	0	2		03	50	50	100	1
6	ESC	22ECT306x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
7	UHV	22HST307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	22ECT308x or 22ECL308x	Ability Enhancement Course/Skill Enhancement Course – III	ECE	If the course is a Theory: 1	0	0		01	50	50	100	1
					If a course is a laboratory: 0	0	2		02				
9	HS	22CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	22NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		22PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON310	Yoga	Yoga Teacher									
									Total	550	350	900	21

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. K: This letter in the course code indicates common to all the streams of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC) 22ECT306x			
22ECT306A	**Signals and system**	**22ECT306C**	**Computer Organization and Architecture**
22ECT306B	**Sensors and Instrumentation**	**22ECT306D**	**Applied Numerical methods**
Ability Enhancement Course – III 22ECT308x OR 2ECL308x			
22ECL308A	**LICs Lab using PSPICE**	**22ECL308C**	**Digital Engineering Course (NASSCOM)**
22ECL308B	**Simulink Programming Basics**	**22ECL308D**	**IOT for Smart Infrastructure**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Dr.Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Communication Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24
(Applicable to 2022 batch)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22ECT401	Engineering Electromagnetics	ECE	3	0	0		03	50	50	100	3
2	IPCC	22ECU402	Principles of Communication Systems	ECE	3	0	2		03	50	50	100	4
3	IPCC	22ECU403	Modern Control systems	ECE	3	0	2		03	50	50	100	4
4	PCCL	22ECL404	Communication laboratory	ECE	0	0	2		03	50	50	100	1
5	ESC	22ECT405x	ESC/ETC/PLC	ECE	3	0	0		03	50	50	100	3
6	AEC/ SEC	22ECT406x or 22ECL406x	Ability Enhancement Course/Skill Enhancement Course- IV	ECE	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
7	BSC	22BIT407	Biology For Engineers	TD / PSB: BT, CHE,	2	0	0		03	50	50	100	2
8	UHV	22HST408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	HS	22CDN409	Aptitude and Verbal Ability Skill-II	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN410	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN410	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON410	Yoga	Yoga Teacher									
									Total	500	400	900	19

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.

Engineering Science Course (ESC/ETC/PLC) 22ECT405x OR 22ECL405x			
22ECT405A	**8051 Microcontroller**	**22ECT405C**	**Operating Systems**
22ECT405B	**Power Electronics**	**22ECT405D**	**Engineering Statistics and Linear Algebra**
Ability Enhancement Course / Skill Enhancement Course – IV 22XXT405x OR 22XXL406x			
22ECL406A	**C++ Basics**	**22ECL406C**	**LabVIEW Programming**
22ECL406B	**Electronic Devices**	**22ECL406D**	**Risk Management in IOT Implementation**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of Degree.

Assessment and Evaluation method

III Semester:

- **22ECU302- Digital System Design using Verilog** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers
- **22ECU303- Analog Electronic Circuits** shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
- **ESC or ETC, of 03 credits Courses** shall have only a theory component (L: T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L: T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
- **All 01 Credit** courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ
- **Integrated courses (IPCC)** will have 50 marks CIE and 50 Marks SEE.
- **Non-integrated courses (PCC)** have 50 marks CIE (including 5 marks Assignment and 5 marks Group Activity) and 50 Marks SEE.

IV Semester:

- **22ECU402- Principles of Communication Systems** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers
- **22ECU403- Modern Control systems** shall have the 03 hours of theory examination), however, practical sessions question shall be included in the theory question papers.
- **ESC or ETC, of 03 credits Courses** shall have only a theory component (L: T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L: T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
- **All 01 Credit-** courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ
- **Integrated courses (IPCC)** will have 50 marks CIE and 50 Marks SEE.
- **Non-integrated courses (PCC)** have 50 marks CIE (including 5 marks Assignment and 5 marks Group Activity) and 50 Marks SEE.

III Semester

DIGITAL SYSTEM DESIGN USING VERILOG			
Course Code:	22ECU302	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	04	**SEE Marks:**	50
Total Hours of Pedagogy:	52	**Total Marks:**	100
Credits:	04	**Exam Hours:**	03

Course objectives:

1. To impart the concepts of simplifying Boolean expression using K-map techniques and Quine-McCluskey minimization techniques.
2. To impart the concepts of designing and analyzing combinational logic circuits.
3. To impart design methods and analysis of sequential logic circuits.
4. To impart the concepts of Verilog HDL data flow and behavioural models for the design of digital systems.

Module-1

Principles of Combinational Logic: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms.
(Section 3.1 to 3.5 of Text 1).

Teaching Learning Method:	Chalk and Talk, YouTube videos
RBT Level:	L1, L2, L3

Module-2

Logic Design with MSI Components and Programmable Logic Devices : Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Devices (PLDs) (Section 5.1 to 5.7 of Text 2)

Teaching Learning Method:	Chalk and Talk, YouTube videos
RBT Level:	L1, L2, L3

Module-3

Flip-Flops and its Applications: The Master-Slave Flip-flops (Pulse-Triggered flip-flops): SR flip-flops, JK flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers, Design of Synchronous mod-n Counter using clocked T, JK, D and SR flip-flops. (Section 6.4, 6.6 to 6.9 (Excluding 6.9.3) of Text 2)

Teaching Learning Method:	Chalk and Talk, YouTube videos
RBT Level:	L1, L2, L3

Module-4

Introduction to Verilog: Typical Design Flow, Data types, Modules, Ports.
Verilog Data flow description: Continuous assignments, Delays, Expressions, Operators, and operands, operator types, Examples (Section1.3, 3.2, 6.1 to 6.5 of Text 3)

Teaching Learning Method:	Chalk and Talk, YouTube videos, Programming assignments
RBT Level:	L1, L2, L3

Module-5

Verilog Behavioral description: Procedural Assignments, Conditional statements, Multiway branching, Loops, Examples. (Section 7.2, 7.4, 7.5, 7.6 and 7.9 of Text 3)
Verilog Structural description: Gate types, Examples. (Section 5,1 of Text 3) (Gate level description only)

Teaching Learning Method:	Chalk and Talk, YouTube videos, Programming assignments
RBT Level:	L1, L2, L3

PRACTICAL COMPONENT OF IPCC

Using suitable simulation software, demonstrate the operation of the following circuits

Sl. No.	Experiments
1	To simplify the given Boolean expressions and realize using Verilog program.
2	To realize Adder/Subtractor (Full/half) circuits using Verilog data flow description.
3	To realize 4-bit ALU using Verilog program.
4	To realize the following Code converters using Verilog Behavioral description a) a) Gray to binary and vice versa b) Binary to excess3 and vice versa
5	To realize using Verilog Behavioral description: 8:1 mux, 8:3 encoder, Priority encoder
6	To realize using Verilog Behavioral description: 1:8 Demux, 3:8 decoder, 2-bit Comparator
7	To realize using Verilog Behavioral description: Flip-flops: a) JK type b) SR type c) T type and d) D type
8	To realize Counters - up/down (BCD and binary) using Verilog Behavioral description.

Demonstration Experiments (For CIE only – not to be included for SEE)

Use FPGA/CPLD kits for downloading Verilog codes and check the output for interfacing experiments.

9	Verilog Program to interface a Stepper motor to the FPGA/CPLD and rotate the motor in thespecified direction (by N steps).
10	Verilog programs to interface a Relay or ADC to the FPGA/CPLD and demonstrate its working.
11	Verilog programs to interface DAC to the FPGA/CPLD for Waveform generation.
12	Verilog programs to interface Switches and LEDs to the FPGA/CPLD and demonstrate its working.

Course Outcomes

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

1. Simplify Boolean functions using K-map and Quine-McCluskey minimization technique.
2. Analyze and design for combinational logic circuits.
3. Analyze the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous sequential using Flip Flops.
4. Model Combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Data flow model.
5. Model Combinational circuits (multiplexers) and sequential circuits using behavioural and structural model.

Suggested Learning Resources:

Text Books

1. Digital Logic Applications and Design by John M Yarbrough, Thomson Learning,2001.
2. Digital Principles and Design by Donald D Givone, McGraw Hill, 2002.
3. HDL Programming VHDL and Verilog by Nazeih M Botros, 2009 reprint, Dream tech press.

Reference Books:

1. Fundamentals of logic design, by Charles H Roth Jr., Cengage Learning
2. Logic Design, by Sudhakar Samuel, Pearson/Sanguine, 2007
3. Fundamentals of HDL, by Cyril P R, Pearson/Sanguine2010

MOOCS:

1. Electronic Design Automation http://nptel.ac.in/courses/106105083/
2. Digital system design with PLDs and FPGA shttp://nptel.ac.in/courses/117108040/Fundamentals of HDL

Activity Based Learning (Suggested Activities in Class)/Practical Based learning

Programming Assignments/Mini Projects can be given to improve programming skills.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1											2	
CO2	3	1	1											2	
CO3	3	1	1											2	
CO4	3	1	1											2	
CO5	3	1	1											2	

High-3, Medium-2, Low-1

III Semester

ANALOG ELECTRONIC CIRCUITS			
Course Code:	22ECU303	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52	**Total Marks:**	100
Credits:	4	**Exam Hours:**	3

Course objectives: This course will enable students to

1. Explain various BJT parameters, connections and configurations.
2. Design and demonstrate the diode circuits and transistor amplifiers.
3. Explain various types of FET biasing and demonstrate the use of FET amplifiers.
4. Analyse Power amplifier circuits in different modes of operation.
5. Construct Feedback and Oscillator circuits using FET.

Module-1	**08 hrs**

BJT Biasing: Biasing in BJT amplifier circuits: The Classical Discrete circuit bias (Voltage-divider bias), Biasing using a collector to base feedback resistor.

Small signal operation and Models: Collector current and transconductance, Base current and input resistance, Emitter current and input resistance, voltage gain, Separating the signal and the DC quantities, The hybrid Π model.

MOSFETs: Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor. Small signal operation and modeling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, transconductance, **Text 1**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Basic BJT Amplifier Configurations- Design of Common Emitter and Common collector amplifier circuits.
RBT Level:	L1, L2, L3

Module-2	**08 hrs**

MOSFET Amplifier configuration: Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance RS, Source follower.

MOSFET internal capacitances and High frequency model: The gate capacitive effect, Junction capacitances, High frequency model. Frequency response of the CS amplifier: The three frequency bands, high frequency response, Low frequency response.

Oscillators: FET based Phase shift oscillator, LC and Crystal Oscillators (no derivation) **Text 1**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Discrete Circuit MOS Amplifier – The common source amplifier and the source follower.
RBT Level:	L1, L2, L3

Module-3	**08 hrs**

Feedback Amplifier: General feedback structure, Properties of negative feedback, The Four Basic Feedback Topologies, The series-shunt, series-series, shunt-shunt and shunt-series amplifiers (Qualitative Analysis).

Output Stages and Power Amplifiers: Introduction, Classification of output stages, Class A output stage, Class B output stage: Transfer Characteristics, Power Dissipation, Power Conversion efficiency, Class AB output stage, Class C tuned Amplifier. **Text 1**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Class D power amplifier
RBT Level:	L1, L2, L3

Module-4	**08 hrs**

Op-Amp Circuits: Op-amp DC and AC Amplifiers, DAC – Weighted resistor and R-2R ladder, ADC-Successive approximation type, Small Signal half wave rectifier, Absolute value output circuit,
Active Filters, First and second order low-pass and high-pass Butterworth filters, Band-pass filters, Band reject filters. (no derivations only concepts) **Text 2**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Clippers and Clampers, Peak detector, Sample and hold circuit.
RBT Level:	L1, L2, L3

Module-5	**08 hrs**

555 Timer and its applications: Monostable and Astable Multivibrators.
Thyristors: Static Anode-Cathode characteristics and Gate characteristics of SCR, Turn-On methods, Turn-off Mechanism, Turn-Off Methods: Natural and Forced Commutation – Class A without design consideration. **Text 2, 3**

Teaching Learning Method:	Chalk and talk method, Power Point Presentation. Self-study topics: Basic Construction, working and applications of DIAC, TRIAC, IGBT, GTO.
RBT Level:	L1, L2, L3

PRACTICAL COMPONENT OF IPCC

1. Design and verification of voltage follower, inverting amplifier and non- inverting amplifier using OP-AMP.
2. Design and verification of Integrator and Differentiator using OP-AMP.
3. Design and Simulation of Function generator to generate square wave and triangular wave generator using OP-AMP.
4. Analyze Input, Output characteristics of BJT Common emitter
5. Design and Simulation of input and output characteristics of MOSFET
6. Analyze of Static characteristics of SCR
7. Design and Simulation of RC Phase shift Oscillator using FET.
8. Design and Simulation of R-2R Ladder DAC.

Course Outcomes:

After the completion of the Course the student can:

CO1. Understand the characteristics of BJTs and FETs for switching and amplifier circuits.
CO2. Design and analyse FET amplifiers and oscillators with different circuit configurations and biasing conditions.
CO3. Understand the feedback topologies and approximations in the design of amplifiers and oscillators.
CO4. Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.

Suggested Learning Resources:

Text Books:

1. Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th Edition, Oxford,2015. ISBN:978-0-19-808913-1

2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education,2018. ISBN: 978-93-325-4991-3
3. Electronic Principles, Albert Malvino, David J Bates, 7th Edition, McGraw Hill Education
4. (India)Private Limited, 2017, ISBN:978-0-07-063424-4Reference Books (if required)

Web Links:

1. www.nptel.in
2. Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos
3. C.Halkias, McGraw-Hill, 2015.
4. Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											1	1	1
CO2	3	3	3										1	1	1
CO3	3	3	2										1	1	1
CO4	3	2	2										1	1	1

High-3, Medium-2, Low-1

III Semester

NETWORK ANALYSIS			
Course Code:	22ECT304	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	2:2:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52 Hours	**Total Marks:**	100
Credits:	3 (2:1:0)	**Exam Hours:**	03 Hrs

Course objectives:

1. To familiarize the basic laws, source transformation, source shifting and network analysis techniques.
2. To understand the network theorems and their applications for the analysis of electrical circuits.
3. To understand the transient behaviour of electrical circuits using the initial conditions.
4. To Apply Laplace transforms for the analysis of electrical circuits.
5. To evaluate the two port network parameters for the electrical circuits.

Module-1	**11 hrs**
Introduction: Ohm's Law, Nodes, Branches, and Loops, Kirchhoff's Laws, Series Resistors and Voltage division, Parallel Resistors and Current division, Wye-Delta transformations, Source Transformation, Source Shifting, Series and Parallel Capacitors, Series and Parallel Inductors. **Methods of Analysis**: Nodal Analysis, Nodal Analysis with Voltage Sources, Mesh Analysis, Mesh Analysis with Current Sources, Nodal vs Mesh Analysis, Sinusoid steady-state analysis using Nodal Analysis and Mesh Analysis. **Text Book: 2.1 to 2.7, 4.4, 6.3, 6.5, 3.1 to 3.7, 10.1 to 10.3.**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4

Module-2	**10 hrs**
Circuit Theorems: Linearity Property, Superposition, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer theorem. **Resonance**: Series resonance and parallel resonance **Text Book: 4.2,4.3, 4.5, 4.6, 10.4, 10.6, 14.5, 14.6.**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4

Module-3	**11 hrs**
Transient Behaviour and Initial Conditions: Introduction**,** the Source-Free RC circuit, the Source-Free RL circuit, Singularity Functions, Step Response of an RC circuit, Step Response of an RL Circuit, Finding Initial and Final Values. **Text Book: 7.1 to 7.6, 8.1, 8.2**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4

Module-4	**10 hrs**
Laplace Transforms: Introduction, Definition of the Laplace Transform, Properties of Laplace Transform, Circuit Element Models, and Circuit Analysis using Laplace Transforms. **Text Book: 15.1 to 15.3, 16.1 to 16.3**	
Teaching Learning Method: **RBT Level:**	Chalk and Board, Problem Based Learning L1, L2, L3, L4

Module-5	10 hrs
Two-Port Networks: Introduction, Impedance parameters, Admittance Parameters, Hybrid Parameters, Transmission Parameters, Relationship between Parameters, Interconnection of Networks. **Text Book: 19.1 to 19.6**	
Teaching Learning Method:	Chalk and Board, Problem Based Learning
RBT Level:	L1, L2, L3, L4

Course outcomes:

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

CO1. Simplify the electrical network and analyse the electrical circuits using mesh and nodal analysis.

CO2. Solve complex electrical circuits using network theorems and explain series and parallel resonance circuits.

CO3. Evaluate the transient response of electrical circuits using initial conditions.

CO4. Apply Laplace transforms for Circuit Analysis

CO5. Evaluate the performance of two-port networks.

Suggested Learning Resources:

Text Books:

1: Fundamentals of Electric Circuits, Charles K Alexander Matthew N O Sadiku, Mc Graw Hill, 2021.

Reference Books

1: Engineering Circuit Analysis, William H Hayt et al, Mc Graw Hill, 8th Edition, 2014.

2: Network Analysis, M.E. Vanvalkenburg, Pearson, 3rd Edition, 2014.

Material:

Material will be provided by the course co-ordinator

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Quizzes

Activity 2: Seminars

Activity 3: Simulation of Electrical Circuits using PSPICE

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3											3		
CO4	3	3											3		
CO5	2	2											3		

High-3, Medium-2, Low-1

III Semester

ANALOG AND DIGITAL ELECTRONICS LAB			
Course Code:	22ECL305	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:		**Total Marks:**	100
Credits:	**01**	**Exam Hours:**	03

Course objectives:

This laboratory course enables student to:

1. Understand the electronic circuit schematic and its working
2. Realize and test amplifier and oscillator circuits for the given specifications
3. Realize the opamp circuits for the applications such as DAC, implement mathematical functions
4. and precision rectifiers.
5. Study the static characteristics of SCR and test the RC triggering circuit.
6. Design and test the combinational and sequential logic circuits for their functionalities.
7. • Use the suitable ICs based on the specifications and functions.

Sl. No.	Experiments
1	Design and set up the BJT common emitter voltage amplifier and determine the gain, bandwidth, input and output impedances.
2	Design and set-up BJT/FET i) Colpitts Oscillator ii) Crystal Oscillator
3	Design and set up the circuits using opamp: i) Adder ii) Integrator iii) Differentiator and iv) Comparator
4	Obtain the static characteristics of SCR and test SCR Controlled HWR and FWR using RC triggering circuit.
5	Design and implement (a) Half Adder & Full Adder using basic gates (b) Half subtractor & Full subtractor using basic gates (c) 4-variable function using IC74151(8:1MUX).
6	Realize (i) Binary to Gray code conversion & vice-versa using gates
7	a) Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop
8	Realize a) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490 / 7476
9	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) for a 4-bit binary input using toggle switches (ii) by generating digital inputs using mod-16
10	Test the precision rectifiers using opamp: i) Half wave rectifier ii) Full wave rectifier
11	Design and test Monostable and Astable Multivibrator using 555 Timer

Course outcomes (Course Skill Set):

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

CO 1. Design and analyze the BJT/FET amplifier and oscillator circuits.

CO 2. Design and test Opamp circuits to realize the mathematical computations, DAC and precision rectifiers.

CO 3. Design and test the combinational logic circuits for the given specifications.

CO 4. Test the sequential logic circuits for the given functionality.

CO 5. Demonstrate the basic electronic circuit experiments using SCR and 555 timer.

Suggested Learning Resources:

1. Fundamentals of Electronic Devices and Circuits Lab Manual, David A Bell, 5th Edition, 2009, Oxford University Press.

2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3.

3. Fundamentals of Logic Design, Charles H Roth Jr., Larry L Kinney, Cengage Learning, 7th Edition.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3										1	1	1
CO2	3	3	3										1	1	1
CO3	3	3	3										1	1	1
CO4	3	3	3										1	1	1
CO5	3	3	3										1	1	1

High-3, Medium-2, Low-1

III Semester

SIGNALS AND SYSTEM			
Course Code:	22ECT306A	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	3

Course objectives:

1. To prepare students with fundamental knowledge/ overview of signals and systems with their properties.
2. Apply convolution to analyse how signals interact with linear time-invariant (LTI) systems and the analysis of the signals in time domain using difference/differential equations.
3. Understand the basic concepts of the Fourier series and Fourier transform for a given signal.
4. Analyse and apply the concepts of the Fourier Transform and its properties.
5. Understand the concept of the Z-transform and its significance in discrete-time signal analysis.

Module-1	**08 Hrs**
Introduction: Definition of signal and systems, classification of signals, basic operations on signals (Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal), Elementary signals/Functions (Unit Step, Unit impulse, ramp, exponential, sinusoidal). **Properties of System:** Linear-nonlinear, Time variant-invariant, causal-noncausal, memory-memoryless, stable-unstable.	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-2	**08 Hrs**
Time domain representations for Linear Time Invariant Systems: Introduction, Convolution: Impulse response representation for LTI systems, Properties of the impulse response representation for LTI systems, Difference and differential equation representations for LTI systems.	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3, L4

Module-3	**08 Hrs**
Fourier representations of signals: Introduction, Discrete-Time Periodic signals: The Discrete-Time Fourier Series, Continuous-Time Periodic Signals: The Fourier Series, Discrete-Time Non Periodic signals: The Discrete-Time Fourier Transform, Continuous-Time Non Periodic Signals: The Fourier Transform. (Definition and basic problems)	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3, L4

Module-4	**08 Hrs**
Properties of Fourier Transform: Linearity, Symmetry, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parsevals relationships and Duality. (Statement and Proof) **Applications of Fourier Representations:** Introduction, Frequency response of LTI system, Fourier Transform representations for periodic signals Sampling-Sampling continuous time signals.	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3, L4

Module-5	**08 Hrs**

The Z-Transforms: Introduction, the Z transform, properties of the region of convergence, properties of the Z-Transform, Inverse of the Z-transform.	
Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3, L4

Course outcomes:

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

CO1. Demonstrate an understanding of continuous-time and discrete-time signals and perform basic operations on signals, classify systems based on their properties.

CO2. Analyse and solve time domain representations for LTI Systems and also able to classify the LTI system based on the properties.

CO3. Understand the fundamental concepts of Fourier series, Fourier transforms, and their significance in signal analysis. Apply Fourier analysis techniques to solve problems.

CO4. Demonstrate a thorough knowledge of the key properties of the Fourier Transform, including linearity, time shifting, frequency shifting, and scaling. Apply convolution and modulation theorems to solve problems involving the multiplication of signals in the time domain.

CO5. Apply the Z-transform to analyse discrete-time signals.

Suggested Learning Resources:

Text Books:

1: Simon Haykin and Barry Van Veen, "Signals and Systems", 2nd Edition, John Wiley & Sons, Oct 2002.

Reference Books:

1: Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.

2: Michael Roberts, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010.

3: V. Krishnaveni and A. Rajeswari, "Signals and Systems", Wiley India, Reprint 2012.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Interactive Demos and Simulations: Use interactive software or online tools to demonstrate signal transformations, system responses, and other concepts. Encourage students to manipulate parameters and observe the effects in real-time.

Activity 2: Signal Processing Workshops: Organize workshops where students work in groups to process and analyze real signals (audio, images) using software like MATLAB.

Activity 3: Case Studies: Present real-world case studies where understanding Signals and Systems is crucial. Examples include audio compression (MP3), image compression (JPEG), or equalization in audio systems.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1									2	3	1	
CO2	3	2	2									2	3	1	
CO3	3	2	2	2								2	3	1	
CO4	3	2	2	2								2	3	1	
CO5	3	2	2	2								2	3	1	

High-3, Medium-2, Low-1

III Semester

SENSORS AND INSTRUMENTATION			
Course Code:	22ECT306B	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

This course will enable students to understand:

1. Operation principle, characteristics, classification of different sensors
2. types of errors in measurement and the operation of different Transducers
3. working of Multirange Ammeters, Voltmeters and Multimeters.
4. principle of operation of digital measuring instruments and Bridges.

Module-1	**08 hrs**
INTRODUCTION: introduction to sensors/transducers. principles, classification, parameters, Environmental parameters, Characterization. **MECHANICAL AND ELECTROMECHANICAL SENSORS:** Introduction, resistive potentiometer, Strain gauge, Inductive sensors, capacitive sensors, Force/stress sensors using Quartz Resonators, Ultrasonic sensors. **TEXT 1**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-2	**07 hrs**
THERMAL SENSORS: Introduction, Gas thermometric sensors, Thermal expansion type thermometric sensors, Dielectric constant and refractive index thermo sensors. Nuclear thermometer, magnetic thermometer, Resistance change type thermometric sensors, thermo emf sensors, Thermal radiation sensors. **TEXT 1**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-3	**08 hrs**
MAGNETIC SENSORS: Introduction, Sensors and the principle behind, Magneto resistive sensors, Hall effect and sensors, Inductance and eddy current sensors, Angular/rotary movement transducer, Eddy current sensors, Electromagnetic flow meter, Switching magnetic sensor, SQUID sensor. **TEXT 1**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-4	**08 hrs**
Principles of Measurement: Static Characteristics, Error in Measurement, Types of Static Error. Voltmeters: Introduction, Multi range voltmeter. Ammeters: DC Ammeter, Multi-range Ammeter. Digital Voltmeter: Ramp Technique, Dual slope integrating Type DVM, Direct Compensation type and Successive Approximations type DVM. **TEXT 2**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-5	**08 hrs**
Digital Instruments: Introduction, Digital Multimeter, Digital frequency meters, Digital measurement of time. Signal Generators: Function generator, Block diagram of Oscilloscope. Bridges: Wheatstone's Bridge, Capacitance and Inductance Comparison bridge, Maxwell's bridge, Wien's bridge. **TEXT 2**	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation
RBT Level:	L1, L2, L3

Course outcomes:

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

CO 1: Understand operation principle, classification, characteristics of sensors, mechanical and electrical sensors

CO 2: Understand operation principle, different types, characteristics of thermal sensors.

CO 3: Understand operation principle, different types, characteristics of magnetic sensors.

CO 4: Analyse principle of measurement, operation of different ammeters and voltmeters.

CO 5: Analyse the operation, classification, different types of digital instruments.

Suggested Learning Resources:

Text Books:

1. D Patranabis, "Sensors and Transducers", PHI Learning Private Limited, New Delhi – 110 001, Second Edition 2010
2. H. S. Kalsi, "Electronic Instrumentation", 3rd Edition, McGraw Hill, 2012

Reference Books:

1. David A. Bel "Electronic Instrumentation & Measurements", 2nd Edition, Oxford University Press PHI, 2006

Web Links:

http://nptel.ac.in/courses

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Seminar on different types of sensors
2. Seminar on different measuring instruments

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2							1	1					
CO2	3	2							1	1					
CO3	3	2							1	1					
CO4	3	2							1	1					
CO5	3	2							1	1					

High-3, Medium-2, Low-1

III Semester

COMPUTER ORGANIZATION AND ARCHITECTURE			
Course Code:	22ECT306C	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03hrs

Course objectives:

1. Understand the meaning of basic structure of computers, and machine instructions and programs.
2. Analyze addressing modes and assembly language.
3. Compute the quantitative parameters for functions of input and output organization.
4. Associate the concepts of memory system
5. understanding the concept of simple processor organisation with two controls.

Module-1	**00 hrs**
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation (upto 1.6.2 of Chap 1 of Text). **Machine Instructions and Programs**: Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, (upto 2.4.6 of Chap 2 and 6.7.1 of Chap 6 of Text).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation L1,L2,L3

Module-2	**00 hrs**
Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions (from 2.4.7 of Chap 2, except 2.9.3, 2.11 & 2.12 of text).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation L1,L2,L3

Module-3	**00 hrs**
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access, (upto 4.2.4 and 4.4 except 4.4.1 of Chap 4 of text).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation L1,L2,L3

Module-4	**00 hrs**
Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage-Magnetic Hard Disks (5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to 5.5.4), 5.7 (except 5.7.1), 5.9, 5.9.1 of Chap 5 of Text).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation L1,L2,L3

Module-5	**00 hrs**
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control (upto 7.5 except 7.5.1 to 7.5.6 of Chap 7 of Text).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation L1,L2,L3

Course outcomes:

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

CO1. Explain the basic organization of a computer system.

CO2. Describe the addressing modes, instruction formats and program control statement.

CO3. Explain different ways of accessing an input/ output device including interrupts.

CO4. Illustrate the organization of different types of semiconductor secondary storage memories.

CO5. Illustrate simple processor organization based on hardwired control and micro programmed control.

Suggested Learning Resources:

Text Books:

1: Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.

Reference Books (if required)

1: David A. Patterson, John L. Hennessy: Computer Organization and Design – The Hardware / Software Interface ARM Edition, 4th Edition, Elsevier, 2009.

2: William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.

3: Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

Web Links: https://archive.nptel.ac.in/courses/106/105/106105163/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Programming Assignments / Mini Projects can be given

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2			2							1			
CO2	3	2			2							1			
CO3	3	2			2							1			
CO4	3	2		2	2							1			
CO5	3	2			3							1			

High-3, Medium-2, Low-1

LIC (Linear Integrated Circuits) Lab using PSPICE	
Course Code: **22ECL308A**	CIE Marks:**50**
Teaching Hours/Week (L:T:P: S): **0:0:2:0**	SEE Marks:**50**
Credits: **1**	Exam Hours:**100**

Course objectives:

- To gain hands on experience in designing LIC applications.
- To learn simulation software used to simulate the circuits.
- To learn fundamental principles of applications of linear integrated circuits.
- To design the applications of linear integrated circuits for the given specifications.

Sl. No	Experiments using PSPICE NOTE: Every experiment has to be designed, circuit to be drawn / constructed and executed in thespecified software. Results are also to be noted and inferred.
	Note: Standard design procedure to be adopted.
1	To realize using op-amp an Inverting Amplifier and Non-Inverting Amplifier
2	To realize using op-amps i) Summing Amplifier ii)Difference amplifier
3	To realize using op-amps an Instrumentation Amplifier
4	To realize using op-amps i) Differentiator ii)Integrator
5	To realize using op-amps a Full wave Precision Rectifier
6	To realize using op-amps i) Inverting and Non-Inverting Zero Crossing Detectors ii) Positive and Negative Voltage level detectors
7	To realize using op-amp an Inverting Schmitt Trigger
8	To realize using op-amp an Astable Multivibrator
9	To design and implement using op-amps i) Butterworth I & II order Low Pass Filter ii) Butterworth I & II order High Pass Filter

10	To design and implement using op-amp a RC Phase Shift Oscillator
11	To design and implement Mono-stable Multivibrator using 555 timer
12	To design and implement 4 - bit R-2R Digital to Analog Converter

Course outcomes (Course Skill Set):

After studying this course, students will be able to;

CO1: Sketch/draw schematics of linear integrated circuit applications.

CO2: Design the applications of LIC for the given specifications.

CO3: Demonstrate the fundamentals of linear integrated circuits and their applications using PSPICE tool.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3							1	2	2			3	2	
CO2	3	3						1	2	2			3	2	
CO3	3	3			2			1	2	2			3	2	

High-3, Medium-2, Low-1

IV Semester

ENGINEERING ELECTROMAGNETICS			
Course Code:	22ECT401	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understanding the concepts of vectors, electric fields for EM waves and to analyze and solve problems using coulomb's law, gauss law.
2. Understanding the concepts of energy density, potential difference and capacitance.
3. Understanding the Biot Savart law, Laplace and Poisson's equations and to acquire knowledge of their practical applications.
4. Understanding the importance of Maxwell's equation and applying them for time varying fields.
5. To understand the importance of wave propagation in free space & dielectrics and applying them for time varying fields.

Module-1	**08 hrs**
Electrostatics: Coulomb's Law and electric field intensity, Field due to continuous volume charge distribution, Field of a line charge. Field of a sheet of charge. Electric flux density, Gauss' law and its applications. Divergence, Maxwell's First equation (Electrostatics), **TEXT 1**	
Teaching Learning Method: Lecture-based learning and Group learning **RBT Level:** L1, L2	
Module-2	**08 hrs**
Energy and potential: Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge, Potential gradient , Energy density in an electrostatic field. **TEXT 1**	
Teaching Learning Method: Lecture-based learning and Group learning **RBT Level:** L1, L2	
Module-3	**08 hrs**
Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem. **Steady magnetic field:** Biot-Savart law and its applications, Ampere's circuital law and its applications, magnetic flux and flux density **TEXT 1**	
Teaching Learning Method: Lecture-based learning and Group learning **RBT Level:** L1, L2	
Module-4	**08 hrs**
Magnetic forces - Force on a moving charge and differential current element, Force between differential current elements. **Maxwell's equations:** Inductance and examples, Faraday's law, Displacement current. Maxwell's equation in point and Integral form, Boundary conditions for perfect dielectric materials, magnetic boundary conditions. **TEXT 1**	
Teaching Learning Method: Lecture-based learning and Group learning **RBT Level:** L1, L2,L3	
Module-5	**08 hrs**
Electromagnetic waves: Wave propagation in free space and dielectrics, Propagation in good conductors – skin effect, Wave polarization, standing wave ratio. **TEXT 1**	

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2, L4

Course outcomes:

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

CO1. Able to define electrostatic field and its laws such as Coulomb's law, Gauss' law & Divergence.

CO2. Able to understand energy expanded, potential difference, Potential gradient & Energy density in electrostatic field

CO3. Able to apply and solve Ampere's circuital law and apply Maxwell's equations in wave propagation.

CO4. Able to analyze magnetic forces and Maxwell's equations.

CO5. Able to understand propagation of waves in different medium with its fundamental concepts of skin effect and standing wave ratio .

Suggested Learning Resources:

Text Books:

1. William H Hayt Jr. and John A Buck, "Engineering Electromagnetics", 8th edition, McGraw- Hill, 2012Collin RE. Foundations for microwave engineering. John Wiley & Sons; 2007.
2. David K Cheng, "Field and Wave Electromagnetics", 2nd edition, Pearson Education Asia, Indian Reprint – 2001Annapurna Das, Sisir K Das, Microwave Engineering, TMH Publication, 2001

Reference Books

1. John Krauss and Daniel A Fleisch,"Electromagnetics with Applications", 5th edition, McGraw-Hill, 1999Microwave Devices and circuits- Liao / Pearson Education. 1992
2. Edward C. Jordan and Keith G Balmain,, "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice – Hall of India / Pearson Education, Reprint – *2002*M.Kulkarni., "Microwave devices and Radar Engg."Umesh Publications, 2011

Web Links:

1. www.nptel.in
2.www.google.com , david k cheng fields and waves electromagnetics pdf download
3.www.google.com, william h hayt engineering electromagnetics pdf
4.www.youtube/electromagnaticsforengineers

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Creating physical modules

2: Exploring new technologies and presenting

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												2	
CO2	3	3	2											2	
CO3	3	2	2											2	
CO4	3	3	2											2	
CO5	3	3	2										2	2	

High-3, Medium-2, Low-1

IV Semester

PRINCIPLES OF COMMUNICATION SYSTEMS			
Course Code:	22ECU402	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S)	3: 0: 2: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	52	**Total Marks:**	100
Credits:	04	**Exam Hours:**	03

Course objectives:

1. Understand and analyse concepts of Analog Modulation schemes viz; AM, FM., Low pass sampling and Quantization as a random process.
2. Understand and analyse concepts digitization of signals viz; sampling, quantizing and encoding.
3. Evolve the concept of SNR in the presence of channel induced noise and study Demodulation of analog modulated signals.
4. Evolve the concept of quantization noise for sampled and encoded signals and study the concepts of reconstruction from these samples at a receiver.

Module-1	**09 hrs**
Amplitude Modulation: Introduction, Amplitude Modulation: Time & Frequency Domain description, switching modulator, Envelop detector. **Double Side Band-Suppressed Carrier Modulation:** Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. **SINGLE SIDE–Band and Vestigial Sideband Methods of Modulation:** SSB Modulation, VSB Modulation, Frequency Translation, Frequency Division Multiplexing.	
Teaching Learning Method:	Chalk and talk method, Power Point Presentation.
RBT Level:	L1, L2, L3

Module-2	**08 hrs**
ANGLE MODULATION: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase– Locked Loop: Nonlinear model of PLL, Linear model of PLL. The Super Heterodyne Receiver.	
Teaching Learning Method:	Chalk and talk method, Power Point Presentation, YouTube videos.
RBT Level:	L1, L2, L3

Module-3	**08 hrs**
NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth. **NOISE IN ANALOG MODULATION:** Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.	
Teaching Learning Method:	Chalk and talk method, Power Point Presentation, YouTube videos.
RBT Level:	L1, L2, L3

Module-4	**07 hrs**
SAMPLING AND QUANTIZATION: Introduction, Why Digitize Analog Sources? The Low Pass Sampling Process, Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves.	
Teaching Learning Method:	Chalk and talk method, Power Point Presentation, YouTube videos.
RBT Level:	L1, L2, L3

Module-5	07 hrs
SAMPLING AND QUANTIZATION (Contd): The Quantization Random Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation, Application examples - (a) Video + MPEG (Text1:7.11) and (b) Vocoders (refer Section 6.8 of Reference Book 1)	
Teaching Learning Method:	Chalk and talk method, Power Point Presentation, YouTube videos.
RBT Level:	L1, L2, L3

PRACTICAL COMPONENT OF IPCC	
Sl.No.	**Experiments**
1	Generation and demodulation of Amplitude modulation (AM) wave.
2	Generation and demodulation of Double side band supressed carrier (DSB-SC) wave.
3	Generation and demodulation of Frequency modulation (FM) wave.
4	Phase locked loop Synthesis
5	Generation and demodulation of Pulse Amplitude Modulation.
6	Generation and demodulation of Pulse Position Modulation.
7	Time division multiplexing of two band limited signals.
8	Illustrate the process of sampling and reconstruction of low pass signals using Matlab.
9	Illustration of Pulse Code Modulation using Matlab
10	Illustration of Delta Modulation using Matlab.
11	Noise in AM receiver using (Matlab/ Simulink/Scilab)
12	Noise in FM receiver using (Matlab/ Simulink/Scilab)

Course outcomes:

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

CO1. Understand the amplitude and frequency modulation techniques and analyze the perform time and frequency domain transformations.

CO2. Identify the schemes for amplitude and frequency modulation and demodulation of analog signals and compare the performance.

CO3. Characterize the influence of channel noise on analog modulated signals.

CO4. Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems.

CO5. Illustration of digital formatting representations used for Multiplexers, Vocoders and Video transmission.

Suggested Learning Resources:

Text Books:

1: Simon Haykins & Moher, Communication Systems, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978 – 81 – 265 – 2151 – 7.

2: Simon Haykins, An Introduction to Analog and Digital Communication, John Wiley India Pvt. Ltd., 2008, ISBN 978–81–265–3653–5.

Reference Books:

1: B P Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press., 4th edition, 2010, ISBN: 97801980738002.

2: H Taub & D L Schilling, Principles of Communication Systems, TMH, 2011.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Surprise Tests
- Assignments
- Seminars
- Micro Projects can be given to improve the skills

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1					1	1	1		1	3	3	
CO2	3	2	1					1	1	1		1	3	3	
CO3	3	2	1					1	1	1		1	3	3	
CO4	3	2	1					1	1	1		1	3	3	
CO5	3	2	1					1	1	1		1	3	3	

High-3, Medium-2, Low-1

IV Semester

MODERN CONTROL SYSTEMS			
Course Code:	22ECU403	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	2:2:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52 Hours	**Total Marks:**	100
Credits:	4 (2:1:1)	**Exam Hours:**	03 Hrs

Course objectives:

1.To familiarize the basic laws, source transformation, source shifting and network analysis techniques.
2. To understand the network theorems and their applications for the analysis of electrical circuits.
3. To understand the transient behaviour of electrical circuits using the initial conditions.
4. To Apply Laplace transforms for the analysis of electrical circuits.
5. To evaluate the two port network parameters for the electrical circuits.

Module-1	**08 hrs**

Introduction to Control Systems: Open loop control system, Closed loop control system, Examples of Control System.

Mathematical Modelling: Introduction, Differential equations of Physical Systems (Only Electrical and Mechanical Systems), Transfer function of Linear Systems, Analogous Systems.

Text Book1: 1.1, 1.3, 2.1, 2.2, 2.5.

Teaching Learning Method:	Chalk and Board, Problem Based Learning
RBT Level:	L1, L2, L3, L4

Module-2	**08 hrs**

Block Diagrams: Block Diagram Models, Block Diagram Reduction, Applications.

Signal Flow Graphs: Signal-Flow Graph Models, Mason's Gain Formula, Applications.

State Variable Models: Introduction**,** the state variables of a dynamic system, the state differential equation, signal flow graph and block diagram models, the transfer function from the state equation, the time response and the State Transition Matrix.

Text Book1: 2.6, 2.7, 3.1 to 3.4, 3.6, 3.7

Teaching Learning Method:	Chalk and Board, Problem Based Learning
RBT Level:	L1, L2, L3, L4

Module-3	**08 hrs**

Transient and Steady-State Response Analysis: Introduction, First-Order Systems, Second-Order Systems, Effects of Proportional, Integral and Derivative Control Actions on System Performance, Steady-State Errors in Unity-feedback Control Systems.

Text Book2: 5.1 to 5.3, 5.7, 5.8

Teaching Learning Method:	Chalk and Board, Problem Based Learning
RBT Level:	L1, L2, L3, L4

Module-4	**08 hrs**

Stability of Control Systems: Routh's Stability Criterion, Relative Stability.

Text Book2: 5.6.

The Root-Locus Method: Introduction, The Root Locus Concept, The Root Locus Procedure, Examples.

Text Book1: 7.1 to 7.3

Teaching Learning Method:	Chalk and Board, Problem Based Learning

RBT Level:	L1, L2, L3, L4

Module-5	**08 hrs**

Frequency Response Analysis: Introduction, Correlation between Time and Frequency Response, Bode Plots, experimental determination of Transfer functions.

Text Book3: 8.1, 8.2, 8.4, 8.6

Teaching Learning Method:	Chalk and Board, Problem Based Learning
RBT Level:	L1, L2, L3, L4

Modern Control Systems **Integrated Laboratory Component**	**12 hrs**

Sl. No	**Experiments using PSPICE** NOTE: Every experiment has to be designed, necessary diagrams/plots to be drawn / constructed and executed in thespecified software. Results are also to be noted and inferred.
	Note: Standard design procedure to be adopted.
1	Obtain Cascaded, Parallel and Feedback closed loop transfer functions using MATLAB.
2	Convert Transfer function to state space representation and Vice-versa.
3	Obtain 2D and 3D plots of unit step response of 2^{nd} order system.
4	Find the Time Response Specifications of unit step response of 2^{nd} order System.
5	Draw root locus using MATLAB
6	Draw BODE PLOTs using MATLAB
7	Study the effect of PI controller using MATLAB
8	Study the effect of PD controller using MATLAB
9	Study the effect of PID controller using MATLAB
10	Study of speed characteristics of DC motors using MATLAB.

Course outcomes:

At the end of the course the student will be able to:.3

CO1. Obtain the mathematical model of control systems.

CO2. Simplify the control systems using graphical methods and represent the given system in state space approach.

CO3. Evaluate the system performance through time domain specifications and steady state error.

CO4. Examine stability using Routh's Criterion and Root-Locus method.

CO5. Evaluate the system performance in frequency domain.

Suggested Learning Resources:

Text Books:

1: Modern Control Systems, Richard C. Dorf and Robert H. Bishop, Pearson, 13th Edition, 2017.

2: Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5th Edition, 2010.

3: Control Systems Engineering, I J Nagrath and M Gopal, New Age International Publishers, 4th edition, 2006.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Quizzes

Activity 2: Seminars

Activity 3: Simulation using MATLAB

Activity 4: Case studies

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3											3		
CO2	3	3											3		
CO3	3	3											3		
CO4	3	3											3		
CO5	3	3											3		

High-3, Medium-2, Low-1

IV Semester

COMMUNICATION LABORATORY			
Course Code:	22ECL404	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S)	0: 0: 2: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	13	**Total Marks:**	100
Credits:	1	**Exam Hours:**	3

Course objectives:

1. Demonstrate the Analog modulation techniques.
2. Model an optical communication system and study its characteristics.
3. Simulate the digital communication concepts and compute and display various parameters along with plots/figures
4. Design, Demonstrate and Analyze filters using op-amp.

Sl. No.	Experiments
	Part –A discrete Experiments
1	Time division multiplexing and de-multiplexing using IC 8038
2	Generation and detection of standard Amplitude modulation.
3	Generation and detection of Pulse Amplitude modulation.
4	Pre-Emphasis and De-Emphasis Circuits
5	Coupling and bending loss in optical fiber communication.
6	Attenuation loss and numerical aperture in optical communication.
	Part –B Simulation using Simulink
1	Design of active second order Butterworth low pass filter.
2	Design of active second order Butterworth high pass filter.
3	Design of active second order Butterworth Band pass filter.
4	Design of active second order Butterworth Band elimination filter.
5	Pulse Width Modulation and Demodulation
6	Pulse Position Modulation and Demodulation

Course outcomes:

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

CO1: Simulate the digital modulation schemes with the display of waveforms and computation of performance parameters. ·

CO2: Design and test the analog/digital modulation circuits/systems and display the waveforms.

CO3: Design and illustrate the operation of instrumentation amplifier, LPF, HPF, DAC and oscillators using linear IC.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2					1	1	1		1	3	3	
CO2	3	3	2					1	1	1		1	3	3	
CO3	3	3	2					1	1	1		1	3	3	
CO4	3	3	2					1	1	1		1	3	3	
CO5	3	3	2					1	1	1		1	3	3	

High-3, Medium-2, Low-1

IV Semester

8051 MICROCONTROLLER			
Course Code:	22ECT405A	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

This course will enable students to:

• Understand the difference between a microprocessor and a microcontroller and embedded microcontrollers.
• Familiarize the basic architecture of 8051 micro controller.
• Program 8051microprocessor using Assembly Level Language and C.
• Understand the interrupt system of 8051 and the use of interrupts.
• Understand the operation and use of inbuilt Timers/Counters and the Serial port of 8051.
• Interface 8051 to external memory and I/O devices using its I/O ports.

Module-1	**08 hrs**
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. **Text2 :** Chapter 1 section 1.1 to 1.3, chapter 3 sections 3.1 to 3.3	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1, L2, L3	

Module-2	**08 hrs**
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions. **Text2 :** Chapter 5 , chapter 6, chapter 7, chapter 8	
Teaching Learning Method: Chalk and talk method, Power Point Presentation **RBT Level:** L1, L2, L3	

Module-3	**08 hrs**
8051 Jump and Call instructions & Embedded C Jump and Call Instructions, Calls & Subroutine instructions. Assembly language program examples of subroutines and involving loops. 8051 Programming in C: Data Types and Time delay in 8051 C, I/O programming in 8051 C, Logical Operations in C. **Text2 :** chapter 8 section 8.1 to 8.4.**Text1** : chapter 7 section 7.1 to 7.3	
Teaching Learning Method: Chalk and talk method, Power Point Presentation **RBT Level:** L1, L2, L3	

Module-4	**08 hrs**
8051 Timers and Serial Port 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.	

Text1: Chapter 9 section 9.1 Chapter 10 section 10.1 to 10.5	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power Point Presentation, L1, L2, L3

Module-5	**08 hrs**

8051 Interrupts and Interfacing Applications.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly and C language interfacing programming.

Text 1: Chapter 11 section 11.1 and 11.2 Chapter 13 section 13.1 to 13.2, chapter 12 section 12.1, chapter 17 section 17.2

Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power Point Presentation L1, L2, L3

Course outcomes:

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

CO1. Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and instruction set of 8051.

CO2. Develop 8051 Assembly level programs using the 8051-instruction set.

CO3. Develop 8051 Assembly / C language program to generate timings and waveform using 8051 timers, to send & receive serial data using 8051 serial ports.

CO4. Develop 8051 Assembly / C language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.

CO5. Interface various peripheral devices to 8051 using I/O ports.

Suggested Learning Resources:

Text Books:

1: Kenneth J. Ayala, "The 8051 Microcontroller", Kenneth J Ayala, 3rd Edition, Thomson/Cengage Learning.

2: Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D. McKinlay, "The 8051 Microcontroller and Embedded Systems – using assembly and C", PHI, 2006 / Pearson, 2006.

Reference Books:

1. "The 8051 Micro controller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.

2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

Web Links: https://swayam.gov.in/nd1_noc20_cs25

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Programming 8051 using Assembly and C programs.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3							1					2	
CO2	3	3	2		1				1					2	
CO3	3	3	2		1				1					2	
CO4	3	3	2		1				1					2	
CO5	3	3	2		1				1					2	

High-3, Medium-2, Low-1

IV Semester

POWER ELECTRONICS			
Course Code:	22ECT405B	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To get an overview of different types of power semi-conductor devices.
2. To understand the operation, characteristics of thyristors.
3. To Understand the fundamental principles of basic power electronic converters.
4. To describe the need and functions of different types of power electronics converters.

Module-1	**08 hrs**
INTRODUCTION: Applications of power electronics, power semiconductor devices, control characteristics, types of power electronic circuits, peripheral effects **THYRISTORS:** Introduction, characteristics, two transistor model, turn-on and turn off methods, di/dt and dv/dt protection.	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1, L2,L3	

Module-2	**08 hrs**
COMMUTATION TECHNIQUES: Introduction, natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation.	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1,L2,L3	

Module-3	**08 hrs**
AC VOLTAGE CONTROLLERS: Introduction, principle of ON-OFF and phase control, single-phase bidirectional controllers with resistive loads. **CONTROLLED RECTIFIERS**: Introduction, principle of phase controlled converter operation, single-phase semi converters, full converters and dual converters	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1,L2,L3	

Module-4	**08 hrs**
DC CHOPPERS: Introduction, principle of step-down operation, step-down chopper with RL loads, Principle of step-up operation, step-up chopper with Resistive load, performance parameters, Chopper classification (Class A to Class E).	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1,L2,L3	

Module-5	**08 hrs**
INVERTERS: Introduction, principle of operation, performance parameters, single phase bridge inverters, Three phase inverters, voltage control of single phase inverters, current source inverter, principles of switched mode power supply (SMPS).	

Teaching Learning Method:	Chalk and talk method, Power Point Presentation,
RBT Level:	L1,L2,L3

Course outcomes:

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

CO1. To give an overview of applications power electronics, different types of power semiconductor devices, explain the construction, working and characteristics of SCR

CO2. To analyse different commutation techniques of SCR

CO3. To explain the analysis techniques, performance parameters and characteristics of controlled rectifiers and Voltage controllers

CO4. To explain the analysis techniques, performance parameters and characteristics of DC-to-DC converters

CO5. To explain the analysis techniques, performance parameters and characteristics of DC to AC converters

Suggested Learning Resources:

Text Books:

1: Ned Mohan, Tore M. Undeland, William P Robbins, "Power Electronics: Converters, Applications, and Design", John Wiley and Sons Inc.,, New York, 2003.

2: Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Prentice Hall , India, New Delhi, 2004.

3: Joseph Vithayathil, e, "Power Electronics, Principles and Applications", Tata McGraw-Hill Edition, 2010.

Reference Books:

1: Singh M.D., Khanchandani K B, "Power Electronics", Tata McGraw Hill, 2nd Edition, New Delhi, 2007.

2: Dr.P.S.Bimbra., "Power Electronics", Khanna Publications, 3rd Edition, 2003.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											2	3	
CO2	3	3											2	3	
CO3	3	3											2	3	
CO4	3	3											2	3	
CO5	3	3											2	3	

High-3, Medium-2, Low-1

IV Semester

OPERATING SYSTEMS			
Course Code:	22ECT405C	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

This course will enable students to understand:

1. the history and types of operating systems.
2. the design issues associated with operating systems development.
3. the process management and scheduling of operating system.
4. the concepts of memory management of operating system.
5. the file and I/O operations of operating system.

Module 1	**07 hrs**

INTRODUCTION: Goals of an O.S, Operation of an O.S

OVERVIEW OF OPERATING SYSTEMS: OS and computer system, Efficiency, system performance and user convenience, Classes of operating systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems. **TEXT 1**

Teaching Learning Method:	Chalk and Board, PowerPoint Presentation
RBT Level:	L1, L2

Module 2	**08 hrs**

STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of an operating system, Operating systems with monolithic structure, Layered design of an operating system, Virtual machine operating systems, Kernel based operating systems. **TEXT1**

Teaching Learning Method:	Chalk and Board, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module 3	**08 hrs**

PROCESS MANAGEMENT: Process and programs, Programmer view of processes, OS view of processes, Threads.

SHEDULING: Preliminaries, Non pre-emptive scheduling policies, pre-emptive scheduling policies, scheduling in practice. **TEXT 1**

Teaching Learning Method:	Chalk and Board, Power Point Presentation
RBT Level:	L1, L2, L3

Module 4	**08 hrs**

MEMORY MANAGEMENT: Managing the memory hierarchy, static and dynamic memory allocations, memory allocation to a process, reuse of memory, contiguous and non contiguous memory allocation, paging, segmentation, segmentation with paging.

VIRTUAL MEMORY: Virtual memory Basics, Demand paging, page replacement policies. **TEXT 1**

Teaching Learning Method: **RBT Level:**	Chalk and Board, PowerPoint Presentation L1, L2

Module 5	**08 hrs**

FILE SYSTEMS: File system and IOCS, Files and file organization, Fundamentals of file organizations, Directory structures, File protection, Interface between file system and IOCS, Allocation of disk space. implementation of file access. **TEXT 1**

Teaching Learning Method: **RBT Level:**	Chalk and Board, Power Point Presentation L1, L2

Course outcomes

CO1: Understand the evolution of operating systems and various types of operating systems in practice

CO2: Analyse the structure of operating system.

CO3: Analyse the concepts of process management and different scheduling management.

CO4: Understand the design issues in memory management and virtual memory.

CO5: Understand the file and I/O management techniques.

Suggested Learning Resources:

Text Book:

1. D. M. Dhamdhare, "Operating Systems", Second Edition, TMH, 2008

Reference Books:

1. Stalling William, "Operating Systems", Sixth edition, Pearson Education,
2. Avi Silberchatz, Peter Baer Galvin, Greg Gagne, "Operating system Concepts", Ninth edition, John wiley & Sons

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Seminar on different types of Operating System.
2. Problems on Scheduling Policies.
3. Posters about Fundamental Functions of Operating System.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		2								1			
CO2		2	2	2						2		2			
CO3	2	2	2			1	1					1			
CO4	2	2		2							1	1			
CO5	2	2									1	1			

High-3, Medium-2, Low-1

IV Semester

C++ Basics			
Course Code	22ECL406A	**CIE Marks**	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	**SEE Marks**	50
Credits	01	**Exam Hours**	03

Course objectives:

1. Understand object-oriented programming concepts, and apply them in solving problems.
2. To create, debug and run simple C++ programs.
3. Introduce the concepts of functions, friend functions, inheritance, polymorphism and function overloading.
4. Introduce the concepts of exception handling and multithreading.

Sl. No	Experiments
1	Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX & Min.
2	Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept.
3	Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students.
4	Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and – operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 else display error
5	Demonstrate simple inheritance concept by creating a base class FATHER with data members: *First Name, Surname, DOB & bank Balance* and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create & initialize F1 & S1 objects with appropriate constructors & display the FATHER & SON details.
6	Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate & display total income of a family using Friend function.
7	Write a C++ program to accept the student detail such as name & 3 different marks by get_data()method & display the name & average of marks using display() method. Define a friend function for calculating the average marks using the method mark_avg().
8	Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & theyhave area to calculate & return the area of rectangle & triangle respectively.
9	Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE class containing data members & members functions: i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer). (ii) Member functions: To read the data of an employee, to calculate Net_Salary & to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_All_Allowances_IT).
10	Write a C++ program with different class related through multiple inheritance & demonstrate theuse of different access specified by means of members variables & members functions.

11	Write a C++ program to create three objects for a class named count object with data members such as roll_no & Name. Create a members function set_data ( ) for setting the data values & display ( ) member function to display which object has invoked it using „this" pointer.
12	Write a C++ program to implement exception handling with minimum 5 exceptions classes including two built in exceptions.

Suggested Learning Resources:

1. Object oriented programming in TURBO C++, Robert Lafore, Galgotia Publications, 2002
2. The Complete Reference C++, Herbert Schildt, 4th Edition, Tata McGraw Hill, 2003.
3. Object Oriented Programming with C++, E Balaguruswamy, 4th Edition, Tata McGraw Hill, 2006.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**2**							**1**	**1**					
CO2	**3**	**2**							**1**	**1**					
CO3	**3**	**2**							**1**	**1**					
CO4	**3**	**2**							**1**	**1**					
CO5	**3**	**2**							**1**	**1**					

High-3, Medium-2, Low-1

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

BDA Outer Ring Road, Mallathalli,Bengaluru-56

Board Of Studies 2023-24

Approved
Scheme and Syllabus of
V & VI Semester

For

2021 Batch

Submitted by

Department of Electronics and Communication Engineering

To

DEAN (Academic)

Dr. Ambedkar Institute of Technology, Bengaluru-560056

Outcome Based Education(OBE) and Choice Based Credit System (CBCS) (As per NEP2020)

B.E. Electronics & Communication Engineering

Tentative Scheme of Teaching and Examination effective from the Academic Year 2022-23

(Applicable to 2021 batch)

V Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	PCC	21ECT501	Digital Communication	ECE	3	0	0			3	50	50	100	3
2	IPCC	21ECT502	Microprocessor & Microcontrollers	ECE	3	0	2		3	3	50	50	100	4
3	PCC	21ECT503	Computer Communication Networks	ECE	3	0	0		3	3	50	50	100	3
4	PCC	21ECT504	Microwave Theory & Antennas	ECE	3	0	0		3	3	50	50	100	3
5	PCC	21ECL505	Communication Lab II	ECE	0	0	2		3	3	50	50	100	1
6	AEC	21ECT506	Research Methodology & Intellectual Property Rights	Any Department	2	0	0		2	2	50	50	100	2
7	HSSC	21CV507	Environmental Studies	Civil/Chemistry	1	0	0			1	50	50	100	1
8	AEC	21ECT508	Ability Enhancement Course-V	ECE						1/2	50	50	100	1
9	HSSC	21HSN509	Aptitude and Verbal ability skills		1	0	1	0		2	50	--	PP/NP	0
										Total	450	400	800	18

Ability Enhancement Course - V

21ECL5081	Computer Communication Networks Lab	**21ECL5083**	Antenna Design & Testing
21ECL5082	Communication Simulink Toolbox	**21ECL5084**	Microwaves toolbox

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VI Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	HSSC	21ECT601	Technological Innovation Management and Entrepreneurship								50	50	100	03
2	IPPC	21ECT602	Computer Organization & ARM Microcontrollers	ECE	2	2			4	3	50	50	100	04
3	PCC	21ECT603	VLSI Design & Testing	ECE	3				3	3	50	50	100	03
4	PEC	21ECE604X	Professional Elective -I	ECE	3				3	3	50	50	100	03
5	OEC	21ECE605X	OpenElective-I	ECE	3				3	3	50	50	100	03
6	PCC	21ECL606	VLSI Laboratory	ECE			2		2		50	50	100	01
7	MP	21ECM607	Mini Project	ECE			2		2		50	50	100	03
8	INT	21ECI608	Innovation/Entrepreneurship /Societal Internship								50	50	100	03
9	HSSC	21HSN609	Analytical & Reasoning skills	Placement Cells	2	0	0-		02	--	50	--	PP/NP	00
								Total			500	450	900	22

Research/Industrial Internship - At the End of the sixth / Seventh semester (in two cycles to accommodate all the students of the University) Research/Industrial Internship shall be carried out – Based on industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo a mandatory internship of 24 weeks during the vacation of VI/VII semesters. A University Viva-Voce examination shall be conducted during VII/VIII semester and the prescribed credit shall be included in VII/VIII semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. Research internship Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give you the flavour of current research going on on a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Industry internships: This is an extended period of work experience undertaken by university/Institute students looking to supplement their degree with professional development. The students are allowed to prepare themselves for the workplace and develop practical skills as well as academic ones. It also helps them learn to overcome

unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with "unexpected contingencies" helps students recognize, appreciate, and adapt to organization realities by tempering knowledge with practical constraints.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or a group having not more than 4 students. (or Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications) CIE procedure for
Mini-project: (i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. SEE for Mini-project: (i) Single discipline: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester-end examination (SEE) conducted at the department. (ii) Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester-end examination (SEE) conducted separately at the departments to which the student/s belongs
Open Elective Courses: Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives). Selection of an open elective shall not be allowed if, • The candidate has studied the same course during the previous semesters of the program. • The syllabus content of open electives is similar to that of the Departmental core courses or professional electives. • A similar course, under any category, is prescribed in the higher semesters of the program. • Registration to electives shall be documented under the guidance of the Programme Coordinator/ Advisor/Mentor

Professional Elective Courses-I		**Open Elective Courses-I**	
Subject Code	**Title**	**Subject Code**	**Title**
21ECE6041	Artificial Neural Networks (L:T:P :: 2:2:0)	**21ECE6051**	Communication Engineering (L:T:P :: 3:0:0)
21ECE6042	Cryptography (L:T:P :: 2:2:0)	**21ECE6052**	Microcontrollers (L:T:P :: 3:0:0)
21ECE6043	Python Programming (L:T:P :: 2:0:2)	**21ECE6053**	Basic VLSI Design (L:T:P :: 3:0:0)
21ECE6044	Micro Electro Mechanical Systems (L:T:P :: 3:0:0)	**21ECE6054**	Electronic Circuits with Verilog (L:T:P :: 2:0:2)
		21ECE6055	Sensors & Actuators (L:T:P :: 3:0:0)

Assessment and Evaluation method

V Semester:

- **21ECT502- Microprocessor & Microcontrollers** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers
- **ESC or ETC, of 03 credits Courses** shall have only a theory component (L: T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L: T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
- **All 01 Credit** courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ
- **Integrated courses (IPCC)** will have 50 marks CIE and 50 Marks SEE.
- **Non-integrated courses (PCC)** have 50 marks CIE (including 5 marks Assignment and 5 marks Group Activity) and 50 Marks SEE.

VI Semester:

- **21ECT602- Computer Organization & ARM Microcontrollers** shall have the 03 hours of theory examination (SEE), however, practical sessions question shall be included in the theory question papers
- **ESC or ETC, of 03 credits Courses** shall have only a theory component (L: T :P:S=3:0:0:0) or if the nature the of course required practical learning then the syllabus shall be designed as an Integrated course (L: T:P:S= 2:0:2:0). All **PLC** courses are Integrated courses.
- **All 01 Credit-** courses shall have the SEE of 02 hours duration and the pattern of the question paper shall be MCQ
- **Integrated courses (IPCC)** will have 50 marks CIE and 50 Marks SEE.
- **Non-integrated courses (PCC)** have 50 marks CIE (including 5 marks Assignment and 5 marks Group Activity) and 50 Marks SEE.

V Semester

DIGITAL COMMUNICATION			
Course Code:	21ECT501	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:2	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	3	**Exam Hours:**	3

Course objectives:

1. Understand the mathematical representation of signal, symbol, and noise.
2. Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
3. Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
4. Compute performance parameters and mitigate channel induced impediments in corrupted channel conditions.

Module-1

Bandpass Signal to Equivalent Low pass:

Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).

Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10). Overview of HDB3, B3ZS, B6ZS (Ref.1: 7.2)

Teaching Learning Method:	Lectures, Interactive (Q & A discussion), Activity/Assignment based
RBT Level:	L1, L2, L3

Module-2

Signaling over AWGN Channels-

Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver.

(Text 1:7.1, 7.2, 7.3, 7.4)

Teaching Learning Method:	Lectures, Interactive (Q&A discussion), Activity/Assignment based
RBT Level:	L1, L2, L3, L4

Module-3

Digital Modulation Techniques:

Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M ary PSK, M-ary QAM. (Relevant topics in Text 1of 7.6, 7.7).

Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability (Relevant topics in Text 1of 7.8).

Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) (Text 1: 7.11, 7.12. 7.13).

Teaching Learning Method:	Lectures, Interactive (Q&A discussion), Activity/Assignment based
RBT Level:	L1, L2, L3, L4

Module-4

Communication through Band Limited Channels:

Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero lSI-The Nyquist Criterion (statement only), Design of band limited signals with controlled lSI-Partial Response signals, Probability of error for detection of Digital PAM: Probability of error for detection of Digital PAM with Zero lSI, Symbol-by-Symbol detection of data with controlled lSI (Text 2: 9.1, 9.2, 9.3.1, 9.3.2). Channel Equalization: Linear Equalizers (ZFE, MMSE), (Text 2: 9.4.2).

Teaching Learning Method:	Lectures, Interactive (Q&A discussion), Activity/Assignment based
RBT Level:	L1, L2, L3, L4

Module-5

Principles of Spread Spectrum:

Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2).

Teaching Learning Method:	Lectures, Interactive (Q&A discussion), Activity/Assignment based
RBT Level:	L1,L2,L3

Course outcomes:

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

CO1. Understand the representation of bandpass signals into its' equivalent low pass signals and properties of various line code formats and their usage.

CO2. Analyse and compute the performance parameters of two different receiver architectures when low-pass and band pass symbol sets defined over symbol period are transmitted over noisy and noiseless bandlimited channel.

CO3. Generate and Evaluate different M-ary symbol sets on performance parameters at the receiver side under ideal and corrupted bandlimited channels.

CO4. Demonstrate the digital transmission of bandpass signals through bandlimited channels incorporating signal design processed at the receiver to meet specified performance criteria.

CO5. Understand the principles of spread spectrum communications to identify its application to recent communication systems in use today.

Suggested Learning Resources:

Text Books:

1: Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0—47 1-64735-5.

2: John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8—131-70573-5.

3: B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0- 198-07380-2.

Reference Books

1: Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.

2: Bernard Sklar and Ray, "Digital Communications - Fundamentals and Applications", Pearson Education, Third Edition, 2014, ISBN: 978-81-317-2092-9.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Presentation on various topics

Activity 2: Small projects on applications of digital communication
Activity 3: Group discussion on various topics of digital communication

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1			1	1	2		1		2	2	2	2
CO2	3	3	2	2		2	1	2		2		3	3	3	3
CO3	3	3	2	2		2	2	2		3		3	3	3	3
CO4	3	3	2	2		2	2	2		3		3	3	3	3
CO5	2	1	1	1		2	2	2		3		3	2	2	3

High-3, Medium-2, Low-1

V Semester

MICROPROCESSOR & MICROCONTROLLER			
Course Code:	21ECU502	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52	**Total Marks:**	100
Credits:	04	**Exam Hours:**	03

Course objectives:

i. To illustrate the architecture of 8051 Micro controller.

ii. To understand the Special Function Registers, addressing modes and memory organization.

iii. To introduce Assembly language programming of 8051 Micro controller.

iv. To understand the RISC V microprocessors and Instruction Set Architecture.

Module-1	**08 hrs**

Introduction to microprocessors and microcontrollers: RISC & CISC CPU Architectures, Harvard & Von- Neumann CPU architecture.

8051 Microcontroller: The 8051 Architecture, Pin diagram of 8051, Memory organization, External Memory interfacing. Classification of Instruction, Addressing modes: Immediate addressing, Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, bit direct addressing. **(TEXT 1 and TEXT 2)**

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation, YouTube videos
RBT Level:	L1, L2, l3

Module-2	**07 hrs**

8051 Instructions and Programming: 8051 instructions, Data transfer instructions,Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instructions. 8051 programming: Assembler directives, Assembly language programs and Time delay calculations. Stack operations.

Introduction to Embedded C: C data types, logical operations, programming 8051 using embedded C

(**TEXT 2 and TEXT 3**)

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation, YouTube videos
RBT Level:	L1, L2, L3

Module-3	**09 hrs**

Timers/counters: 8051 timers/counters, delay program, counter programming 8051 timers to generate delay and counting operation using assembly and C language. Data communication, Basics of Serial Data Communication, 8051 Serial Communication, Programming in assembly and C.

Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, Programming in assembly and C.

8051 interrupts and interfacing: Interrupts and Basics of interrupts, 8051 Interfacing and Applications: Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to DAC,LED/LCD. **(TEXT 3)**

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation, YouTube videos
RBT Level:	L1, L2, L3

Module-4	**08 hrs**

RISC-V Microprocessors: Introduction, Modular vs. Incremental ISAs, ISA Design 101
RV32I: RISC-V Base Integer ISA: Introduction, RV32I Instruction formats, RV32I Registers, RV32I Integer Computation, RV32I Loads and Stores, RV32I Conditional Branch, RV32I Unconditional Jump, RV32I Miscellaneous, Comparing RV32I, ARM-32, MIPS-32, and x86-32 using Insertion Sort.
RISC-V Assembly Language: Introduction, Calling convention, Assembly, Linker, Static vs. Dynamic Linking, Loader.

Teaching Learning Method:	Chalk and Talk, Power point presentations, Programming assignments
RBT Level:	L1, L2, L3

Module-5	**08 hrs**

RV32M: Multiply and Divide- Introduction
RV32F and RV32D: Single- and Double-Precision Floating Point- Introduction, Floating-Point Registers, Floating-Point Loads, Stores, and Arithmetic, Floating-Point Converts and Moves, Miscellaneous Floating-Point Instructions, Comparing RV32FD, ARM-32, MIPS-32, and x86-32 using DAXPY.
RV32C: Compressed Instructions- Introduction, **RV32A: Atomic Instructions-** Introduction, **RV32V: Vector**- Introduction

Teaching Learning Method:	Chalk and Talk, Power point presentations, Programming assignments
RBT Level:	L1, L2, L3

PRACTICAL COMPONENT OF IPCC

Conduct the following experiments by writing Assembly Language Program (ALP) using ARM Cortex M3 Registers using an evaluation board/simulator and the required software tool

Sl. No.	**Experiments**	**12 hrs**
1	**Data transfer programs-** **i]** WALP to transfer data between internal and external memories **ii]** WALP to exchange data between internal and external memories	
2	**Arithmetic operation programs-** **i]** WALP to add 10 bytes of data **ii]** WALP to add multi bytes of data **iii]** WALP to find the square and cube of an 8 bit binary number	

3	**Logical operation programs-**
	i] Let X, Y, Z refer to the contents of the memory location 30h,31h,and 32h respectively, write an ALP to perform the following logical operations;
	If X=00 perform the operation Y OR Z.
	If X=01 perform the operation Y AND Z.
	If X=02 perform the operation Y XOR Z.
	ii] WALP to compare the bytes of data present at the memory location 21h and 22h and represent the result of comparison through the bits whose addresses are 00h and 01h.
	If (21h)<(22h)then clear the bit at 01h and also set the bit at 00h.
	If (21h)>(22h)then set the bit at 01h and also clear the bit at 00h.
	If (21h)=(22h)then set the bit at 01h and also set the bit at 00h.
	iii] WALP to stimulate the Boolean expression **Eg:** Y=A+BC.	

4	i] **Parity Program-** WALP to count the number of 1's in a byte which is be accepted from the port 0 and displays the result on the port1. **ii] Palindrome Program-** WALP to check whether the gives byte is a valid bit palindrome,accep byte from the port0 and display aah if valid else 00H in port1.
5	**Timer program-** WALP to generate the output value AAH and 55H alternatively at the Port 0 for every 2 sec.
6	**Counter program-** WALP to count the number of inputs to the counter_0 by configuring the timer as a counter in mode_1 and display the count in ports.
7	**Design and implementation of RISC V Processor Subsystem using Verilog:** a) Floating Point Addition & Subtraction. b) Floating Point Multiplication. c) Operand Logic.
Demonstration Experiments (For CIE only not for SEE) Conduct the following experiments on an 8051 MC using evaluation version of Embedded 'C' & Keil µvision-3 tool/compiler.	
08	**Demonstrate the serial communication-**WALP to transfer the characters serially.
09	**Demonstrate the interfacing of DAC programs-**WALP to generate the wave forms i] Square wave ii] Triangle wave **iii]** Ramp wave (Both positive and negative)
10	**Demonstrate the interfacing of LED programs-** WALP to display the count (UP/DOWN/LED BLINKING)

Course outcomes:

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

CO1: understand the features and architecture of 8051 Microcontroller.

CO2: program 8051 microcontroller using assembly language and embedded C.

CO3: configure timers/counters of 8051 and understand serial communication and interrupts of 8051.

CO4: understand need of RISC V microprocessors and basics of RV32I.

CO5: understand basics of RV32M, RV32F, RV32D, RV32C, RV32A, RV32V.

Suggested Learning Resources:

Text Books:

1. **Yu-cheng Liu, Glenn A.Gibson,** "Microcomputer Systems: The 8086/8088 Family Architecture, Programming, and Design"

2. **Kenneth J. Ayala,** "The 8051 Microcontroller Architecture, Programming & Applications", 2e Penram International, 1996 / Thomson Learning 2005.

3. **Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D. McKinlay,** "The 8051 Microcontroller and Embedded Systems – using assembly and C", PHI, 2006 / Pearson, 2006.

4. **The RISC-V Reader: An Open Architecture** Atlas Beta Edition, 0.0.1, David Patterson and Andrew Waterman, October 4, 2017

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Programming Assignments / Mini Projects can be given to improve programming skills

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					2	2	2				2	1	3	1
CO2	3	3	3			2		2	1			2	1	3	1
CO3	3	3	3		3	2		2	1			2	1	3	1
CO4	3	2	3		3	2		2	1			2	1	3	1
CO5	3	2	2		2	2		2	1				1	3	1

High-3, Medium-2, Low-1

V Semester

COMPUTER COMMUNICATION NETWORKS			
Course Code:	21ECT503	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:1	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	3	**Exam Hours:**	03

Course objectives:
This course will enable students to:
1. Provide Insight into the basics of networking, OSI reference and TCP/IP model.
2. Study of access links, protocols, error detection and correction techniques in the data link layer.
3. Understanding of routing algorithms, addressing techniques of the network layer.
4. Understand Protocol techniques of the transport layer.
5. Identify Services, Protocols, directory service and Security of the application layer

Module-1	**08 hrs**
Introduction: Data communication, Networks, Network types. **Network Models:** TCP/IP Protocol Suite, The OSI Model, Connecting devices. (1.1, 1.2, 1.3.1-1.3.4, 2.2, 2.3, 17.1.1-17.1.3 of Text)	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation of OSI and TCP-IP protocol suites, Example of ARP and RARP.
RBT Level:	L1, L2, L3
Module-2	**08 hrs**
Data-Link Layer: Introduction, Link Layer addressing. **Error Detection and Correction:** Introduction, Cyclic Redundancy Check, Checksum. **Media Access Control:** Random Access, Controlled Access, Channelization, Virtual LAN. **Wired LANs**: Ethernet Protocol, Standard Ethernet. (9.1, 9.2.1, 9.2.2, 10.1, 10.3.1, 10.4.1, 10.4.2, 12.1, 12.2, 12.3, 13.1,13.2.1, 13.2.2,17.1, 17.2 of Text)	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animations showing Framing, CSMA, Connecting devices, Problems on ALOHA, CSMA, Framing and Standard Ethernet.
RBT Level:	L1, L2, L3
Module-3	**08 hrs**
Network Layer: Network Layer services, Packet Switching, IPV4 Addresses, IPv6 addressing and Protocol. **Network Layer Protocols:** Internet Protocol (IP). **Unicast Routing:** Routing Algorithms. (18.1, 18.2, 18.4, 19.1, 20.1, 20.2 ,22.1 ,22.2 of Text)	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation of DHCP, routing protocols, Numericals on Addressing,
RBT Level:	L1, L2, L3
Module-4	**08 hrs**
Transport Layer: Introduction, Transport Layer Protocols. **Transport-Layer Protocols in the Internet:** Port numbers, User Datagram Protocol, Transmission Control Protocol. 23.1, 23.2, 24.1.2 - 24.3.5 of Text)	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation/Implementation of Flow control protocols and TCP using

RBT Level:	simulators. L1, L2, L3

Module-5	**08 hrs**

Application Layer: Introduction, **Standard Client – Server Protocols**: World Wide Web and HTTP, Domain Name system: Name space, DNS in internet, Resolution, DNS Messages, Registrars, DDNS, security of DNS, Network Security.
(25.1, 26.1.2, 26.2, 26.3, 26.6 ,31.1 of Text)

Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation, YouTube videos, Animation/Implementation of HTTP, FTP, DNS using network simulators.
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Define the network components, layers, addressing, topology, and connectivity and network types for data transmission.

CO2. Distinguish the basic network configurations and standards associated with each network.

CO3. Describe the layering architecture of computer networks and distinguish between the OSI reference model and TCP/IP protocol suite.

CO4. Identify the protocols and functions associated with the transport layer services.

CO5.Construct a network model and determine the routing of packets using different routing algorithms and identify the concepts of Network security.

Suggested Learning Resources:

Text Books:

1: Forouzan, “Data Communications and Networking”, 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.

Reference Books

1: James J Kurose, Keith W Ross, “Computer Networks”, Pearson Education.

2: Wayne Tomasi, “Introduction to Data Communication and Networking”, Pearson India, 1st edition.

3: Andrew Tannenbaum, “Computer Networks”, Prentice Hall.

4: William Stallings, “Data and Computer Communications”, Prentice Hall

Web Links:

https://nptel.ac.in/courses/106105183.

TCP/IP Tutorial and Technical Overview, (IBM Redbook) - Download From http://www.redbooks.ibm.com/abstracts/gg243376.html

TCP/IP Guide, Charles M Kozierok, Available Online - http://www.tcpipguide.com/ Request for Comments (RFC) - IETF - http://www.ietf.org/rfc.html

https://cosmolearning.org/courses/computer-networks-524/video-lectures/

https://www.eecis.udel.edu/~bohacek/videoLectures/ComputerNetworking/ComputerNetworking_v2.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Implementation of simple networks and various networking protocols and algorithms using simulators like NCTUns / CISCO packet tracer and measurement of various parameters using WireShark

Activity 2: Implementation of simple networks and various networking protocols and algorithms in

C/C++/Python

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	**3**	**3**	**3**	-	-	-	-	**3**	**3**	-	-	-	-	-
CO2	-	**3**	**3**	**3**	**3**	-	-	-	**3**	**3**	-	-	**1**	-	-
CO3	-	**3**	**3**	**3**	**3**	-	-	-	**3**	**3**	-	**3**	-	**1**	-
CO4	-	**3**	**3**	**3**	**3**	-	-	-	**3**	**3**	-	**3**	**2**	-	-
CO5	-	**3**	**3**	**3**	**3**	-	-	-	**3**	**3**	-	**3**	**2**	**2**	-

High-3, Medium-2, Low-1

V Semester

MICROWAVE THEORY AND ANTENNA			
Course Code:	21ECT504	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03 Hrs

Course objectives:

1. Understanding the basics of microwave and waveguides.
2. Understanding the concepts of microwave networks, microwave passive devices and semiconductor devices.
3. Understanding microwave tubes, microwave design principles and antenna basics.
4. Understanding the importance of point sources, arrays and radiations from wires.
5. To understand different types of antennas like aperture, reflector, broadband and Microstrip antennas.

Module-1	**08 hrs**
Introduction to Microwaves -History of Microwaves, Microwave Frequency bands, applications of Microwaves, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. **Waveguides-**Rectangular waveguide, Introduction to Circular waveguide (No derivations and Numerical examples), Strip line, Micro strip line. **TEXT 1,2**	
Teaching Learning Method:	Chalk and Talk, YouTube videos
RBT Level:	L1, L2

Module-2	**08 hrs**
Microwave Network Analysis - Network parameters for microwave circuits, Scattering Parameters. Microwave Passive devices and semiconductor Devices - Microwave passive devices - Directional Coupler, Power Divider, Magic Tee, Attenuator. Microwave Semiconductor Devices - Gunn Diodes, IMPATT diodes, PIN diodes. **TEXT 1,2**	
Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2

Module-3	**08 hrs**
Microwave Tubes: Klystron- two cavity klystron amplifier and reflex klystron (klystron oscillator) Antenna Basics - Physical concept of radiation, near and far field regions, basic antenna parameters: radiation patterns, beam area, radiation Intensity, beam efficiency, reciprocity, directivity and gain, antenna apertures, effective height, bandwidth ,radiation efficiency, radio communication Link and antenna field zones. **TEXT 1,2,3.4**	
Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2

Module-4	**08 hrs**
Radiations from wires: Short electric dipole, resistance of dipole, Half wave dipole antenna, folded dipole antennas. **Point Sources & their arrays** - Arrays, Point source, Power theorem and its application, Examples of power patterns, Field patterns, Phase patterns, Array of isotropic point sources different cases, non-isotropic sources, principle of pattern multiplication, linear arrays of n elements of equal amplitude & spacing, broad side, end fire arrays. **TEXT 3,4**	

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2, L3

Module-5	**08 hrs**

Aperture and Reflector Antennas- Huygens' principle, Babinet's principle, Radiation from sectoral and pyramidal horns: design concepts, prime-focus parabolic reflector and cassegrain antennas.
Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods. **TEXT 3,4**

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2, L4

Course outcomes:

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

CO1. Identify the microwave frequency band, its applications and different types of waveguides
CO2. Analyse microwave networks, microwave passive devices and semiconductor devices.
CO3. Apply microwave design principle, microwave tubes and antenna basics.
CO4. Be able to analyse the radiation patterns from different types of wires, point sources and their arrays.
CO5. Illustrate and design antennas like aperture, reflector, and broadband. Microstrip antenna.

Suggested Learning Resources:

Text Books:

1. Collin RE. Foundations for microwave engineering. John Wiley & Sons; 2007.
2. Annapurna Das, Sisir K Das, Microwave Engineering, TMH Publication, 2001
3. J.D. Kraus, Antennas and wave propagation, McGraw Hill, 4th ediation 2010.
4. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.

Reference Books

1. Microwave Devices and circuits- Liao / Pearson Education. 1992
2. M.Kulkarni., "Microwave devices and Radar Engg."Umesh Publications, 2011
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.

Web Links:

1. www.nptel.in
2. https://www.academia.edu/12559664/Collin_Foundations_for_Microwave_Engineering
3. https://www.academia.edu/13759443/Basic_Antennas_Understanding_Practical_Antennas_and_Design_Joel_R_Hallas_2009
4. www.youtube/microwave , www.youtube/antennas

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Creating physical modules

2: Exploring new technologies and presenting

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1												2	
CO2	3	3	2											2	
CO3	3	2	3	2			1					1	2	2	
CO4	3	3	2	2			1					1	2	2	

CO5	3	3	2	2			**1**					**1**	**2**	**2**	

High-3, Medium-2, Low-1

V Semester

COMMUNICATION LAB II			
Course Code	**21ECL505**	**CIE Marks**	50
Teaching Hours/Week (L: T: P: S)	0:0:2:0	**SEE Marks**	50
Credits	01	**Exam Hours**	03

Course objectives:

This laboratory course enables students to

- Design and demonstrate communication circuits for different digital modulation techniques.
- To simulate Source coding Algorithms using C/C++/ MATLAB code.
- To simulate Error correcting and detecting codes using C/C++/ MATLAB code.
- Simulate the networking concepts and protocols using C/C++/ Network simulation tool.
- Understand entropies and mutual information of different communication channels.

Sl.No.	**Experiments**
	Implement the following using discrete components
1	FSK generation and detection
2	PSK generation and detection
3	DPSK Transmitter and receiver
4	QPSK Transmitter and Receiver
	Implement the following in C/C++/MATLAB/Scilab/Python or any other Suitable software
5	Write a program to encode binary data using Huffman code and decode it.
6	Write a program to encode binary data using a (7,4) Hamming code and decode it.
7	Write a program to encode binary data using a ((3,1,2)/suitably designed) Convolution code and decode it.
8	For a given data, use CRC-CCITT polynomial to obtain the CRC code. Verify the program for the cases a) Without error b) With error
	Implement the following algorithms in C/C++/MATLAB/Network simulator
9	Write a program for congestion control using leaky bucket algorithm.
10	Write a program for distance vector algorithm to find suitable path for transmission.
11	Write a program for flow control using sliding window protocols.
12	Configure a simple network (Bus/star) topology using simulation software **OR** Configure a simple network (Ring/Mesh) topology using simulation software.
	Demonstration Experiments (For CIE)
13	Configure and simulate simple Wireless Local Area network.
14	Simulate the BER performance of (2, 1, 3) binary convolutional code with generator sequences g(1) =(1 0 1 1) and g(2) =(1 1 1 1) on AWGN channel. Use QPSK modulation scheme. Channel decoding is to be performed through Viterbi decoding. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size 3 lakh bits. Also find the coding gain.
15	Simulate the BER performance of (7, 4) Hamming code on AWGN channel. Use QPSK modulation scheme. Channel decoding is to be performed through maximum-likelihood decoding. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size 5 lakh bits. Use the following parity check matrix for the (7, 4) Hamming code. Also

	find the coding gain. $H = \begin{bmatrix} 1 & 0 & 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 \end{bmatrix}$
16	Simulate the BER performance of rate 1/3 Turbo code. Turbo encoder uses two recursive systematic encoders with $G(D) = [1, \frac{1+D^4}{1+D+D^2+D^3+D^4}]$ and pseudo-random interleaver. Use QPSK modulation scheme. Channel decoding is to be performed through maximum a-posteriori (MAP) decoding algorithm. Plot the bit error rate versus SNR (dB), i.e. $P_{e,b}$ versus E_b/N_0. Consider binary input vector of size of around 3 lakh bits and the block length as 10384 bits. Also find the coding gain.

Course outcomes (Course Skill Set):

On the completion of this laboratory course, the students will be able to:

1. Design and test the digital modulation circuits and display the waveforms.
2. To Implement the source coding algorithm using C/C++/ MATLAB code.
3. To Implement the Error Control coding algorithms using C/C++/ MATLAB code.
4. Illustrate the operations of networking concepts and protocols using C programming and network simulators.

Suggested Learning Resources:

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.
2. K Sam Shanmugam, "Digital and analog communication systems", John Wiley India Pvt. Ltd, 1996.
3. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2					1	1	1		1	3	3	
CO2	3	3	2					1	1	1		1	3	3	
CO3	3	3	2					1	1	1		1	3	3	
CO4	3	3	2					1	1	1		1	3	3	

` **High-3, Medium-2, Low-1**

V Semester

COMPUTER COMMUNICATION NETWORKS LAB			
Course Code:	21ECL5081	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:1:0(L - T –P)	**SEE Marks:**	50
Total Hours of Pedagogy:	12	**Total Marks:**	100
Credits:	1	**Exam Hours:**	03

Course objectives:

This course will enable students to:

1. Demonstrate the simulation of few protocols of data link layer and network layer.
2. Demonstrate the network communication between source and destination.
3. Demonstrate the detection and correction of error in data communication.
4. Simulate the configuration and verification of networking devices.

	Syllabus Contents
1	Write a C program to implement Bit Stuffing and DeStuffing. **RBT Level: L2, L3**
2	Write a C program to simulate a Character Stuffing and Destuffing for a given message. **RBT Level: L2, L3**
3	Write a C program to compute a Polynomial Checksum for a given binary data frame. **RBT Level: L2, L3**
4	Write a C program to simulate a Shortest Path Algorithm. **RBT Level: L2, L3**
5	Using TCP/IP Sockets, write a client-server program to make client to communicate with Server using socket programming techniques in python. **RBT Level: L2, L3**
6	Using TCP/IP Sockets, write to program to develop server and client file sharing system using Socket Programming in python. **RBT Level: L2, L3**
	Part B
7	**Configuring and Verifying LAYER 2 Switches**: For a given number of HOSTS, create a network by connecting Networking Devices, Configure and verify the same. Configuration includes HOSTNAME, BANNER, PASSWORD (CONSOLE, TELNET and ENABLE), MANAGEMENT IP and DEFAULT GATEWAY **RBT Level: L2, L3**
8	**Configuring and Verifying VLAN**: Create a network for a given number of HOSTS and Establish a communication between the hosts by connecting Switches, configure them and verify the same. Configuration includes Switch port configuration and encapsulation methods. **RBT Level: L2, L3**
9	**Configuring and Verifying IP Routing**: Using IP routing ,Establish a communication between the hosts by connecting the Network Devices, configure them and verify the same among different networks. Configuration includes: 1. Static Routing 2. Dynamic Routing (RIP/OSPF/EIGRP) **RBT Level: L2, L3**

10	**Configuring DHCP Server on a Router**: Configure DHCP server on a router to assign IP address dynamically to the hosts and verify the same. a. For One Broadcast Domain b. For Many Broadcast Domain **RBT Level: L2, L3**
11	**Configure a mail server**: Configure mail server using Packet tracer. **RBT Level: L2, L3**
12	Demonstration of Serial Communication using (i) RS232 (ii) MODEM COMMUNICATION (iii) FIBER OPTIC COMMUNICATION **RBT Level: L2**
	PART-C
13	[Simulation Case-Study] Dr. AIT is granted a block of addresses starting from 192.168.100.0/24. The Dr. AIT College committee decided to distribute these blocks of addresses to THREE Departments with each department receiving just FOUR Addresses. 1. Design the sub blocks and give the slash notation to each sub block
14	2. Simulate the above case using Cisco-packet Tracer. Note: while simulating Consider the following Constraints: a. Establish a communication within the Departments. b. Only HOD's of each Department can communicate (Single user from each Department) with each other.
15	Configure port security on the interface of the switch for the network topology.

Course outcomes:

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

CO1.Conduct an experiment to simulate various protocols of data link and network layer.

CO2.Configure and verify VLAN and switches.

CO3.Write the program to verify the detection and correction of error.

CO4.Demonstrate the data communication between two systems using the communication kit.

CO5.Write the program to transfer file and establish connection between two devices .

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	-	3	3	-	-	-	3	3	-	3	2	3	-
CO2	-	2	-	3	3	-	-	-	3	3	-	3	2	3	-
CO3	-	2	-	3	3	-	-	-	3	3	-	3	2	3	-
CO4	-	2	-	3	3	-	-	-	3	3	-	3	2	3	-
CO5	-	2	-	3	3	-	-	-	3	3	-	3	2	3	-

High-3, Medium-2, Low-1

V Semester

COMMUNICATION SIMULINK TOOLBOX			
Course Code:	21ECL5082	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	13	**Total Marks:**	100
Credits:	01	**Exam Hours:**	03

Course objectives:

- To impart knowledge of simulation software in digital communications
- To develop skills required to build and analyze the performance of various simulated communication systems under different conditions

Sl. No	Experiments
1	Modulation & demodulation of a random binary data stream using 16 – QAM.
2	Bit error rate (BER) improvement using Pulse Shaping on 16 – QAM signal. (Use forward error correction (FEC) coding.)
3	Perform OFDM modulation and obtain time domain and frequency domain plots to show a low rate signal, a high-rate signal, and a frequency selective multipath channel response.
4	(a) Simulate basic OFDM with no cyclic prefix. (b) Perform Equalization, Convolution, and Cyclic Prefix Addition on basic OFDM.
5	OFDM with FFT Based Oversampling - Modify an OFDM+ Cyclic Prefix signal to efficiently output an oversampled waveform from the OFDM modulator.
6	Simulate a basic communication system in which the signal is first QPSK modulated and then subjected to Orthogonal Frequency Division Multiplexing (OFDM).
7	Obtain the scatter plots & eye diagrams of a QPSK signal to visualize the signal behaviour in presence of AWGN.
8	(a) Generate a multiband signal using the Communications Toolbox. (b) Random noise generation using Simulink & display histogram plots of Gaussian, Rayleigh, Rician, and Uniform noise.
9	QPSK Transmitter and Receiver in Simulink.
10	Multipath Fading Channel in Simulink – For example: Simulate QPSK transmission over a • multipath Rayleigh fading channel and • a multipath Rician fading channel.
11	Adjacent and Co-Channel Interference using Simulink. • Use PSK-modulated signals to show the effects of adjacent and co-channel interference on a transmitted signal.
12	Modulation Classification with Deep Learning • Predict Modulation Type Using CNN

Course outcomes:

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

1. Perform sampling, aliasing, filtering, and quadrature modulation through simulation.
2. Plot signal space representation of digital modulation techniques.
3. Design and implement a pulse shape and matched filter to avoid inter-symbol interference and maximize receiver SNR.
4. Demonstrate advanced wireless communication techniques like Multipath fading, CCI etc. and model the same using MATLAB / Simulink

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															

High-3, Medium-2, Low-1

V Semester

ANTENNA DESIGN & TESTING			
Course Code:	21ECL5083	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	13	**Total Marks:**	100
Credits:	01	**Exam Hours:**	03

Course objectives:

1. To understand the various antenna parameters.
2. Conduct experiments to study the Radiation pattern of Antennas.
3. Design different types of antenna arrays and study the pattern characteristics (MATLAB)
4. Design of MMIC antennas like Patch Antenna and study the characteristics.

Sl. No	**Experiments**
1	To obtain the radiation pattern of a Yagi-Uda Antenna array and calculate its directivity
2	To obtain the radiation pattern of a Dipole Antenna array and calculate its directivity.
3	To calculate the aperture of a Dipole Antenna.
4	To obtain the near and far fields of a given antenna and compare the fields.
5	To obtain the Radiation pattern of a microstrip antenna.
6	To obtain the resonant frequency of a Yagi-Uda /Dipole antenna.
7	To obtain the bandwidth of a given Antenna.
8	Plot 2-D and 3-D radiation pattern of omnidirectional antenna using MATLAB.
9	Design and implementation of a broadside array using MATLAB.
10	Design and implementation of an endfire array using MATLAB.
	Demonstration Experiments (For CIE)
11	Design of a Patch Antenna using HFSS Software.
12	Design of a dipole Antenna using HFSS Software.

Course outcomes:
At the end of the course the student will be able to:

1. Analyze the radiation pattern and characteristics of antenna
2. Ability to design various antenna
3. Ability to use different software tools to study antenna characteristics
4. Analyze radiation pattern of linear array antennas

Suggested Learning Resources:

1. Antennas and Wave Propagation -John D Krauss, Ronald J Marhefka, Ahmad S Khan, 4th Edition,
2. McGraw Hill Education, 2013.
3. https://www.mathworks.com/help/antenna/
4. Help and demo files of the HFSS and MATLAB software

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2											2	2	
CO2	3	3	3										3	3	
CO3	2	2	2	2	3								2	2	
CO4	2	2	2	2									2	2	

High-3, Medium-2, Low-1

V Semester

MICROWAVES TOOLBOX			
Course Code:	21ECL5084	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	13	**Total Marks:**	100
Credits:	01	**Exam Hours:**	03

Course objectives:

- Identification of microwave components/devices.
- Study basic principles of operation of microwave devices/ components

Sl. No	Experiments
1	V- I Characteristics of Gunn-diode.
2	Study of characteristics of Magic Tee
3	Coupling and Isolation characteristics of microstrip directional coupler.
4	Determination of power division of microstrip power divider.
5	Determination of resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
6	Measurement of frequency, guide wavelength, power and attenuation in a microwave Test bench.
7	Study of characteristics of E plane Tee / H plane Tee.
8	To measure unknown impedance using Smith chart through test bench setup.
9	Measurement of VSWR and reflection coefficient and attenuation in a microwave test bench Setup.
10	Study propagation of wave using rectangular waveguide using MATLAB.
11	Study of impedance matching using MATLAB.
12	To calculate phase and group velocity using MATLAB.

Course outcomes:

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

1. Demonstrate the characteristics of microwave sources.
2. Demonstrate the characteristics of directional coupler
3. Study of microwave measurement procedure.
4. Apply MATLAB toolbox for study of microwaves phenomena.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**3**	**2**									**2**	**2**	**2**	
CO2	**3**	**3**	**3**	**3**		**2**						**1**	**2**	**2**	
CO3	**2**	**2**	**2**	**2**	**3**								**2**	**2**	
CO4	**2**	**2**	**2**	**2**									**2**	**2**	

High-3, Medium-2, Low-1

VI Semester

TECHNOLOGICAL INNOVATION MANAGEMENT AND ENTREPRENEURSHIP			
Course Code:	21ECT601	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52	**Total Marks:**	100
Credits:	04	**Exam Hours:**	03

Course objectives:

1. Understand basic skills of Management.
2. Understand the need for Entrepreneurs and their skills.
3. Identify the Management functions and Social responsibilities.
4. Understand the Ideation Process, creation of Business Model.

Module-1	**08 hrs**

Management: Nature and Functions of Management- Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession
(Selected topics of Chapter 1, Text 1).
Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making-Meaning, Types and Steps in Decision Making
(Selected topics from Chapters 4 & S, Text 1). L1,L2

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation
RBT Level:	L1, L2

Module-2	**07 hrs**

Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees-Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; Staff"mg-Need and Importance, Recruitment and Selection Process
(Selected topics from Chapters 7, 8 & 11, Text 1).
Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication - Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership.
(Selected topics from Chapters 15to 18and 9, Text 1).

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation
RBT Level:	L1, L2

Module-3	**08 hrs**

Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance
(Selected topics from Chapter 3, Text 1).
Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship
(Selected topics from Chapter 2, Text 2).

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation
RBT Level:	L1, L2

Module-4	**08 hrs**

Family Business: Role and Importance of Family Business, Contributions of Family Business in India, Stages of Development of a Family Business, Characteristics of a Family-owned Business in India, Various types of family businesses
(Selected topics from Chapter 4, (Page 71-75) Text 2).
Idea Generation and Feasibility Analysis- Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility.
(Selected topics from Chapter 6(Page No. 111-117) & Chapter 7(Page No. 140-142), Text 2)

Teaching Learning Method:	Chalk and Talk, Power point presentations
RBT Level:	L1, L2

Module-5	**08 hrs**

Business model- Meaning, designing, analyzing and improvising; Business Plan - Meaning, Scope and Need; Financial, Marketing, Human Resource and Production/Service Plan; Business plan Formats; Project report preparation and presentation; Why some Business Plan fails?
(Selected topics from Chapter 8 (Page No 159-164, Text 2)

Teaching Learning Method:	Chalk and Talk, Power point presentations
RBT Level:	**RBT Level:** L1, L2

Course outcomes:

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

CO 1. Understand the fundamental concepts of Management and Entrepre- neurship and opportunities in order to setup a business

CO 2. Identify the various organizations' architecture

CO 3. Describe the functions of Managers, Entrepreneurs and their social responsibilities

CO 4. Understand the components in developing a business plan

CO 5. Recognize the various sources of funding and institutions supporting entrepreneurs.

Suggested Learning Resources:

Text Books:

1. Principles of Management - P.C Tripathi, P.N Reddy, McGraw Hill Education, fYhEdition, 2017. ISBN-13:978-93-5260-5354.

2. Entrepreneurship Development Small Business Enterprises- Poomima MCharantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.

3. Dynamics ofEntrepreneurial Development and Management byVasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.

4. Robert D. Hisrich, Mathew J. Manimala, Michael PPeters and DeanA. Shepherd, "Entrepreneurship", S1h Edition, Tata Mc-Graw HillPublishing Co.Ltd.- New Delhi, 2012

Reference Books:

1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, I01h Edition 2016. ISBN- 978-93-392-2286-4.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

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CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

High-3, Medium-2, Low-1

VI Semester

COMPUTER ORGANIZATION & ARM MICROCONTROLLERS			
Course Code:	21ECT602	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52	**Total Marks:**	100
Credits:	04	**Exam Hours:**	03

Course objectives:

1. to explain the basic organization of a computer system.
2. to understand functioning of different sub systems, such as processor, Input/output, and memory.
3. to describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.
4. to Program ARM Cortex M3 for different applications.
5. to analyse the Thumb instruction set and different C-Programming concepts.

Module-1	**08 hrs**
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Input/Output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB. **Text 1**	
Teaching Learning Method: Chalk and Talk, PowerPoint Presentation, YouTube videos **RBT Level:** L1, L2	
Module-2	**08 hrs**
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations. **Basic Processing Unit**: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Basic concepts of pipelining, **Text 1**	
Teaching Learning Method: Chalk and Talk, PowerPoint Presentation, YouTube videos **RBT Level:** L1, L2	
Module-3	**08 hrs**
ARM Embedded Systems: Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware – AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System, Applications. ARM Processor Fundamentals, ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions. **Text 2**	
Teaching Learning Method: Chalk and Talk, PowerPoint Presentation, YouTube videos **RBT Level:** L1, L2	
Module-4	**08 hrs**
Introduction to the ARM Instruction set: Introduction, Data processing instructions, Load – Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution. **Text 2**	
Teaching Learning Method: Chalk and Talk, Power point presentations, Programming assignments **RBT Level:** L1, L2, L3	
Module-5	**08 hrs**

Introduction to the THUMB instruction set: Introduction, THUMB register usage, ARM – THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions.

Efficient C Programming: Overview of C Compilers and optimization, Basic C Data types, C looping structures. **Text 2**

Teaching Learning Method:	Chalk and Talk, Power point presentations, Programming assignments
RBT Level:	**RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC

Conduct the following experiments by writing Assembly Language Program (ALP) using ARM Cortex M3 Registers using an evaluation board/simulator and the required software tool

Sl. No.	Experiments	12 hrs
1.	Write an ALP to find the sum of first 10 integer numbers.	
2.	Write an ALP to calculate the value of the polynomial function.	
3.	Write an ALP to store data in desired Memory location.	
4.	Write a C program to Output the message using UART of LPC1768.	
5.	Write a C Program to interface LED using LPC 1768.	
6.	Write a C Program to interface Relay using LPC 1768.	
7.	Write a C Program for DC motor/Stepper motor rotation using LPC 1768.	
8.	Write a C Program to interface a DAC and generate Triangular and Square waveforms.	
9.	Write a C program to demonstrate the use of an External interrupt in LPC 1768	

Demonstration Experiments (For CIE only not for SEE)

Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil µvision-4 tool/compiler.

10.	Write a C program to interface a Real Time Clock (RTC) of LPC 1768.
11.	Write a program to read on-chip ADC value and display it on UART terminal using LPC 1768
12.	Write a C program to interface Keypad using LPC 1768.

Course outcomes:

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

CO 1: Understand the basic structure and Input output organization of a computer system.

CO 2: Explain functioning of different sub systems, such as processor, Input/output, and memory.

CO 3: Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.

CO 4: Apply the instruction set to Program ARM Cortex M3 for different applications.

CO5: Analyse Thumb Instruction set and C-Programming Concepts to Program ARM Cortex M3.

Suggested Learning Resources:

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 8).

2. Andrew N Sloss, Dominic System and Chris Wright, "ARM System Developers Guide", Elsevier, Morgan Kaufman publisher, 1st Edition, 2008

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Programming Assignments / Mini Projects can be given to improve programming skills

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												3	
CO2	3	2												3	
CO3	3	2												3	
CO4	3	2	2		2		1		1					3	
CO5	3	2	2		2		1		1					3	

High-3, Medium-2, Low-1

VI Semester

VLSI DESIGN AND TESTING			
Course Code:	21ECT603	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	3

Course objectives:

1. Impart knowledge of MOS transistor theory and CMOS technology
2. Learn the operation principles and analysis of inverter circuits.
3. Infer the operation of Semiconductor memory circuits.
4. Demonstrate the concept of CMOS testing.

Module-1	**8 Hrs**
Introduction: A Brief History, MOS Transistors, CMOS Logic (1.1 to 1.4 of TEXT1) **MOS Transistor Theory:** Introduction, Long-channel I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (2.1, 2.2, 2.4 and 2.5 of TEXT1).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, PowerPoint Presentation, YouTube videos, Videos on transistor working Self-study topics: MOSFET Scaling and Small-Geometry Effects RBT Level: L1, L2, L3
Module-2	**08 Hrs**
Fabrication: CMOS Fabrication and Layout, Introduction, CMOS Technologies, Layout Design Rules, (1.5 and 3.1 to 3.3 of TEXT1). **Delay:** Introduction, Transient Response, RC Delay Model, Linear Delay Model, Logical Efforts of Paths (4.1 to 4.5 of TEXT1, except sub-sections 4.3.7, 4.4.5, 4.4.6, 4.5.5 and 4.5.6).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation, YouTube videos, Videos on fabrication Self-study topics: Layouts of complex design using Euler's method RBT Level: L1, L2, L3
Module-3	**08 Hrs**
Semiconductor Memories: Introduction, Dynamic Random Access Memory (DRAM) and Static Random Access Memory (SRAM), Nonvolatile Memory, Flash Memory, Ferroelectric Random Access Memory (FRAM) (10.1 to 10.6 of TEXT2)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, PowerPoint Presentation, YouTube videos on Standard cell memory Design Self-study topics: Memory array design RBT Level: L1, L2, L3
Module-4	**08 Hrs**
Faults in digital circuits: Failures and faults, Modelling of faults, **Temporary faults Test generation for combinational logic circuits**: Fault diagnosis of digital circuits, test generation techniques for combinational circuits, Detection of multiple faults in combinational logic circuits. (1.1 to 1.3, 2.1 to 2.3 of TEXT3)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, PowerPoint Presentation, YouTube videos, videos on testing algorithms for test generation Self-study topics: Testable combinational logic circuits RBT Level: L1, L2, L3

Module-5	07 Hrs

Test generation for sequential circuits: Testing of sequential circuits as iterative combinational circuits, state table verification, test generation based on circuits structure, functional fault models, test generation based on functional fault models.

Design of testable sequential circuits: Controllability and Observability, Adhoc design rules, design of diagnosable sequential circuits, The scan path technique, LSSD, Random Access scan technique, partial scan. (4.1 to 4.5, 5.1 to 5.7 of TEXT3)

Teaching Learning Method:	Chalk and talk method/Power point presentation, YouTube videos
RBT Level:	Self-study topics: Memory testing techniques RBT Level: L1, L2, L3

Course outcomes:

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

CO1. Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.

CO2. Draw the basic gates using the stick and layout diagram with the knowledge of physical design aspects.

CO3. Interpret memory elements along with timing considerations.

CO4. Interpret testing and testability issues in combinational logic design.

CO5. Interpret testing and testability issues in Sequential logic design.

Suggested Learning Resources:

Text Books:

1: "CMOS VLSI Design- A Circuits and Systems Perspective", Neil H E Weste, and David Money Harris 4th Edition, Pearson Education. 2015

2: "CMOS Digital Integrated Circuits: Analysis and Design", Sung Mo Kang & Yosuf Leblebici, Third Edition, Tata McGraw-Hill, 2019.

3: "Digital Circuit Testing and Testability", Lala Parag K, New York, Academic Press, 1997

Reference Books:

1: "Basic VLSI Design", Douglas A Pucknell, Kamran Eshraghian, 3rd Edition, Prentice Hall of India publication, 2005.

2: "Essential of Electronic Testing for Digital, Memory and Mixed Signal Circuits", Vishwani D Agarwal, Springer, 2002.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Model displayed for clear understanding of fabrication process of MOS transistor

2: Practise session can be held to understand the significance of various layers in MOS process, with the help of coloured layouts

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		2								1	1	1
CO2	3	3	2										1	1	1
CO3	3	2	1										1	1	1
CO4	3	3	2										1	1	1
CO5	3	2	3										1	1	1

High-3, Medium-2, Low-1

VI Semester

ARTIFICIAL NEURAL NETWORK			
Course Code:	21ECE6041	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	3

Course objectives:

1. To provide a strong foundation of fundamental concepts and structures in Neural Networks.
2. To understand the Analysis of different techniques and algorithms in Neural Networks.
3. To study the concepts of setting parameters and multilayered Networks.
4. To understand the concepts of Prediction, Polynomial Neural Networks.
5. To analyze the Optimization techniques in Neural Networks
6. To enable the student to apply these techniques in applications which involve neural models.

Module-1	**08 hrs**
Introduction, Fundamental concepts and models of Artificial Neural Network, Biological Neural Networks, structure and function of single neuron, neural network architectures, modelling of neural network, Neural learning process.	
Teaching Learning Method: **RBT Level:**	L1, L2

Module-2	**09 hrs**
Supervised Learning for single layer network: Perceptron, linear separability, Perceptron Training Algorithm, Delta rule. Supervised Learning for Multi- layer network: multilevel discrimination, preliminaries, Back propagation, setting parameter values.	
Teaching Learning Method: **RBT Level:**	L1, L2

Module-3	**08 hrs**
Prediction networks: Introduction, Recurrent network, Radial Basis Functions, Polynomial networks: Higher order network, Sigma–pi network, Function link architecture, Pi-sigma network	
Teaching Learning Method: **RBT Level:**	L1, L2

Module-4	**08 hrs**
Unsupervised learning: Winner take all networks. Hamming networks, Maxnet, Simple competitive learning, Hebb rule, Optimization Methods: Hop filed networks, Travelling Sales person problem, Iterated Gradient Descent	
Teaching Learning Method: **RBT Level:**	L1, L2

Module-5	**06 hrs**
Introduction to Neural Network Algorithms- Support Vector Machine, Generative Adversarial Network, Convolutional Neural Network, Machine learning, Deep learning **Case studies on neural network modelling:** Facial Recognition, Stock Market Prediction Weather Forecasting, Voice Recognition	

Teaching Learning Method:	
RBT Level:	L2, L3, L4

Course outcomes:

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

CO1. Understand the basic concepts of Neural Networks.

CO2. Analysis and development of different techniques in neural networks.

CO3. Analysis the concepts of Prediction Networks.

CO4. Understand and analysis of the concepts of Polynomial networks in Artificial

CO5. Use different optimization, machine learning technique for different model and enveloping the application.

Suggested Learning Resources:

Text Books:

1. Kishan Mehrotra, C. K. Mohan, Sanjay Ranka,Penram, "Elements of Artificial Neural Networks", 2007.
2. J. Zurada, Jaico, "Introduction to Artificial Neural Systems", *2003.*
3. Neural Networks A Classroom Approach- Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition 2019
4. Mohamad H Hassoun " Fundamentals of Artificial Neural Networks, PHI 2019 edition

Reference Books

1. Simon Hayking, "Neural Networks: A Comprehensive Foundation",2nd Edition, PHI.
2. Laurene Fausett, "Fundamentals of Neural Networks: Architecture, Algorithms and Applications", Person Education, 2004.

Web Links: nptl.iitm.ac.in

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Project on Voice recognition system

Activity 2: Stock Market Prediction

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	1	-	-	2	-	-	-	3	3	3	2
CO2	3	3	2	2	1	-	-	2	-	-	-	3	3	3	2
CO3	3	2	2	2	1	-	-	2	-	-	-	3	3	3	2
CO4	3	3	2	2	2	-	-	2	-	-	-	3	3	3	2
CO5	3	1	1	2	1	-	-	2	-	-	-	3	3	3	2

High-3, Medium-2, Low-1

VI Semester

CRYPTOGRAPHY			
Course Code:	21ECE6042	**CIE Marks:**	40+5+5
Teaching Hours/Week (L:T:P:S):	3: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	3	**Exam Hours:**	03

Course objectives:

This course will enable students to:

- Preparation: To prepare students with fundamental knowledge/ overview in the field of Information Security with knowledge of mathematical concepts required for cryptography.
- Core Competence: To equip students with a basic foundation of Cryptography by delivering the basics of symmetric key and public key cryptography and design of pseudo random sequence generation technique

Module-1	**08 hrs**
Basic Concepts of Number Theory and Finite Fields: Divisibility and The Division Algorithm Euclidean algorithm, Modular arithmetic, Groups, Rings and Fields, Finite fields of the form GF(p), Polynomial Arithmetic, Finite Fields of the Form GF(2m) (Text 1: Chapter 3)	
Teaching Learning Method:	Chalk and Talk, YouTube videos, Flipped Class Technique Programming on implementation of Euclidean algorithm, multiplicative inverse, Finite fields of the form GF(p), construction of finite field over GF(2m).
RBT Level:	L1, L2, L3
Module-2	**08 hrs**
Introduction: Computer Security Concepts, A Model for Network Security (Text 1: Chapter 1) **Classical Encryption Techniques**: Symmetric cipher model, Substitution techniques, Transposition techniques (Text 1: Chapter 1)	
Teaching Learning Method:	Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. Programming on Substitution and Transposition techniques. Self-study topics: Security Mechanisms, Services and Attacks.
RBT Level:	L1, L2, L3
Module-3	**08 hrs**
Block Ciphers: Traditional Block Cipher structure, Data encryption standard (DES) (Text 1: Chapter 2: Section1, 2) The AES Cipher. (Text 1: Chapter 4: Section 2, 3, 4) **More on Number Theory**: Prime Numbers, Fermat's and Euler's theorem, discrete logarithm. (Text 1: Chapter 7: Section 1, 2, 5)	
Teaching Learning Method:	Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. Implementation of SDES using programming languages like C++/Python/Java/Scilab. Self-study topics: DES S-Box- Linear and differential attacks
RBT Level:	L1, L2, L3
Module-4	**08 hrs**

ASYMMETRIC CIPHERS: Principles of Public-Key Cryptosystems, The RSA algorithm, Diffie - Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography (Text 1: Chapter 8, Chapter 9: Section 1, 3, 4)	
Teaching Learning Method:	Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. Implementation of Asymmetric key algorithms using programming languages like C++/Python/Java/Scilab. Numerical examples on Elliptic Curve Cryptography
RBT Level:	L1, L2, L

Module-5	**08 hrs**

Pseudo-Random-Sequence Generators and Stream Ciphers: Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs, A5, Hughes XPD/KPD, Nanoteq, Rambutan, Additive generators, Gifford, Algorithm M, PKZIP (Text 2: Chapter 16)	
Teaching Learning Method:	Chalk and Talk, YouTube videos, Flipped Class Technique and PPTs. Implementation of simple stream ciphers using programming languages like C++/Python/Java/Scilab.
RBT Level:	L1, L2, L3

Course outcomes:

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

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

1. Explain traditional cryptographic algorithms of encryption and decryption process.
2. Use symmetric and asymmetric cryptography algorithms to encrypt and decrypt the data.
3. Apply concepts of modern algebra in cryptography algorithms.
4. Design pseudo random sequence generation algorithms for stream cipher systems.

Suggested Learning Resources:

Text Books:

1. William Stallings , "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325-1877-3
2. Bruce Schneier, "Applied Cryptography Protocols, Algorithms, and Source code in C", Wiley Publications, 2nd Edition, ISBN: 9971-51-348-X.

Reference Books:

1. Cryptography and Network Security, Behrouz A Forouzan, TMH, 2007.
2. Cryptography and Network Security, Atul Kahate, TMH, 2003

Weblink:

https://nptel.ac.in/courses/106105031

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VI Semester

PYTHON PROGRAMMING			
Course Code:	21ECE6043	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	3	**Exam Hours:**	03

Course objectives:

1. To acquire the fundamentals of Python programming language.
2. To attain an understanding of functions and collection types.
3. To familiarize the concepts of sequence types, data structures, and error handling in Python.
4. To realize the concepts of object-oriented in Python.
5. To get familiarised with the concepts of file handling and regular expressions.

Module-1	**08 hrs**

Introduction: Introducing Python, Setting Up Python in Windows, introducing IDLE.

Parts of Python programming: Identifiers, Variables, Keywords, statements and expressions, variables, operators, datatypes-Built-in datatypes, sequences in Python, indentation, comments, Input and Output statements.

Control Flow - if, if-elif-else, while loop, for loop, infinite loop, break, continue, return, and pass statements.

Teaching Learning Method:	Chalk and Talk, Power Point Presentation
RBT Level:	L1, L2, L3

Module-2	**08 hrs**

Functions - Defining Functions, Calling Functions, positional Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Recursive Functions, Anonymous Functions, and Function Decorators.

Strings and Lists: Creation, Basic operations, built-in methods, del statement.

Teaching Learning Method:	Chalk and Talk, Power Point Presentation
RBT Level:	L1, L2, L3

Module-3	**08 hrs**

Tuples, and Dictionaries: Creating Tuples, Accessing the Tuple Elements, Basic Operations on Tuples, Operations on Dictionaries, Dictionary methods, using foe loop with dictionaries, converting lists into dictionaries, Converting Strings into Dictionary,

Data Structures in Python: Linked Lists, Stacks, Queues, Deques. Programming Examples.

Exceptions: Errors in a Python Program, Exception Handling, The Except Block, User Defined Exceptions.

Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-4	**08 hrs**

Object Oriented Programming in Python: Features of Object -Oriented Programming System (OOPS), Creating a class, The Self Variable, constructor, Types of variables, Namespaces, Types of Methods, passing members of one class to another class, Inner classes.

Inheritance and Polymorphism: Constructors in Inheritance, overriding Super class constructors and methods, The super() method, Types of Inheritance: Single/Multiple, Method Resolution order, Polymorphism, Operator Overloading, Method overloading, Method Overriding. Programming Examples	
Teaching Learning Method:	Chalk and Talk, PowerPoint Presentation
RBT Level:	L1, L2, L3

Module-5	**08 hrs**
Files in Python: Types of files, Opening and closing file, Working with Text files, Working with Binary Files, with statements, Pickle in Python, The seek() and tell() methods, Random accessing Binary files, zipping, and unzipping Files, reading and writing to CSV files. **Regular Expressions**: Regular Expression, Sequence Characters in Regular Expression, Quantifiers in Regular Expression, Special Characters in Regular Expression, Using Regular Expression on Files, Retrieving Information from a HTML File.	
Teaching Learning Method:	Chalk and Talk, Power Point Presentation
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Apply the knowledge of Python scripting elements, Python constructs, datatypes, to solve engineering problems.

CO2. Identify the problem to apply the concepts of control structures, functions and error handling to solve them using the Python programming language

CO3. Apply the knowledge of Python and use the language scripting elements to manage the data, build the data structures, and handle errors.

CO4. Designing the solution to real-world problems through object-oriented concepts such as Inheritance, Polymorphism, and operator overloading.

CO5. Demonstrating the concepts of file handling and regular expressions

Suggested Learning Resources:

Text Books:

1: Core Python Programming: Dr. R. Nageshwara Rao, Dream Tech Press,2018

2: Introduction to Python Programming, Gowrishankar S, Veena A, CRC Press,2019

Reference Books:

1: Think Python, Allen Downey, Green Tea Press.

2: Core Python Programming, W.Chun, Pearson.

3: Introduction to Python, Kenneth A. Lambert, Cengage

4: Learning Python, Mark Lutz, Orielly

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Group activity for a group of 4 or 5 students -5 marks

Activity 2: Two assignments are evaluated for 5 marks: Assignment1 – From Unit 1 and 2, Assignment2 from units 3,4 and 5

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1				1					2		
CO2	2	2	3	1	2			1					2		
CO3	2	3	3	2	2			1					2		
CO4	2	3	3	1	2			1					2		
CO5	1	3	2	1	2			1					2		

High-3, Medium-2, Low-1

VI Semester

MICRO ELECTRO MECHANICAL SYSTEMS			
Course Code:	21ECE6044	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0:1	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. **Preparation**: To prepare students with fundamental knowledge/ overview in the field of Micro Electro Mechanical Systems.
2. **Core Competence**: To equip students with a basic foundation in electronic engineering, mechanical engineering, electrical engineering, chemistry, physics and mathematics fundamentals required for comprehending the operation and application of MEMS circuits, design.
3. **Professionalism & Learning Environment:** To inculcate in students an ethical and professional attitude by providing an academic environment inclusive of effective communication, teamwork, ability to relate engineering issues to a broader social context, and life-long learning needed for a successful professional career.

Module 1	**08 hrs**

Overview of MEMS and Microsystems: MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization, Applications and Markets.

Text1:**1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9**

Teaching Learning Method:	Chalk and talk method, Animation of MEMS products and applications.
RBT Level:	L1, L2, L3

Module 2	**08 hrs**

Working Principles of Microsystems: Introduction, Microsensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers, Microfluidics.Text**1: 2.1,2.2,2.3,2.4,2.5,2.6**

Engineering Science for Microsystems Design and Fabrication: Introduction, Atomic Structure of Matter, Ions and Ionization Molecular Theory of Matter and Intermolecular Forces, Plasma Physics, Electrochemistry.**Text1: 3.1,3.2,3.3, 3.4, 3.7,3.8**

Teaching Learning Method:	Power Point Presentation, You Tube videos, Animations of MEMS Microsensors, Micro actuators, Micro accelerometers and Microfluidics, molecules, Ions and matter
RBT Level:	L1, L2, L3

Module 3	**08 hrs**

Engineering Mechanics for Microsystems Design: Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermomechanics, Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis.**Text1:4.1,4.2,4.3,4.4,4.5,4.6,4.7**

Teaching Learning Method:	Chalk and talk method, Power Point Presentations and supporting You Tube Videos Solve numerical related to Thin Plates, and Vibration. Self-study topics: solve numerical related to the topics
RBT Level:	L1,L2, L3

Module 4	**08 hrs**

Scaling Laws in Miniaturization: Introduction, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Electromagnetic Forces, Scaling in Electricity, Scaling in Fluid Mechanics, Scaling in Heat Transfer. **Text1:6.1,6.2,6.3,6.4,6.5,6.6,6.7,6.8**	
Teaching Learning Method:	Chalk and Talk Method, You Tube Videos, Solve numerical related to scaling in Geometry Self-study topics: solve numerical of the topics
RBT Level:	L1, L2, L3

Module 5	**08 hrs**
Overview of Micromanufacturing: Introduction, Bulk Micro manufacturing, Surface Micro machining, The LIGA Process, Summary on Micro manufacturing. **Text1:9.1,9.2,9.3,9.4,9.5** **Microsystem Packaging**: Introduction, Overview of Mechanical Packaging of Microelectronics, Microsystem Packaging. **Text1:11.1,11.2,11.3**	
Teaching Learning Method:	Power Point Presentation, YouTube videos, Animation of MEMS micro manufacturing Supporting animation videos on packaging.
RBT Level:	L1, L2, L3

Course outcomes (Course Skill Set)

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

1. Appreciate the technologies related to Micro Electro- Mechanical Systems.
2. Understand design and fabrication processes involved with MEMS devices.
3. Analyze the MEMS devices and develop suitable mathematical models
4. Understand design of scaling factors in MEMS devices.
5. Know various application areas, mechanical packaging for MEMS devices.

Suggested Learning Resources:

Text Book:

1. Tai-Ran Hsu, MEMS and Microsystems: DesignandManufacture,1st Ed, Tata Mc Graw Hill.

Reference Books:

1. Hans H Gatzen, Volker Saile, JurgLeuthold, Microand Nano Fabrication: Tool sand Processes, Springer, 2015.
2. DilipKumar Bhattacharya, Brajesh Kumar Kaushik, Microelectromechanical Systems (MEMS), Cengage Learning.
3. Chang Liu, Foundations of MEMS, Pearson Ed.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Develop mini projects and Final year projects using MEMS components to address the real-world problems

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2											2	3	
CO2	3	3	3		2								3	3	
CO3	3	3	3	2									1	3	
CO4		3	3				2						1	3	
CO5													1	2	

High-3, Medium-2, Low-1

VI Semester

COMMUNICATION ENGINEERING			
Course Code:	**21ECE6051**	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	**3:0:0:0**	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Describe essential elements of an electronic communication system.
2. Understand Amplitude, Frequency & Phase modulations, and Amplitude demodulation.
3. Define the sampling theorem and methods to generate pulse modulations.
4. Learn the various methods of digital modulation techniques and compare the different schemes.
5. Introduce the basic concepts of information theory and coding
6. Understand the basic concepts of wireless and cellular communications.

Module-1	**08 Hrs**
Introduction to Electronic Communications: Historical perspective, Electromagnetic frequency spectrum, Signal and its representation, Elements of electronic communications system, primary communication resources, signal transmission concepts, Analog and digital transmission, Modulation, Concept of frequency translation, Signal radiation and propagation (Text 1: 1.1 to 1.10)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power Point Presentation Self-study topics: Classification of Signals and systems RBT Level: L1, L2, L3
Module-2	**08 Hrs**
Amplitude Modulation Techniques: Types of analog modulation, Principle of amplitude modulation, AM power distribution, Limitations of AM, (TEXT 1: 4.1, 4.2, 4.4, 4.6) **Angle Modulation Techniques**: Principles of Angle modulation, Theory of FM-basic Concepts, Theory of phase modulation (TEXT1: 5.1, 5.2, 5.5)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method/Power point presentation Self-study topics: DSBSC, SSB and VSB modulation techniques and comparison. RBT Level: L1, L2, L3
Module-3	**08 Hrs**
Sampling Theorem and Pulse Modulation Techniques: Digital Versus Analog Transmissions, Sampling Theorem, Classification of pulse modulation techniques, PAM, PWM, PPM, PCM, Quantization of signals (TEXT 1: 7.2 to 7.8)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method Self-study topics: Differential PCM and Delta Modulation RBT Level: L1, L2, L3
Module-4	**08 Hrs**
Digital Modulation Techniques: Types of digital Modulation, ASK, FSK, PSK, QPSK. (TEXT 1: 9.1 to 9.5) **Information Theory, Source and Channel Coding:** Information, Entropy and its properties, Shannon,-Hartley Theorem, Objectives of source coding, Source coding technique, Shannon source coding theorem, Channel coding theorem, Error Control and Coding. [Text1: 10.1,10.2, 10.11.2, 11.1 to 11.3, 11.8, 11.9, 11.12]	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power Point Presentation.

	Self-study topics: Quadrature Amplitude Modulation, Comparison of Digital Modulation techniques. RBT Level: L1, L2, L3

Module-5	**07 Hrs**

Evolution of wireless communication systems: Brief History of wireless communications, Advantages of wireless communication, disadvantages of wireless communications, wireless network generations, Comparison of wireless systems, Evolution of next generation networks, Applications of wireless communication (TEXT 2: 1.1 to 1.7)

Principles of Cellular Communications: Cellular terminology, Cell structure and Cluster, Frequency reuse concept, Cluster size and system capacity, Method of locating cochannel cells, Frequency reuse distance (TEXT 2: 4.1 to 4.7)

Teaching Learning Method: **RBT Level:**	Chalk and talk method/Power point presentation Self-study topics: Basic propagation mechanisms, Multipath fading. RBT Level: L1, L2, L3

Course outcomes:

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

CO1. Describe the scheme and concepts of radiation and propagation of communication signals through air.

CO2. Understand the AM and FM modulation techniques and represent the signal in time and frequency domain relations.

CO3. Understand the process of sampling and quantization of signals and describe different methods to generate digital signals.

CO4. Describe the basic digital modulation techniques, channel capacity, source coding technique and the channel coding.

CO5. Compare the different wireless communication systems and describe the structure of cellular Communication.

Suggested Learning Resources:

Text Books:

1: T L Singal, Analog and Digital Communications, McGraw Hill Education (India) Private Limited, 2012, 0-07-107269-1

2: T L Singal, Wireless Communications, McGraw Hill Education (India) Private Limited, 2016, ISBN:0-07-068178-3.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Wherever necessary MatLab/Labview tools must be used.

1.Write Matlab Code for the following circuits, observe the waveform

i. AM, FM, QPSK, BPSK, TDM, PWM etc Generation and Demodulation.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		2			1	1	1			1	1	1
CO2	3	3	3		3			1	1				1	1	1
CO3	3	3	3		1			1	1				1	1	1
CO4	3	3	3		1			1	1				1	1	1
CO5	3	3	3										1	1	1

High-3, Medium-2, Low-1

VI Semester

MICROCONTROLLERS			
Course Code:	21ECE6052	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

This course will enable students to:

• Understand the difference between a microprocessor and a microcontroller and embedded microcontrollers.
• Familiarize the basic architecture of 8051 micro controller.
• Program 8051microprocessor using Assembly Level Language and C.
• Understand the interrupt system of 8051 and the use of interrupts.
• Understand the operation and use of inbuilt Timers/Counters and the Serial port of 8051.
• Interface 8051 to external memory and I/O devices using its I/O ports.

Module-1	**08 hrs**
8051 Microcontroller: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. **Text2 :** Chapter 1 section 1.1 to 1.3, chapter 3 sections 3.1 to 3.3	
Teaching Learning Method: Chalk and talk method, Power Point Presentation, **RBT Level:** L1, L2, L3	

Module-2	**08 hrs**
8051 Instruction Set: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions. **Text2 :** Chapter 5 , chapter 6, chapter 7, chapter 8	
Teaching Learning Method: Chalk and talk method, Power Point Presentation **RBT Level:** L1, L2, L3	

Module-3	**08 hrs**
8051 Jump and Call instructions & Embedded C Jump and Call Instructions, Calls & Subroutine instructions. Assembly language program examples of subroutines and involving loops. 8051 Programming in C: Data Types and Time delay in 8051 C, I/O programming in 8051 C, Logical Operations in C. **Text2 :** chapter 8 section 8.1 to 8.4.**Text1** : chapter 7 section 7.1 to 7.3	
Teaching Learning Method: Chalk and talk method, Power Point Presentation **RBT Level:** L1, L2, L3	

Module-4	**08 hrs**
8051 Timers and Serial Port 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially.	

Text1: Chapter 9 section 9.1 Chapter 10 section 10.1 to 10.5	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power Point Presentation, L1, L2, L3

Module-5	**08 hrs**

8051 Interrupts and Interfacing Applications.8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch, 8051 C programming to generate a square waveform on a port pin using a timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Stepper motor and their 8051 Assembly and C language interfacing programming.

Text 1: Chapter 11 section 11.1 and 11.2 Chapter 13 section 13.1 to 13.2, chapter 12 section 12.1, chapter 17 section 17.2

Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power Point Presentation L1, L2, L3

Course outcomes:

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

CO1. Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller, Interfacing of 8051 to external memory and instruction set of 8051.

CO2. Develop 8051 Assembly level programs using the 8051-instruction set.

CO3. Develop 8051 Assembly / C language program to generate timings and waveform using 8051 timers, to send & receive serial data using 8051 serial ports.

CO4. Develop 8051 Assembly / C language programs to generate square wave on 8051 I/O port pin using interrupt and C Programme to send & receive serial data using 8051 serial port.

CO5. Interface various peripheral devices to 8051 using I/O ports.

Suggested Learning Resources:

Text Books:

1: Kenneth J. Ayala, "The 8051 Microcontroller", Kenneth J Ayala, 3rd Edition, Thomson/Cengage Learning.

2: Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D. McKinlay, "The 8051 Microcontroller and Embedded Systems – using assembly and C", PHI, 2006 / Pearson, 2006.

Reference Books:

1. "The 8051 Micro controller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.

2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

Web Links: https://swayam.gov.in/nd1_noc20_cs25

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3					3	1	2		1	1	2	3
CO2	2	3	3		3			3	1	2		1	1	2	3
CO3	2	3	3		3			3	1	2		1	1	2	3
CO4	2	3	3		3			3	1	2		1	1	2	3
CO5	2	3	3	2	3			3	1	2		1	1	2	3

High-3, Medium-2, Low-1

VI Semester

BASIC VLSI DESIGN			
Course Code:	21ECE6053	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	(L:T:P :: 3:0:0)	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03 hrs

Course objectives:

1. Impart knowledge of MOS transistor theory and CMOS technologies
2. Impart knowledge on architectural choices and performance trade-offs involved in designing and realizing the circuits in CMOS technology
3. Cultivate the concepts of subsystem design processes
4. Demonstrate the concepts of CMOS testing

Module-1	**08 Hrs**
Introduction: A Brief History, MOS Transistors, MOS Transistor Theory, Ideal I-V Characteristics, Nonideal I-V Effects, DC Transfer Characteristics (1.1, 1.3, 2.1, 2.2, 2.4, 2.5 of TEXT2). **Fabrication:** nMOS Fabrication, CMOS Fabrication [P-well process, N-well process, Twin tub process], BiCMOS Technology (1.7, 1.8, 1.10 of TEXT1).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, YouTube videos, Power point presentation RBT Level: L1, L2
Module-2	**08 Hrs**
MOS and BiCMOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout. Basic Circuit Concepts: Sheet Resistance, Area Capacitances of Layers, Standard Unit of Capacitance, Some Area Capacitance Calculations, Delay Unit, Inverter Delays, Driving Large Capacitive Loads (3.1 to 3.3, 4.1, 4.3 to 4.8 of TEXT1).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method/Power point presentation RBT Level: L1, L2, L3
Module-3	**08 Hrs**
Scaling of MOS Circuits: Scaling Models & Scaling Factors for Device Parameters Subsystem Design Processes: Some General considerations, An illustration of Design Processes, Illustration of the Design Processes: Regularity, Design of an ALU Subsystem, The Manchester Carry chain and Adder Enhancement Techniques (5.1, 5.2, 7.1, 7.2, 8.2, 8.3, 8.4.1, 8.4.2 of TEXT1).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, YouTube videos, Power point presentation RBT Level: L1, L2, L3
Module-4	**08 Hrs**
Subsystem Design: Some Architectural Issues, Switch Logic, Gate (restoring) Logic, Parity Generators, Multiplexers, The Programmable Logic Array (PLA) (6.1 to 6.3, 6.4.1, 6.4.3, 6.4.6 of TEXT1). **FPGA Based Systems:** Introduction, Basic concepts, Digital design and FPGAs, FPGA based System design, FPGA architecture, Physical design for FPGAs (1.1 to 1.4, 3.2, 4.8 of TEXT3).	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, YouTube videos, Power point presentation RBT Level: L1, L2, L3
Module-5	**07 Hrs**

Memory, Registers and Aspects of system Timing: System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2 of TEXT1).

Testing and Verification: Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability (12.1, 12.1.1, 12.3, 12.5, 12.6 of TEXT 2).

Teaching Learning Method:	Chalk and talk method/Power point presentation
RBT Level:	RBT Level: L1, L2, L3

Course outcomes:

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

CO1. Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.

CO2. Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.

CO3. Interpret Memory elements along with timing considerations.

CO4. Demonstrate knowledge of FPGA based system design.

CO5. Interpret testing and testability issues in VLSI Design and analyse CMOS subsystems.

Suggested Learning Resources:

Text Books:

1: "Basic VLSI Design"- Douglas A Pucknell & Kamran Eshraghian, PHI, 3rd Edition.

2: "CMOS VLSI Design- A Circuits and Systems Perspective", Neil H E Weste, David Harris, Ayan Banerjee, 3rd Edition, Pearson Education.

3: "FPGA Based System Design", Wayne Wolf, Pearson Education, 2004, Technology and Engineering.

Web Links:

https://nptel.ac.in/courses/117101058

https://nptel.ac.in/courses/117106093

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Wherever necessary Cadence/Synopsis/Menta Graphics tools must be used.

1.Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

i. An inverter

ii. A Buffer

iii. Transmission Gate

iv. Basic/universal gates

v. Flip flop -RS, D, JK, MS, T

vi. Serial & Parallel adder

vii. 4-bit counter [Synchronous and Asynchronous counter]

2. Design an op-amp with given specification* using given differential amplifier Common source and Common Drain amplifier in library** and completing the design flow mentioned below:

a. Draw the schematic and verify the following

i) DC Analysis

ii) AC Analysis

iii) Transient Analysis

b. Draw the Layout and verify the DRC, ERC

c. Check for LVS

d. Extract RC and back annotate the same and verify the Design

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3		2								1	1	1
CO2	3	3	2										1	1	1
CO3	3	2	1										1	1	1
CO4	3	3	2										1	1	1
CO5	3	2	3										1	1	1

High-3, Medium-2, Low-1

VI Semester

ELECTRONICS CIRCUITS WITH VERILOG			
Course Code:	21ECE6054	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	(L:T:P :: 3:0:0)	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To understand the basic Verilog HDL design flow.
2. To understand the basic Verilog programming concepts.
3. To describe the simple logic circuits using dataflow, gate-level, and behavioural level modelling.
4. To model digital systems using advanced concepts of Verilog HDL.

Module-1	**08 Hrs**
Overview of Digital Design with Verilog HDL: Evolution of CAD, emergence of HDLs, typical HDL flow, why Verilog HDL?, trends in HDLs. (Text 1) **Hierarchical Modelling Concepts:** Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. (Text 1)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation RBT Level: L1, L2, L3
Module-2	**08 Hrs**
Basic Concepts: Lexical conventions, datatypes, system tasks, compiler directives. (Text 1) **Modules and Ports:** Module definition, port declaration, connecting ports, hierarchical name referencing. (Text 1)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation RBT Level: L1, L2, L3
Module-3	**08 Hrs**
Gate-Level Modeling: Modeling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays, min, max, and typical delays. (Text1) **Dataflow Modeling**: Continuous assignments, delay specification, expressions, operators, operands, operator types. (Text 1)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation RBT Level: L1, L2, L3
Module-4	**08 Hrs**
Behavioral Description: Behavioral Description Highlights, Structure of the HDL Behavioral Description, Sequential Statements, IF Statement, The case Statement , Verilog casex and casez The wait-for Statement. The Loop Statement, For-Loop, While-Loop, Verilog repeat, Verilog forever (content with respect to Verilog only) (Text 2)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation RBT Level: L1, L2, L3
Module-5	**07 Hrs**
Structural Description: Highlights of Structural Description, Organization of Structural Description Binding (4.1, 4.2, 4.3 till example 4.9) (Text 2) **Tasks and Functions:** Differences between tasks and functions, declaration, invocation, automatic tasks and functions. (Text 1)	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation RBT Level: L1, L2, L3

Course outcomes:

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

CO1. Understand the Verilog HDL design flow.

CO2. Describe the basic concepts of Verilog HDL programming

CO3. Design of digital electronics circuits using dataflow, behavioural, gate-level, and structural modelling.

CO4. Design complex digital circuits using advanced Verilog concepts.

Suggested Learning Resources:

Text Books:

1: "Verilog HDL: A Guide to Digital Design and Synthesis", Samir Palnitkar, Pearson education, Second edition.

2: "HDL programming (VHDL and Verilog)", Nazeih M Botros, John Wiley India Pvt. Ltd., 2008.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Wherever necessary Xilinx/Model sim, Questa tools must be used.

1.Write Verilog Code for the following circuits and their Test Bench for verification, observe the waveform and synthesize the code with technological library with given Constraints*. Do the initial timing verification with gate level simulation.

i. An inverter

ii. A Buffer

iii. Transmission Gate

iv. Basic/universal gates

v. Flip flop -RS, D, JK, MS, T

vi. Serial & Parallel adder

vii. 4-bit counter [Synchronous and Asynchronous counter]

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	CO1	3	3	3		2								1	1
CO2	CO2	3	3	2										1	1
CO3	CO3	3	2	1										1	1
CO4	CO4	3	3	2										1	1

High-3, Medium-2, Low-1

VI Semester

SENSORS & ACTUATORS			
Course Code:	21ECE6055	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

- To provide the fundamental knowledge about sensors and measurement system.
- To impart the knowledge of static and dynamic characteristics of instruments and understand the factors in selection of instruments for measurement.
- To discuss the principle, design and working of transducers for the measurement of physical time varying quantities.
- Understand the working of various actuators suitable in industrial process control systems.
- Understand the principle and application of smart sensors.

Module-1

Sensors and measurement system: Sensors and transducers, Classifications of transducers-primary & secondary, active & passive, analog and digital transducers. Smart sensors.

Measurement: Definition, significance of measurement, instruments and measurement systems. mechanical, electrical and electronic instruments. Elements of generalized measurement system with example. Input-output configuration of measuring instruments and measurement systems, methods of correction for interfering and modifying inputs.

Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation, More examples relating to applications
RBT Level:	L1, L2, L3

Module-2

Static and Dynamic Characteristics: Static calibration and error calibration curve, accuracy and precision, indications of precision, static error, scale range and scale span, reproducibility and drift, repeatability, signal to noise ratio, sensitivity, linearity, hysteresis, threshold, dead zone and dead time, resolution, signal to noise ratio, factors influencing the choice of transducers/instruments. Dynamic response – Dynamic characteristics, Transfer function of generalized first order system, time constant. Transfer function of generalized second order system, natural frequency and Damping ratio.

Teaching Learning Method:	Chalk and talk method, Power point presentation, VI Lab to demonstrate the characteristics of sensors, More examples relating to applications
RBT Level:	L1, L2, L3

Module-3

Measurement of Temperature: RTD, Thermistor, Thermocouple, laws of thermocouple, Thermopile, AD590.

Measurement of Displacement: Introduction, Principles of Transduction, Variable resistance devices, variable Inductance Transducer, Variable Capacitance Transducer, Hall Effect Devices, Proximity Devices, Digital Transducer.

Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation, Virtual instrumentation Lab to demonstrate the characteristics of sensors
RBT Level:	L1, L2, L3

Module-4	
Measurement of Strain: Introduction, Types of Strain Gauges, Theory of operation of resistance strain gauges, Types of Electrical Strain Gauges –Wire gauges, unbounded strain gauges, foil gauges, semiconductor strain gauges (principle, types & list of characteristics only), Strain gauge Circuits – Wheatstone bride circuit, Applications. **Measurement of Force & Torque:** Introduction, Force measuring sensor –Load cells – column types devices, proving rings, cantilever beam, pressductor. Hydraulic load cell, electronic weighing system. Torque measurement: Absorption type, transmission type, stress type & deflection type.	
Teaching Learning Method:	Chalk and talk method, PowerPoint Presentation, More examples relating to applications
RBT Level:	L1, L2, L3
Module-5	
Actuators and process control system: Introduction. Block diagram and description of process control system with an example. Introduction, Block diagram of Final control operation, Signal conversions analog, digital, pneumatic signal. Actuators, Control elements. **Electrical actuating systems:** Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors, AC motors, Synchronous Motor, Stepper motors. **Pneumatic Actuators**: Principle and working of pneumatic actuators. (Numerical problems on the topic). **Hydraulic Actuators:** Principle and working of Hydraulic actuators. (Numerical problems on the topic).	
Teaching Learning Method:	Chalk and talk method, Power point presentation, More examples relating to applications
RBT Level:	L1, L2, L3
Course outcomes: **At the end of the course the student will be able to:** **CO1:** Discuss the fundamental concepts related to sensors and measurement, functional elements of measurement system, I/O Characteristics of measurement system. **CO2:** Interpret and analyse the static and dynamic characteristics of instruments. **CO3:** Elucidate the working principle and usage of different transducers for temperature, displacement and level measurement. **CO4:** Discuss the principle and working of different types of actuators used in industrial application. **CO5:** Discuss the principle and working of strain, force and torque measurement	
Suggested Learning Resources: **Text Books:** 1.Electrical and Electronic Measurements and Instrumentation, A K Sawhney, 17th Edition, (Reprint 2004), Dhanpat Rai & Co. Pvt. Ltd., 2004. 2. Instrumentation: Devices and Systems, C S Rangan, G R Sarma, V S V Mani, 2nd Edition (32 Reprint), McGraw Hill Education (India), 2014. 3. Process Control Instrumentation Technology by C D Johnson, 7th Edition, Pearson Education Private Limited, New Delhi 2002.	
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning **Activity 1:** **Activity 2:** **Activity 3:**	

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VI Semester

VLSI LAB			
Course Code	21ECL606	**CIE Marks**	50
Teaching Hours/Week (L: T: P: S)	0:0:2:0	**SEE Marks**	50
Credits	01	**Exam Hours**	03

Course objectives:

This laboratory course enables students to

1. Design, model, simulate and verify CMOS digital circuits
2. Design layouts CMOS digital circuits
3. Perform physical verification of CMOS digital circuits
4. Perform RTL- flow and understand the stages in ASIC design.

Sl. No.	Experiments
1	DC, Transient analysis of CMOS logic-Universal gates schematic
2	DC, Transient analysis of CMOS full adder schematic
3	DC, Transient analysis of Pass transistor and transmission gates schematic
4	DC, Transient analysis of Sequential circuits schematic 1. Clocked D Latch 2. Master-Slave Edge Triggered Register
5	DRC and LVS analysis of CMOS Inverter layout
6	DRC and LVS analysis of Common Source Amplifier Layout
7	DRC and LVS analysis of Common Drain Amplifier Layout
8	DRC and LVS analysis of Differential Amplifier Layout
09	Synthesis and Simulation of Inverter using Verilog code
10	Synthesis and Simulation of Buffer Verilog code
11	Synthesis and Simulation of Basic/Universal Gate using Verilog code
12	Synthesis and Simulation of JK, MSJK flip-flops using Verilog code

Course outcomes (Course Skill Set):

On the completion of this laboratory course, the students will be able to:

CO1. Design and simulate basic CMOS circuits like different logic structures.

CO2: Design and simulate basic CMOS circuits like inverter, common source amplifier and Differential Amplifier.

CO3: Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level net list.

CO4: Design and simulate combinational and sequential digital circuits using Verilog HDL.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															

` **High-3, Medium-2, Low-1**

VI Semester

MINI PROJECT			
Course Code:	21ECM607	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	26	**Total Marks:**	100
Credits:	02	**Exam Hours:**	03

Course objectives: The student will be able to learn,

1. Identification of problem, formulation and methodology.
2. To gain technical knowledge by literature survey.
3. Justify the technical aspects with a comprehensive and systematic approach.
4. Engineering solutions to meet industrial and societal needs.

Mini Project Guidelines:

The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s). The detailed Synopsis (approved by the department Project Review Committee) has to be submitted during the 1st week after the commencement of 6th semester.

Formation of Groups:

Students are free to choose their project partners from within the programme or any other programme. The project work is to be carried out by a team of two to four students. Each student in the team must contribute towards the successful completion of the project.

The project may be carried out In-house / Industry / R & D Institution.

Selection of Project Topic:

The topics of the project work must be in the field of respective program. The projects as far as possible should have societal relevance with focus on sustainability.

Course outcomes:

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

CO 1 Acquire knowledge within the chosen domain.
CO 2 Usage of Tools based on the problem.
CO 3 Implement using resource management skills.
CO 4 Demonstrate, Present and Report writing.
CO 5 Exhibit life -long learning & Professional ethics.

Assessment Details (both CIE and SEE):

CIE Assessment:

The following are the weightings given for the various stages of the project.

1. Identification of Problem and Introduction 20%
2. Literature Survey and Identifying Research Gap 20%
3. Methodology, H/W & S/W Specifications 20%
4. Design requirements and Specifications 20%
5. Presentation and Viva voce 20%

SEE Assessment:

The following are the weightages given during Viva Examination.

1. Written presentation of synopsis 10%
2. Presentation/Demonstration of the project 30%
3. Methodology and Experimental Results & Discussion 30%
4. Report 10%
5. Viva Voce 20%

COs	Mapping with Pos

CO1	PO1, PO2, PO5, PO7, PO8, PO9, PO10, PO11
CO2	PO1, PO2, PO5, PO9, PO10, PO11
CO3	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11
CO4	PO1, PO2, PO5, PO6, PO8, PO9, PO10, PO11, PO12
CO5	PO1, PO2, PO5, PO8, PO10, PO11, PO12

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	2	-	2	1	1	1	1	-	**3**	**2**	**-**
CO2	1	1	-	-	3	-	-	-	2	1	1	-	**2**	**2**	**1**
CO3	1	1	3	3	2	1	1	1	1	1	1	-	**-**	**2**	**2**
CO4	1	1	-	-	1	1	-	3	3	1	2	3	**2**	**2**	**1**
CO5	2	2	-	-	1	-	-	3	-	1	2	3	**1**	**2**	**3**

High-3, Medium-2, Low-1

Semester VI

INNOVATION/ENTREPRENEURSHIP/SOCIETAL INTERNSHIP			
Course Code:	21ECI608	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):		**SEE Marks:**	50
Total Hours of Pedagogy:		**Total Marks:**	100
Credits:	3	**Exam Hours:**	3

Course objectives:

1. Understand the process of applying engineering knowledge to produce product and provide services.
2. Explain the importance of management and resource utilization
3. Comprehend the importance of team work, protection of environment and sustainable solutions.
4. Imbibe values, professional ethics for life long learning.

Guidelines

Research/Industrial Internship - At the End of the sixth / Seventh semester (in two cycles to accommodate all the students of the University) Research/Industrial Internship shall be carried out – Based on industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo a mandatory internship of 24 weeks during the vacation of VI/VII semesters. A University Viva-Voce examination shall be conducted during VII/VIII semester and the prescribed credit shall be included in VII/VIII semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. Research internship Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give you the flavour of current research going on on a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Industry internships: This is an extended period of work experience undertaken by university/Institute students looking to supplement their degree with professional development. The students are allowed to prepare themselves for the workplace and develop practical skills as well as academic ones. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with "unexpected contingencies" helps students recognize, appreciate, and adapt to organization realities by tempering knowledge with practical constraints.

Those, who have not pursued /completed the internship will be declared as failed and have to complete during subsequent SEE examination after they satisfy the internship requirements.

Course outcomes:

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

CO1. Apply engineering and management principles

CO2. Analyze real-time problems and suggest alternate solutions

CO3. Communicate effectively and work.
CO4. Imbibe the practice of professional ethics and need for lifelong learning.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	3	2		2				1			3		2
CO2				3	2	2		1					1	1	2
CO3					1		2	3	3					2	2
CO4					1		3			2	3		2	3	2
CO5															

High-3,Medium-2, Low-1

Dr. AMBEDKAR INSTITUTE OF TECHNOLOGY

(An Autonomous Institute affiliated to VTU, Accredited by NAAC with 'A' grade)

BDA Outer Ring Road, Mallathalli,Bengaluru-56

Board Of Studies 2023-24

Approved
Scheme and Syllabus of
VII & VIII Semester
For
2020 Batch

Submitted by

Department of Electronics and Communication Engineering

To

DEAN (Academic)

Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

VII Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing / Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	MC	18HS71	Cost Management of Engg Projects	HS	03	--	--	03	050	050	100	02
2	PC	18EC71	Wireless Communication	EC	04	--	--	03	050	050	100	04
3	PC	18EC72	Microwave and Antenna	EC	04	--	--	03	050	050	100	04
4	PE	18EC73X	Professional Elective-3	EC	03	--	--	03	050	050	100	03
5	PE	18EC74X	Professional Elective-4	EC	03	--	--	03	050	050	100	03
6	OE	18EC75X	Open Elective-C	EC	03	--	--	03	050	050	100	03
7	PC	18ECL76	Advance Communication Lab	EC	--	--	02	02	050	050	100	01
8	PC	18ECL77	Computer Communication Network Lab	EC	--	--	02	02	050	050	100	01
9	Project	18ECP78	Project work phase-1	EC	--	--	02	02	050	050	100	02
10	INT	18ECI79	Internship	--	--	--	--	---	---	---	--	--
			Total		**20**	**--**	**06**	**24**	**400**	**400**	**800**	**23**

Internship: All the students admitted to III year of BE have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters. A University examination will be conducted during VIII semester and prescribed credit are added to VIII semester. Internship is considered as a head of passing and is considered for the award of degree. Those, who do not take-up/complete the internship will be declared as failed and have to complete during subsequent University examination after satisfy the internship requirements

Note: : PC: Professional Core. PE: Professional Elective, OE: Open Elective. MC: Mandatory Course, PRJ: Project work, INT: Internship

Select **ANY ONE** of the Professional Elective. Open Elective-A: Students can select any one of the open electives (Please refer to consolidated list of Dr AIT for open electives) offered by any Department

Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

Professional Elective-3(PE-3)		
Sl. No.	**Course Code**	**Course Title**
1	18EC731	5G Technology
2	18EC732	Virtual Reality
3	18EC733	Real Time Operating systems
4	18EC734	DSP Algorithm and architecture
5	18EC735	Network and Cyber Security
6	18EC736	Optical Fibre Communication

Professional Elective-4(PE-4)		
Sl. No.	**Course Code**	**Course Title**
1	18EC741	Analog and Mixed Mode VLSI
2	18EC742	Operating systems
3	18EC743	Satellite Communication
4	18EC744	Real Time Embedded Systems
5	18EC745	Operations Research
6	18EC746	Adaptive Signal Processing

Open Elective-C (OE-C)		
Sl. No	**Course Code**	**Course Title**
1	18EC751	Internet of Things (CS, IS, EI, TE, ML, ME, IEM, EEE, CV)
2	18EC752	Cryptography (CS, IS, ML,TE, EI,EEE)
3	18EC753	Mobile Communication (EI, EE, ML)
4	18EC754	Bio Mechatronics (CS, IS, EI, TE, ML, ME, IEM, EEE, CV)
5	18EC755	Introduction to Unmanned Aerial Vehicle (UAV) (CS,IS, EI, TE,ML, ME, IEM, EEE,CV)

Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2023-24

B.E in Electronics and Communication Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Applicable to 2020 Batch)

VIII Semester

Sl. No	Course and Course Code		Course Title	Teaching Dept.	Teaching Hours / Week			Examination				Credits
					Theory Lecture (L)	Tutorial (T)	Drawing/ Practical (P)	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	MC	18HS81	Occupational and Safety and Health administration	CV	03	--	--	03	050	050	100	02
2	Project	18ECP81	Project Work Phase-2	EC	--	--	03	03	050	050	100	10
3	Seminar	18ECS82	Technical Seminar	EC	--	--	03	03	050	050	100	01
4	INT	18ECI83	Internship	EC	--	--	03	03	050	050	100	02
Total					**03**	**--**	**09**	**12**	**250**	**250**	**500**	**15**

Internship: Those, who have not pursued /completed the internship will be declared as failed and have to complete during subsequent SEE examination after they satisfy the internship requirements.

Note: : PC: Professional Core. PE: Professional Elective, OE: Open Elective. MC: Mandatory Course, PRJ: Project work, INT: Internship

Select **ANY ONE** of the Professional Elective and Open Elective subject

Students can select any one of the open electives (Please refer to consolidated list of Dr. AIT open electives) offered by any Department.
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives. Registration to electives shall be documented under the guidance of Programme Coordinator/ Mentor.

VII Semester

WIRELESS COMMUNICATION			
Course Code:	18EC71	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	4:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	52 hours theory	**Total Marks:**	100
Credits:	04	**Exam Hours:**	03

Course objectives:

1.To understand the basics of wireless Communication used for mobile telephony.

2.To apply the basic methodologies of cellular system designing

3.To describe 3G network architecture and cellular network

4.To understand GSM and TDMA technologies

5.To distinguish between CDMA technology, wireless LAN and PAN technologies

Module-1	**10 hrs**
Introduction to wireless telecommunication systems and Networks, History and Evolution of wireless radio system, Development of modern telecommunication infrastructure, overview of existing Network infrastructure, Wireless Network applications, Future Wireless Network. Different generations of wireless cellular networks 1G, 2G,2.5G ,3G and 4G Cellular system and beyond, Wireless standard organizations. **TEXT 1**	
Teaching Learning Method:	Chalk and Board /PPT
RBT Level:	L1, L2
Module-2	**10 hrs**
Common Cellular System components, Common cellular network components, Hardware and software, views of cellular networks, 3G cellular systems components. Cellular component identification, Call establishment. **TEXT 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-3	**10 hrs**
Wireless network architecture and operation: The cellular concept Cell fundamentals, Capacity expansion techniques, Cellular backhaul networks, Mobility management, Radio resources and power management, Wireless network security.**TEXT1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-4	**11 hrs**
GSM and TDMA Technology: GSM system overview-introduction to GSM and TDMA,GSM Network and System Architecture, GSM channel concept, GSM system operations-GSM identities, GSM system operations (Traffic cases). **TEXT1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-5	**11 hrs**
CDMA Technology: CDMA system overview, introduction to CDMA,CDMA network and system architecture **CDMA basics:** CDMA Channel concept, CDMA operations(Layer 3) 3g CDMA,IS95B,CDMA 2000 and WCDMA	

Wireless LANs/IEEE 802.11X: Introduction and Evolution of Wireless LANs, Design issues. Wireless PAN/IEEE 802.15x: Introduction, Wireless Pan application and Architecture. **TEXT1**

Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Understand the history and evolution of wireless communication system and overview of the Existing network infrastructures

CO2.Describe 3G cellular system components

CO3. Understand the cellular concepts, Mobility management, power management and wireless Network security.

CO4. Analyse and differentiate GSM and TDMA technologies.

CO5. Understand design issues in CDMA, Wireless LAN and PAN networks.

Suggested Learning Resources:

Text Books:

1. Garry J Mullet, "Introduction to Telecommunication Systems and Networks: , India Edition, Delmar Cengage Learning,2007

Reference Books

1: T. L. Singal, "Wireless Communications" Tata McGraw -Hill Education,2010

2: Vijay K Garg, "IS-95 CDMA and cdma2000: Cellular/PCS Systems Implementation", Pearson Education, reprint 2006

Web Links:

http://www.nptel.ac.in/courses/ /117102062/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Topics on wireless communication applications for presentation

2: Mini projects on wireless communication applications

3: Group discussion on various wireless communication applications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	✓	✓				✓	✓	✓				✓	✓	✓	✓
CO2	✓	✓				✓	✓	✓				✓	✓	✓	✓
CO3	✓	✓				✓	✓	✓				✓	✓	✓	✓
CO4	✓	✓				✓	✓	✓				✓	✓	✓	✓
CO5	✓	✓				✓	✓	✓				✓	✓	✓	✓

High-3, Medium-2, Low-1

VII Semester

MICROWAVE AND ANTENNA			
Course Code:	18EC72	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understanding the basics of microwave and waveguides.
2. Understanding the concepts of microwave networks, microwave passive devices and semiconductor devices.
3. Understanding microwave tubes, microwave design principles and antenna basics.
4. Understanding the importance of point sources, arrays and radiations from wires.
5. To understand different types of antennas like aperture, reflector, broadband and Microstrip antennas.

Module-1	**09 hrs**

Introduction to Microwaves -History of Microwaves, Microwave Frequency bands, applications of Microwaves, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

Waveguides- Rectangular waveguide, Circular waveguide, Strip line, Micro strip line. **TEXT 1,2**

Teaching Learning Method:	Chalk and Talk, YouTube videos
RBT Level:	L1, L2

Module-2	**09 hrs**

Microwave Network Analysis - Network parameters for microwave circuits, Scattering Parameters. **Microwave Passive devices and semiconductor Devices** - Microwave passive devices - Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave Semiconductor Devices - Gunn Diodes, IMPATT diodes, PIN diodes**.**

TEXT 1,2

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2

Module-3	**11 hrs**

Microwave Tubes: Klystron- two cavity klystron amplifier and reflex klystron (klystron oscillator)
Microwave Design Principles - Microwave
Filter Design, RF and Microwave Amplifier Design

Antenna Basics - Physical concept of radiation, near and far field regions, basic antenna parameters: radiation patterns, beam area, radiation Intensity, beam efficiency, reciprocity, directivity and gain, antenna apertures, effective height, bandwidth, radiation efficiency, radio communication Link, antenna temperature and antenna field zones. **TEXT 1,2,3.4**

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2

Module-4	**11 hrs**

Radiations from wires: Short electric dipole, fields of a short dipole, radiation resistance of dipole, Half wave dipole antenna, folded dipole
antennas.

Point Sources & their arrays - Arrays, Point source, Power theorem and its application, Examples of

power patterns, Field patterns, Phase patterns, Array of isotropic point sources different cases, non-isotropic sources, principle of pattern multiplication, linear arrays of n elements of equal amplitude & spacing, broad side, end fire arrays.

TEXT 3,4

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2, L3

Module-5	**12 hrs**

Aperture and Reflector Antennas- Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

TEXT 3.4

Teaching Learning Method:	Lecture-based learning and Group learning
RBT Level:	L1, L2, L4

Course outcomes:

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

CO1. Identify the microwave frequency band, its applications and different types of waveguides

CO2. Analyse microwave networks, microwave passive devices and semiconductor devices.

CO3. Apply microwave design principle, microwave tubes and antenna basics.

CO4. Be able to analyse the radiation patterns from different types of wires, point sources and their arrays.

CO5. Illustrate and design antennas like aperture, reflector, and broadband. Microstrip antenna.

Suggested Learning Resources:

Text Books:

1. Collin RE. Foundations for microwave engineering. John Wiley & Sons; 2007.
2. Annapurna Das, Sisir K Das, Microwave Engineering, TMH Publication, 2001
3. J.D. Kraus, Antennas, McGraw Hill, 1988.
4. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.

Reference Books

1. Microwave Devices and circuits- Liao / Pearson Education. 1992
2. M. Kulkarni., "Microwave devices and Radar Engg." Umesh Publications, 2011
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.

Web Links:

1. www.nptel.in
2. https://www.academia.edu/12559664/Collin_Foundations_for_Microwave_Engineering
3. https://www.academia.edu/13759443/Basic_Antennas_Understanding_Practical_Antennas_and_Design_Joel_R_Hallas_2009

4. www.youtube/microwave , www.youtube/antennas

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Creating physical modules

2: Exploring new technologies and presenting

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1												2	
CO2	3	3	2											2	
CO3	3	2	3	2			1					1	2	2	
CO4	3	3	2	2			1					1	2	2	
CO5	3	3	2	2			1					1	2	2	

High-3, Medium-2, Low-1

VII Semester

5G TECHNOLOGY			
Course Code:	18EC731	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Assess the genesis and impact of 5G and use case requirement in real world.
2. Understanding the 5G architecture and its deployment.
3 Understanding the security features in 5G technology.
4. Understanding the wireless spectrum crunch 5G technologies.
5. Analysing and understanding SON and Green flexible RF in 5G technology.

Module-1	**08 hrs**
Drivers for 5G: The 'Pervasive Connected World' Introduction, Historical Trend of Wireless Communications, Evolution of LTE Technology to Beyond 4G, 5G Roadmap, 10 Pillars of 5G, 5G in Europe, 5G in North America, 5G in Asia, 5G Architecture**Text1**	
Teaching Learning Method: Chalk & Board **RBT Level:** L1, L2, L3	
Module-2	**08 hrs**
The 5G Internet Introduction, Internet of Things and Context-Awareness, Internet of Things, Context-Awareness, Networking Reconfiguration and Virtualization Support, Software Defined Networking, Network Function Virtualization, Mobility, An Evolutionary Approach from the Current Internet, A Clean-Slate Approach, Quality of Service Control, Emerging Approach for Resource Over-Provisioning**. Text1**	
Teaching Learning Method: Chalk & Board **RBT Level:** L1, L2, L3	
Module-3	**08 hrs**
Security for 5G Communications: Introduction, Overview of a Potential 5G Communications, System Architecture, Security Issues and Challenges in 5G Communications Systems, User Equipment, Access Networks, Mobile Operator's Core Network, External IP Networks **Text1**	
Teaching Learning Method: Chalk & Board **RBT Level:** L1, L2, L3	
Module-4	**07 hrs**
The Wireless Spectrum Crunch: White Spaces for 5G. Introduction, Background, Early Spectrum Management, History of TV White Spaces, History of Radar White Spaces, TV White Space Technology, Standards, Approaches to White Space, White Space Spectrum Opportunities and Challenges, TV White Space Applications, International Efforts, Role of WS in 5G Text1	
Teaching Learning Method: Chalk & Board **RBT Level:** L1, L2, L3	
Module-5	**08 hrs**
SON Evolution for 5G Mobile Networks, Introduction, SON in UMTS and LTE, The Need for SON in 5G, Evolution towards Small-Cell Dominant HetNets, Towards a New SON Architecture for 5G, **Green Flexible RF for 5G:** Introduction, Radio System Design, Nonlinear Crosstalk in MIMO Systems **Text1**	

Teaching Learning Method:	Chalk & Board
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Introduction to drivers in 5G technology.

CO2. Analyse the 5G architecture and its deployment.

CO3. Elaborate security features in 5G technology.

CO4. Analyse the role of wireless spectrum crunch 5G technologies.

CO5. Elaborate the SON and Green flexible RF in 5G technology.

Suggested Learning Resources:

Text Books:

1. **Jonathan Rodriguez**, "Fundamentals of 5G Mobile", Wiley Publications, 2015.

Reference Books:

1. **Afif Osseran, Jose F.Monserrat, Patrick Marsch,** " 5G Mobile and Wireless Communications Technology" Cambridge University Press, 2016
2. **Harri Holma, Antti Toskala, Takehiro Nakamura**, " 5G Technology: 3GPP New Radio", John Wiley & Sons Ltd. 2020

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

VIRTUAL REALITY			
Course Code:	18EC732	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	03:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To become familiar with the basic concepts of virtual reality Technology and input devices
2. To understand the output devices.
3. To study the concepts of Modeling in virtual
4. To understand the human factors in VR
5. To become familiar with the applications of VR

Module-1	**09 hrs**
INTRODUCTION: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Text book1: 1.1, 1.3, 1.5, 2.1, 2.2 and 2.3**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2
Module-2	**07 hrs**
OUTPUT DEVICES: Graphics displays, sound displays & haptic feedback. **Text book1: 3.1,3.2 and 3.3**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2
Module-3	**08 hrs**
MODELING: Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model management. **Text book1: 5.1, 5.2 and 5.3, 5.4 and 5.5**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2
Module-4	**07 hrs**
HUMAN FACTORS: Methodology and terminology, user performance studies, VR health and safety issues. **Text book1: 7.1, 7.2 and 7.3**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2
Module-5	**08 hrs**
APPLICATIONS: Medical applications, military applications, robotics applications. **Text book1: 8.1, 8.3 and 9.2**	
Teaching Learning Method: **RBT Level:**	Lecture-based learning and Group learning L1, L2

Course outcomes:

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

CO1 Describe the basic concepts of virtual reality and input devices.

CO2 Compare the input and output devices

CO3 Use the virtual reality modeling techniques

CO4 Illustrate the human factors in virtual reality

CO5 Understanding and identifying the applications of virtual reality

Suggested Learning Resources:

Text Books:

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea& Philippe Coiffet, John Wiley & Sons. 2003
2. Introduction to Virtual Reality, John Vince, Springer, London, Springer-Verlag London Limited 2004

Reference Books (if required)

1. Virtual Reality Systems. John Vince, Pearson Education, 2007

Web Links:

1. https://doi.org/10.1007/978-0-85729-386-2, 978-1-85233-739-1
2. www.nptelcoursematerial
3. www.youtube/virtual
4. Introduction - Learning Virtual Reality [Book] (oreilly.com)
5. https://www.geeksforgeeks.org/virtual reality-introduction

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Creating VR environment using Unity 3D tool

2: Creating VR environment using Unreal engine tool

3: Creating VR environment using Mycraft or Cospace tool

4: Creating VR environment using Blender tool

5: Creating VR environment using A-Frame tool

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3						1							1	
CO2	3						1							1	
CO3	3		2		2		1					1	2	1	1
CO4	3						1							1	
CO5	3		2			3	1							2	

High-3, Medium-2, Low-1

VII Semester

REAL TIME OPERATING SYSTEM			
Course Code:	18EC733	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Impart the fundamental concepts of the OS and real time systems.
2. Expose to the concepts such as scheduling techniques, dynamic priority policies.
3. Describe the concepts such as blocking, deadlock, live lock & soft real-time services.
4. Impart the firmware components, debugging and reliability system design.
5. Expose to different available RTOS's through their analysis.

Module-1	**08 hrs**

Introduction to real-time embedded systems: Brief history of real time systems, a brief history of embedded systems.
System Resources: resource analysis, real-time service utility, scheduling classes, the cyclic executive, scheduler concepts, pre-emptive fixed priority scheduling policies, Real-Time OS, thread safe re-entrant functions. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Module-2	**08 hrs**

Processing: pre-emptive fixed-priority policy, feasibility, rate monotonic least upper bound, necessary and sufficient feasibility, deadline – monotonic policy, dynamic priority policies.
I/O Resources: Worst-case Execution time, Intermediate I/O, Execution efficiency, I/O Architecture. Memory: Physical hierarchy, Capacity and allocation, Shared Memory, ECC Memory, Flash file systems. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Module-3	**08 hrs**

Multi-resource Services: Blocking, Deadlock and livestock, Critical sections to protect shared resources, priority inversion. Soft Real-Time Services: Missed Deadlines, QoS, Alternatives to rate monotonic policy, Mixed hard and soft real-time services. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Module-4	**08 hrs**

Embedded system components: firmware components, RTOS system software mechanisms, software application components.
Debugging components: exceptions assert, checking return codes, single-step debugging, kernel scheduler traces, test access ports, trace ports, power-on self-test and diagnostics, external test equipment, application-level debugging. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Module-5	**07 hrs**

High availability and reliability design: reliability and availability, similarities and differences, reliability, reliable software, available software, design trade- offs, hierarchical applications for fail-safe design. **Text1**

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1: Understand the basics of Real Time Embedded System and System Resources

CO2: Analyse the concepts Processing and IO Resources

CO3: Analyse Various multi-resource services

CO4: Analyse different Embedded System Components and Debug components.

CO5: Analyze and Categorize the design trade-offs

Suggested Learning Resources:

Text Books:

1: Real-time Embedded Components and Systems", Sam Siewert, Cengage Learning.

Reference Books

1: Raj Kamal, "Embedded Systems", Tata McGraw Hill, New Delhi, *2008*.

2: Phillip. A. Laplante, "Real-Time Systems Design and Analysis", Prentice Hall India,2nd Edition, *2005*.

3: Jane. W. S. Liu, "Real Time Systems", Pearson Education, *2005*

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1: Programming Assignments / Mini Projects can be given.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2				2						1			
CO2	2	2		2	2							1			
CO3	2	2				2						1			
CO4	2	2			2	2						1			
CO5	2	2		2	2	2						1			

High-3, Medium-2, Low-1

VII Semester

DSP Algorithms & Architecture			
Course Code:	18EC734	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:1	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To gain the knowledge of basics of DSP like DFT, FFT, LTI systems, Digital Filters.
2. To understand the architectures of DSP processors.
3. To study the implementation of DSP algorithms.
4. To understand the interfacing of DSP processors with memory and I/O devices.
5. To study the applications of DSP processor.

Module-1	**09 hrs**

Introduction to Digital Signal Processing: Introduction, a Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

Architectures for Programmable Digital Signal Processors:

Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.

TEXT 1

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	**RBT Level:** L1, L2, L3

Module-2	**06 hrs**

Programmable Digital Signal Processors: Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54xx., Memory Space of TMS32OC54xx Processors, Program Control.

Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor.

TEXT 1

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	**RBT Level:** L1, L2, L3

Module-3	**06 hrs**

Implementation of Basic DSP Algorithms: Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case).

TEXT 1

Teaching Learning Method:	Chalk and talk method, Power point presentation
RBT Level:	**RBT Level:** L1, L2, L3

Module-4	**10 hrs**

Implementation of FFT Algorithms: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS32OC54xx.

Interfacing Memory and Parallel I/O Peripherals to DSP Devices: Introduction, Memory Space Organization, External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).
TEXT 1

Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Module-5	**06 hrs**

Interfacing and Applications of DSP Processor: Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.
TEXT 1

Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power point presentation **RBT Level:** L1, L2, L3

Course outcomes:

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

CO1: Define the fundamentals of DSP and the general architecture of DSP

CO2: Understand the general architecture of DSP processor and in particular TMS320C54xx DSP to run algorithms.

CO3: Applying the concept of DSP algorithms.

CO4: Analyse the implementation of FFT algorithms and interfacing memory to DSP processor.

CO5: Creating new designs based on existing algorithms targeted to DSP processor.

Suggested Learning Resources:

Text Books:

1. Avatar Singh and S. Srinivasan, "Digital Signal Processing", Third Edition, Thomsoc Learning, 2004

Reference Books (if required)

1: Ifeachor E. C., Jervis B. W Pearson-Education, "Digital Signal Processing: A Practical Approach", edition, Pearson Education, 2002

2: B Venkataramani and M Bhaskar, "Digital Signal Processors", 2nd edition, TMH, 2010

3: Peter Pirsch, "Architectures for Digital Signal Processing", 4th edition, John Wiley, 2007

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Simulation: Assembly language programs to implement FIR, IIR filters and FFT algorithms

2: Interface: TMS320C54xx processor

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	2	2	2						1	1	2	2	1
CO2		2	2	2	2						1	1	2	2	1
CO3		2	2	2	2						1	1	2	2	1
CO4		2	2	2	2						1	1	2	2	1
CO5															

High-3,Medium-2, Low-1

VII Semester

NETWORK AND CYBER SECURITY			
Course Code:	18EC735	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Know about security concerns in Email and Internet Protocol. ·
2. Understand cyber security concepts. ·
3. List the problems that can arise in cyber security. ·
4. Discuss the various cyber security frame work.
5. Will be in a position to apply the concepts of cyber security framework in computer system administration

Module-1	**08 hrs**
Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH) **Text 1**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2
Module-2	**08 hrs**
E-mail Security: Pretty Good Privacy, S/MIME, Domain keys identified mail. **Text1**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2
Module-3	**08 hrs**
IP Security: IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP), Combining security Associations Internet Key Exchange. Cryptographic Suites. **Text 1**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2, L3
Module-4	**07 hrs**
Cyber network security concepts: Security Architecture antipattern: signature-based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. Refactored solution: reputational, behavioural and entropy-based malware detection. The problems: cyber antipatterns concept, forces in cyber antipatterns, cyber anti pattern templates, cyber security antipattern catalog. **Text-2**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2, L3
Module-5	**08 hrs**
Cyber network security concepts: Enterprise security using Zachman framework Zachman framework for enterprise architecture, primitive models versus composite models, architectural problem-solving patterns, enterprise workshop, matrix mining, mini patterns for problem solving meetings. **Text-2: Chapter 3 & 4**	
Teaching Learning Method: **RBT Level:**	Chalk & Board L1, L2, L3

Course outcomes:

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

CO1. Explain network security protocols ·

CO2. Understand the basic concepts of cyber security ·

CO3. Discuss the cyber security problems ·

CO4. Explain Enterprise Security Framework ·

CO5. Apply concept of cyber security framework in computer system administration.

Suggested Learning Resources:

Text Books:

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93-325- 1877-3.

2. Thomas J. Mowbray, "Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions", Wiley.

Reference Books (if required)

1.Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.

2. Cryptography and Network Security, Atul Kahate, TMH, 2003.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

OPTICAL FIBER COMMUNICATION			
Course Code:	18EC736	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To become familiar with the basic concepts of propagation of optical energy in single and multimode optical fibers
2. To understand the fiber losses and its measurements to provide background for optical fiber communications.
3. To understand the the optical sources and detectors.
4. To understand Optical amplifiers and Networks

Module-1	**07 hours**

OVERVIEW OF OPTICAL FIBER COMMUNICATION:

Introduction, Historical development, general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory transmission: total internal reflection, acceptance angle, numerical aperture, skew rays, Cylindrical fiber: modes, mode coupling, step index fibers and graded index fibers, single mode fibers: cutoff wave length and mode filed diameter. **TEXT 1**

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-2	**07 hours**

TRANSMISSION CHARACTERISTICS OF OPTICAL

FIBERS: Introduction, Attenuation, Material absorption: Intrinsic and extrinsic absorption, linear scattering losses: Rayleigh scattering and Mie scattering, Dispersion: Chromatic dispersion: Material and Waveguide dispersion, bending loss. . **TEXT 1**

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2

Module-3	**09 hours**

OPTICAL FIBERS AND CABLES: Cable design: Fiber buffering, cable structural and strength members, cable sheath and water barrier, examples of fiber cables.

OPTICAL SOURCES AND DETECTORS: Laser: Introduction, basic concepts: absorption and emission of radiation, population inversion. Optical emission from semiconductors: The p-n junction, spontaneous emission, carrier recombination, stimulated emission and lasing, heterojunctions, semiconductor materials. **LED:** Introduction, power & efficiency: double heterojuncation LED **Detectors:** Introduction, quantum efficiency, responsivity. Semiconductor photodiodes: p-i-n and Avalanche photodiode, Phototransistors, photoconductive detectors.

TEXT 1

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3

Module-4	**07 hours**

DIGITAL TRANSMISSION SYSTEMS: Point –to-point links: System considerations, Link power Budget, Rise Time Budget, First window transmission distance, Transmission distance for single mode Links

TEXT 2

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3

Module-5	**09hours**

OPTICAL NETWORKS: Introduction, Optical networks concepts: Optical networking terminology, Optical network node and switching elements, Optical network transmission modes, layers and protocols: Synchronous networks, Asynchronous transfer mode, internet protocol, Optical network deployment: Long haul networks, Metropolitan area networks, Access networks, Local area networks. Optical Ethernet, Network protection, restoration and survivability. TEXT 1

Teaching Learning Method:	Chalk and Talk, power point presentation, animations, videos
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1 Describe the basic concepts of propagation of optical energy in single and multimode optical fibers.

CO2 Compare the fiber losses and its measurements to provide background for optical fiber communications.

CO3 Use the cable design and identify the optical sources and detectors.

CO4 Illustrate the digital transmission system of optical fiber communication

CO5 Understanding and Identifying the different optical Networks and its communication.

Suggested Learning Resources:

Text Books:

1: John M. Senior, "**Optical Fiber Communications**", 3rd Impression Reprint v, Pearson Education, 2012

2: Gerd Keiser, "**Optical Fiber Communication**", 3rd Ed., MGH, Reprint, 2012

Reference Books:

1: Joseph C Palais, "**Fiber Optic Communication**", 4th Edition, Pearson Education, 2012

2: GowerJohn , "Optical Communication System", second edition, Prentice, *2013*

Web Links: www.google.com, Optical Fiber Communications", John M. Senior pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Seminar presentation on Optical Fiber Communication

2: Group discussion on applications of Optical Fiber in modern world of technology

3: Encouraging students to know optical Fiber working and applications by visiting Optoelectronic industry

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		1								1	2	1
CO2	3	2	2		1								1	2	1
CO3	3	2	2		1								1	2	1
CO4	3	2	1		1								1	2	1
CO5	3	2	1		1								1	2	1

High-3, Medium-2, Low-1

VII Semester

ANALOG AND MIXED MODE VLSI			
Course Code:	18EC741	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the concept of Analog Design.
2. Analysis of Single stage amplifiers in VLSI perspective.
3. Analysis of Current sources and sinks in VLSI perspective.
4. Understand the concept of Data Converter Fundamentals.
5. Design and Mismatch Error Analysis of DAC and ADC Architectures.

Module-1	**09 hrs**
Basic MOS Device Physics: General considerations: MOSFET as a Switch, MOSFET Structure, MOS symbols, MOS I/V Characteristics: Threshold Voltage, Derivation of I/V Characteristics, Second Order Effects, MOS Device Models: MOS Device Layout, capacitances, MOS Small-signal Model, NMOS versus PMOS devices, Long channel vs Short-channel devices. **(Text 1)**	
Teaching Learning Method: Chalk and talk method, Power point presentation and videos. **RBT Level:** **RBT Level:** L1, L2, L3	
Module-2	**07 hrs**
Single Stage Amplifiers: Basic Concepts, Common source stage, Common Source stage with resistive load, Common Source stage with Diode connected load, Common Source Stage with Current Source load, Common Source stage with Triode load, Common Source stage with source degeneration. **(Text 1)**	
Teaching Learning Method: Chalk and talk method, Power point presentation and videos. **RBT Level:** **RBT Level:** L1, L2, L3	
Module-3	**07 hrs**
Current Sources and Sinks: The current mirror, The Cascade Connection, Sensitivity Analysis, Transient response, other current sources & sinks. **(Text 1, 2)**	
Teaching Learning Method: Chalk and talk method, Power point presentation and videos. **RBT Level:** **RBT Level:** L1, L2, L3	
Module-4	**07 hrs**
Data Converter Fundamentals: Analog versus Digital discrete time signals, Converting Analog signals to Digital signals, Sample and Hold Characteristics, DAC specifications, ADC specifications, Mixed signal layout issues. **(Text 2)**	
Teaching Learning Method: Chalk and talk method, Power point presentation and videos. **RBT Level:** **RBT Level:** L1, L2, L3	
Module-5	**09 hrs**
Data Converter Architectures: DAC architecture, Digital input code, Resistors string, R-2R ladder networks, Current steering, Charge scaling DACs, Cyclic DAC, Pipeline DAC. **ADC Architecture:** Flash, 2-step flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC. **(Text 2)**	
Teaching Learning Method: Chalk and talk method, Power point presentation and videos. **RBT Level:** **RBT Level:** L1, L2, L3	

Course outcomes:

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

CO1. Draw the basic gates using the stick and layout diagrams with the knowledge of physical design aspects.

CO2. Analyse and Design of Single Stage Amplifiers.

CO3. Analyse and Design of Current sources and sinks.

CO4. Understand concepts of ADC and DAC

CO5. Analysis of ADC, DAC Architectures and Mismatch errors.

Suggested Learning Resources:

Text Books:

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Twenty Fifth Reprint, TATA McGraw Hill, 2013.
2. R Jacob Baker, "CMOS Circuit Design, Layout and Simulation", PHI, 2005

Reference Books:

1. Philip E Allen and Douglas R Holberg, "CMOS Analog Circuit Design", Second edition, Oxford University Press, 2004.
2. Adel Sedra and K C Smith, "Microelectronics Circuits", Fifth edition, Oxford University Press, 2009.

Weblink;

1. http://nptel.ac.in

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Design of CMOS amplifier using CAD tools

2: Design of Memory circuits using the MOS transistors

3: Design of OP AMP for particular specifications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2						2	2	3	
CO2	3	3	3	3	3	2						3	2	3	1
CO3	2	3	2	2	2	2						3	1	3	1
CO4	3	3	3	3	3	3						3	2	3	2
CO5	3	3	3	3	3	3						3	3	3	3

High-3, Medium-2, Low-1

VII Semester

OPERATING SYSTEM			
Course Code:	18EC742	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the history and types of operating systems.
2. Understand the design issues associated with operating systems development.
3. Understand the process management and scheduling.
4. Understand the concepts of memory management.
5. Understand the file and I/O operation.

Module-1	**08 hrs**
INTRODUCTION: Goals of an OS, Operation of an OS **OVERVIEW OF OPERATING SYSTEMS:** OS and computer system, Efficiency, system performance and user convenience, Classes of operating systems, O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems. **TEXT 1**.	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Youtube Videos, Programming examples L1, L2

Module-2	**08 hrs**
STRUCTURE OF THE OPERATING SYSTEMS: Operation of an O.S, Structure of an operating system, Operating systems with monolithic structure, Layered design of an operating system, Virtual machine operating systems, Kernel based operating systems. **TEXT1**	
Teaching Learning Method: **RBT Level:**	PowerPoint Presentation, YouTube videos **RBT Level:** L1, L2, L3

Module-3	**08 hrs**
PROCESS MANAGEMENT: Process and programs, Programmer view of processes, OS view of processes, Threads. **SHEDULING:** Preliminaries, Non pre-emptive scheduling policies, pre-emptive scheduling policies, scheduling in practice. **TEXT 1**	
Teaching Learning Method: **RBT Level:**	Chalk and talk method, Power Point Presentations and supporting YouTube Videos L1, L2, L3

Module-4	**08 hrs**
MEMORY MANAGEMENT: Managing the memory hierarchy, static and dynamic memory allocations, memory allocation to a process, reuse of memory, contiguous and non-contiguous memory allocation, paging, segmentation, segmentation with paging. **VIRTUAL MEMORY:** Virtual memory Basics, Demand paging, page replacement policies. **TEXT 1**	
Teaching Learning Method: **RBT Level:**	Chalk and Talk Method, You Tube Videos **RBT Level:** L1, L2

Module-5	08 hrs

FILE SYSTEMS: File system and IOCS, Files and file organization, Fundamentals of file organizations, Directory structures, File protection, Interface between file system and IOCS, Allocation of disk space. implementation of file access. **TEXT 1**

Teaching Learning Method:	Power Point Presentation, YouTube videos
RBT Level:	**RBT Level:** L1, L2

Course outcomes

CO1: Understand the evolution of operating systems and various types of operating systems in practice
CO2: Analyze the structure of operating system.
CO3: Analyze the concepts of process management and different scheduling management.
CO4: Understand the design issues in memory management and virtual memory.
CO5: Understand the file and I/O management techniques

Suggested Learning Resources:

Text Book:

1. D.M.Dhamdhare, "Operating Systems", Second Edition, TMH, 2008

Reference Books:

1. Stalling William, "Operating Systems", Sixth edition, Pearson Education,

2. Avi Silberchatz, Peter Baer Galvin, Greg Gagne, "Operating system Concepts", Ninth edition, John wiley & Sons

Web Links.

1. faculty.salina.k-state.edu/tim/ossg/Introduction/OSrole.html
2. https://users.dimi.uniud.it/~antonio.dangelo/OpSys/.../Operating_System_Concepts.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
Activity 1:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2		2								1			
CO2		2	2	2						2		2			
CO3	2	2	2			1	1					1			
CO4	2	2		2							1	1			
CO5	2	2									1	1			

High-3, Medium-2, Low-1

VII Semester

SATELLITE COMMUNICATION			
Course Code:	18EC743	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To be able to familiar with satellite systems and laws governing satellite orbit
2. To understand concept of geostationary orbit and various losses on signal transmission in satellite system
3. To evaluate link power budget estimation, System noise and various space segment subsystems
4. To study earth segment, interference between satellite circuits and multiple access systems
5. To understand Direct Broadcast System, Satellite mobile and specialized services

Module-1	**10 hrs**
OVER VIEW OF SATELLITE SYSTEMS: Introduction, frequency allocation, INTELSAT, Orbits and launching methods: Kepler's laws, definitions of terms for earth orbiting satellites. Orbital element, apogee and perigee heights, orbit perturbations, inclined orbits, calendars, universal time, sidereal time, orbital plane, local mean time and sun synchronous orbits. Numerical problems.	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	
Module-2	**06 hrs**
GEOSTATIONARY ORBIT: Introduction, antenna, look angles, polar mount antenna, Limits of visibility, earth eclipse of satellite, sun transit outage, launching orbits. Numerical problems.	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	
Module-3	**08 hrs**
SPACE SEGMENT: Introduction, power supply unit, attitude control: spinning satellite stabilization, momentum wheel stabilization. Station keeping, thermal control, TT&C subsystem, transponders. **SPACE LINK**: Introduction, EIRP, transmission losses: free space transmission, feeder losses, and antenna misalignment losses. Link power budget equation, System noise: antenna noise, amplifier noise temperature, overall system noise temperature.	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	
Module-4	**10 hrs**
EARTH SEGEMENT: Introduction, receive only home TV system: out-door unit, indoor unit, MATV, CATV, Tx – Rx earth station. **INTERFERENCE AND SATELLITE ACCESS**: Introduction, interference between satellite circuits. Satellite access: single access, Pre-assigned FDMA, demand assigned FDMA, spade system, TDMA: pre-assigned TDMA.	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	
Module -5	**05 hrs**

SATELLITE SERVICES: satellite mobile services, VSAT, RadarSat, Global positioning satellite system, orbcomm.

Teaching Learning Method:	Chalk and Talk, YouTube videos
RBT Level:	L1,L2,L3

Course outcomes:

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

CO1. Identify the characteristics of satellite communication Orbits, Launching Methods and channels.

CO2. Explain the concept of geostationary orbit and mathematical model for various losses on signal transmission in satellite system.

CO3. Apply analytical and empirical models in the design of satellite networks and space segments. Able to compute link power budget estimation, System noise.

CO4. Illustrate the multiple access schemes for satellite access.

CO5. Compile the Direct Broadcast System, satellite mobile and specialized services

Suggested Learning Resources:

Text Books:

1: Dennis Roddy, "Satellite Communications",4th Edition, McGraw- Hill International edition, 2006,

Reference Books:

1: Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications", 2nd Edition, John Wiley Pvt. Ltd & Sons, 2008.Pearson Education Asia / PHI, Indian Reprint, 1997.

2: W. L. Pitchand, H. L. Suyderhoud, R. A. Nelson. , "'Communication Systems"", 2nd Edition, Pearson Education , 2007

Web Links:

1. https://www.amazon.com/Satellite-Communications-2nd-DennisRoddy/.../00705337...
2. https://www.flipkart.com/satellite-communications-2nd/p/itme9z9vfzvc9gea

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3													
CO2	3	2				3									
CO3		1				2						2			
CO4		1				2						3			
CO5		3				1						2			

High-3, Medium-2, Low-1

VII Semester

REAL TIME EMBEDDED SYSTEMS			
Course Code:	18EC744	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Introduce the fundamental concepts of the Real time Embedded systems.
2. Study concepts relating to Real time Embedded systems such as Scheduling techniques, Dynamic priority policies.
3. Describe concepts related to Multi resource services like blocking, Deadlock, live lock & soft real time services.
4. Understand the basic hardware and software components of Real time embedded systems.
5. Expose to Real time embedded system applications through different case studies.

Module-1	**07 hrs**
Real-Time Embedded Systems: Introduction, Brief history of Real Time Systems, A brief history of Embedded Systems. **System Resources:** Introduction, Resource analysis, Real-Time Service Utility, scheduling classes, Scheduler concepts, Real-Time OS. (Text 1)	
Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3
Module-2	**08 hrs**
Processing with Real Time Scheduling: Introduction, Pre-emptive Fixed Priority Scheduling Policies with timing diagrams, Problems and issues, Feasibility, Rate Monotonic least upper bound (No derivation), Necessary and Sufficient feasibility, Dynamic priority policies. (Text 1)	
Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3
Module-3	**08 hrs**
I/O Resources: Execution efficiency, I/O Architecture. **Memory:** Physical hierarchy, ECC Memory, **Multi-resource Services:** Blocking, Deadlock and livelock. **Soft real-time services:** Missed deadline, QoS. (Text 1)	
Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3
Module-4	**08 hrs**
Embedded System Components: **Hardware Components:** Sensors, Actuators, IO Interfaces, Processor Complex or SoC, Processor and IO Interconnection, Bus Interconnection, High-Speed Serial Interconnection, Low-Speed Serial Interconnection, Interconnection Systems, Memory Subsystems. **Firmware Components:** Boot Code, Device Drivers, Operating System Services. (Text 1)	
Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3

Module-5	08 hrs

Case Studies:

Robotic Applications: Robotic Arm, Actuation, End Effector Path, Sensing, Tasking, Automation and Autonomy.

Computer Vision Applications: Object Tracking, Image Processing for Object Recognition, Characterizing Cameras, Pixel and Servo Coordinates, Stereo-Vision. (Text 1)

Teaching Learning Method:	Chalk & Board, PowerPoint
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1: Discuss the fundamentals of various real time services, real time service utilities, and Real time embedded system.

CO2: Apply priority based static and dynamic Real time scheduling techniques for the given real time embedded system specifications.

CO3: Analyse deadlock conditions, shared memory problem, priority inversion, missed deadlines and QoS of Real time embedded systems.

CO4: Choose the appropriate real time embedded system components to improve the performance.

CO5: Conduct Case Studies about simple real time embedded systems.

Suggested Learning Resources:

Text Books:

1: "**Real-Time Embedded Components and Systems",** Sam Siewert, John Pratt, Mercury Learning and Information, 2016.

Reference Books:

1: James W S Liu, "**Real Time System**", Pearson education, 2008.

Web Links: nptel.ac.in/courses

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Seminar on different Real Time Embedded Systems we come across in daily life.

2: Analysis of different applications of Real Time Embedded Systems.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1				1						1			
CO2	1	1		1	1							1			
CO3	1	1				1						1			
CO4	1	1			1	1						1			
CO5	1	1				1						1			

High-3, Medium-2, Low-1

VII Semester

OPERATIONS RESEARCH			
Course Code:	18EC745	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3 : 0 : 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives: This course will enable students to:

1. Understand the Scope of Operations Research and TP Formulation.
2 Understand the Assignment Problem.
3. Understand the Network Construction.
4. Understand the competitive real-world phenomena using concepts from game theory.
5. Formulate Queuing models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Queuing problems.

Module-1	**08 hrs**
Introduction to Operations Research: Basics definition, Scope, Objectives, Phases, Models and Limitations of Operations Research. **Transportation Problem:** Formulation, Solution, Unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test.Text1	
Teaching Learning Method: **RBT Level:**	

Module-2	**08 hrs**
Assignment model: Formulation. Hungarian method for optimal solution. Solving unbalanced problem. Traveling salesman problem and assignment problem. **Text1**	
Teaching Learning Method: **RBT Level:**	

Module-3	**08 hrs**
PERT-CPM Techniques: Network construction, determining critical path, floats, scheduling by network, project duration, variance under probabilistic models, prediction of date of completion, crashing of simple networks. **Text1**	
Teaching Learning Method: **RBT Level:**	

Module-4	**08 hrs**
Game Theory: Formulation of games, two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game). **Text1**	
Teaching Learning Method: **RBT Level:**	

Module-5	**07 hrs**
Queuing Theory: Queuing system and their characteristics. The M/M/1 Queuing system, Steady state performance analyzing of M/M/ 1 and M/M/C queuing model. **Text1**	
Teaching Learning Method: **RBT Level:**	

Course outcomes:

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

CO1. Determine the optimal solution for Transportation problems.

CO2. Ability to interpret and explain the Assignment Problem.
CO3. Formulate and solve problems as networks and graphs.
CO4. Determine the best strategy and value of the given game model.
CO5. Design the Queuing system, Game Theory and their characteristics.

Suggested Learning Resources:

Text Books:

1: P. Sankara Iyer, "**Operations Research**", First Edition, Tata McGraw-Hill, ***2008***

2: A.M. Natarajan, P. Balasubramani, A. Tamilarasi, "**Operations Research**", First Edition, Pearson Education, ***2005***

Reference Books (if required)

1: P. K. Gupta and D. S. Hira, "**Operations Research**", Second Edition, S. Chand & co, ***2007***

2: S D Sharma, "**Operations Research, Problems and Solutions**", Paperback 1, kedar Nath Publisher, India Ltd, ***2012***

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
Activity 1:
Activity 2:
Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2						1	1			3	1	
CO2	3	2	2						1	1			3	1	
CO3	3	2	2						1	1			3	1	
CO4	3	2	2						1	1			3	1	
CO5	3	2	2						1	1			3	1	

High-3, Medium-2, Low-1

VII Semester

ADAPTIVE SIGNAL PROCESSING			
Course Code:	18EC746	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To understand the basic concept of adaptive filter and adaptive system.
2. To be able to identify the geometrical significance of Eigenvectors and values
3. To analyze the Simple, Newton's and Steepest descent Gradient search method to search performance surface
4. To study estimation of gradient component using Newton's, Steepest-descent methods and LMS algorithm
5. To be familiar with design of adaptive communication system, adaptive noise canceller and adaptive modelling in FIR digital filter synthesis

Module-1	**06 hrs**
ADAPTIVE SYSTEMS: Definition and characteristics, Areas of application, General properties, Open- and closed loop adaptation, Applications of closed-loop adaptation, Example of an adaptive system. (Text1)	
Teaching Learning Method: Chalk board/PPT/Classroom Discussion/Group activity **RBT Level:** L1, L2	
Module-2	**10 hrs**
THE ADAPTIVE LINEAR COMBINER: General description, Input signal and weight vectors, Desired response and error, the performance function, gradient and minimum mean-square error, Example of a performance surface **PROPERTIES OF THE QUADRATIC PERFORMANCE SURFACE**: Normal of the input correlation matrix, Eigen values and Eigen vectors of the input correlation matrix, an example with two weights, geometrical significance of eigenvectors and Eigen values.(Text1)	
Teaching Learning Method: Chalk board/PPT/Classroom Discussion/Group activity **RBT Level:** L1, L2, L3	
Module-3	**10 hrs**
SEARCHING THE PERFORMANCE SURFACE: Methods of searching the performance surface, Basic ideal of gradient search methods, a simple gradient search algorithm and its solution, Stability and rate of convergence, The learning curve, and Gradient search by Newton's method in multidimensional space, Gradient search by the method of steepest descent, Comparison of learning curves. (Text1)	
Teaching Learning Method: Chalk board/PPT/Classroom Discussion/Group activity **RBT Level:** L1, L2, L3	
Module-4	**07 hrs**
THE LMS ALGORITHM: Derivation of the LMS algorithm, convergence of the weight vector, an example of convergence, learning curve, noise in the weight-vector solution (Text1)	
Teaching Learning Method: Chalk board/PPT/Classroom Discussion/Group activity **RBT Level:** L1, L2, L3	
Module-5	**06 hrs**

ADAPTIVE MODELING AND SYSTEM IDENTIFICATION: Multipath communication channel, geophysical exploration, FIR digital filter synthesis. (Text1)

Teaching Learning Method:	Chalk board/PPT/Classroom Discussion/Group activity
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1: Understand the basic concept of adaptive filter and adaptive system

CO2: Understand the design of adaptive linear combiner and identify the geometrical significance of Eigenvectors and values

CO3: Analyse the Simple, Newton's and Steepest descent Gradient search method to search performance surface.

CO4: Estimate the gradient component using Newton's, Steepest-descent methods and LMS algorithm

CO5: Design of adaptive communication system, adaptive noise canceller and adaptive modelling in FIR digital filter synthesis.

Suggested Learning Resources:

Text Books:

1, Bernard Widrow and Samuel D. Stearns, "Adaptive Signal Processing", Edition, Pearson Education, Asia, 2009

2. Simon Haykin, "Adaptive filter Theory", 4th edition, Pearson Education Asia, 2008

Reference Books (if required)

1: T. Adali and Simon Haykin, "Adaptive Signal Processing: Next Generation Solutions,"Wiley India, 2012.

2: Jophn R. Treichler C. Richard Johnson, Jr. and Michael G. Larimore, "Theory and Design of Adaptive Filters", Pearson Education / PHI 2002.

Web Link: https://archive.nptel.ac.in/courses/117/105/117105075/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Group activity through implementation of circuit using MATLAB

2: Discussion of concepts in classroom through real time processing of model using MATLAB

3: Quiz

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2											3	2	
CO2	3	3	3										3	2	
CO3	3	3	3										3	3	
CO4	3	3	3										3	3	
CO5	3	2	2	2									3	2	

High-3, Medium-2, Low-1

VII Semester

INTERNET OF THINGS			
Course Code:	18EC751	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3: 0: 0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	40	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Assess the genesis and impact of IoT applications, architectures in real world
2. Illustrate diverse methods of deploying smart objects and connect them to network.
3. Compare different Application protocols for IoT
4. Infer the role of Data Analytics and Security in IoT.
5. Identify sensor technologies for sensing real world entities and understand the role of IoT in various domains of Industry.

Module-1	**09 hrs**
What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Computer Stack. **TEXT 1**	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	

Module-2	**10 hrs**
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, **Connecting Smart Objects:** Technologies for connecting smart objects, Communication criteria, Topologies, IoT Access Technologies: Protocol Stack utilizing IEEE 802.15.4, LoRaWAN, NB-IOT and other LTE variations. **TEXT 1**	
Teaching Learning Method: Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3	

Module-3	**06 hrs**
IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Optimizing IP for IoT, Profiles and Compliances. **TEXT 1**	
Teaching Learning Method: Chalk and Talk, YouTube videos, assignments **RBT Level:** L1, L2, L3	

Module-4	**06 hrs**
Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. **TEXT 1**	
Teaching Learning Method: Chalk and Talk, YouTube videos, assignments **RBT Level:** L1, L2, L3	

Module-5	**08 hrs**
Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, **TEXT 1**	

Teaching Learning Method:	Chalk and Talk, YouTube videos, assignments
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.

CO2. Compare and contrast the deployment of smart objects and the technologies to connect them to network.

CO3. Appraise the role of IoT protocols for efficient network communication.

CO4. Analyze higher layer IoT Protocols.

CO5. Elaborate the need for Data Analytics and identify the applications of IoT in Industry.

Suggested Learning Resources:

Text Books:

1: David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education (Cisco Press Indian Reprint).

2: Srinivasa K G, "Internet of Things",CENGAGE Leaning India, 2017

Video link: IoT Projects for Beginners To Master The Technology - Great Learning (mygreatlearning.com)

Reference Books:

1: Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1 st Edition, VPT, 2014. (ISBN: 978-8173719547)

2: Raj Kamal, "Internet of Things: Architecture and Design Principles", 1 st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1: Model based implementation of IOT applications

2: Case studies on smart city

3: Case studies on smart health care

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	2	2			1				2	
CO2	3					2	1							2	
CO3	3		2			2	2						2	2	
CO4	3		1			2	1					1	2	2	
CO5	3		1		1	2	1					3	2	2	

High-3, Medium-2, Low-1

VII Semester

CRYPTOGRAPHY			
Course Code:	18EC752	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. To impart the basic concepts of network security and classical encryption, number theory, stream ciphers, block ciphers and authentication
2. To interpret the cryptographic algorithms like stream ciphers and block ciphers using classical encryption techniques
3. To apply the concept of classical encryption techniques to stream ciphers and block ciphers
4. To analyse the stream ciphers, block ciphers and authentication functions
5. To design the stream ciphers, block ciphers and authentication functions

Module-1	**08 hrs**
Introduction: Services, mechanisms and attacks, OSI security architecture, Model for network security. **Symmetric ciphers:** Symmetric Cipher Model, Substitution Techniques: Caesar Cipher, Mono Alphabetic Cipher, Playfair Cipher, Hill Cipher, polyalphabetic Cipher and One-Time Pad (OTP). Transposition Techniques, Rotor Machines, Steganography. **TEXT 1**	
Teaching Learning Method:	
RBT Level:	L1, L2

Module-2	**08 hrs**
Finite Fields: Groups, Rings, Fields. Modular Arithmetic: Divisors, properties of modulo operator, modular arithmetic operations and properties. Euclid's Algorithm, Greatest Common Divisor (GCD), finding GCD. Finite Fields of the form GF (p): Finite fields of order p, polynomial arithmetic. **TEXT 1**	
Teaching Learning Method:	
RBT Level:	L1, L2

Module-3	**08 hrs**
Private Key Encryption: Simplified DES, Block Cipher Principles, Data encryption standard (DES), Strength of DES, Block Cipher Design Principles and Block Cipher Modes of Operation, Evaluation Criteria for Advanced Encryption Standard, The AES Cipher. **TEXT 1**	
Teaching Learning Method:	
RBT Level:	L2, L3, L4

Module-4	**07 hrs**
Public Key Encryption: Principles of Public-Key Cryptosystems, The RSA algorithm. Key Management, Diffie - Hellman Key Exchange. **TEXT 1**	
Teaching Learning Method:	
RBT Level:	L2, L3, L4

Module-5	**08 hrs**
Authentication Functions and Hash Functions: Authentication functions, message authentication codes, hash functions, security of Hash functions and MACs. **TEXT 1**	
Teaching Learning Method:	

RBT Level:	L2, L3, L4

Course outcomes:

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

CO1: Define the basic concepts of network security, classical encryption, number theory, Private key, public key, authentication

CO2: Understand the structure of cryptographic algorithms and their applications.

CO3: Apply the concept of classical encryption techniques to existing standard algorithms.

CO4: Illustrate the significance of cryptographic algorithms and their applications.

CO5: Design the private key and public key, authentication functions for applications.

Suggested Learning Resources:

Text Books:

1. **Text book 1:** William Stallings, "Cryptography and Network Security: Principles and Practice", Fifth Edition, Pearson, 2010

Reference Books:

1. Behrouz Forouzan, "Cryptography and Network Security", edition, TMH, 2007
2. Alfred J. Menezes, Paul C. Van Oorschot and Scott A. Vanstone, "Handbook of Applied Cryptography", edition, CRC Press, Reprint 2001
3. Bruce Scheiner, "Applied cryptography: protocols, algorithms, and source code in C", 2nd edition, Wley India, 2008
4. Atul Kahate , "Cryptography and Network Security", 2nd edition, TMH, 2006

Web Links: http://www.nptel.ac.in/courses/106105031/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

MOBILE COMMUNICATION			
Course Code:	18EC753	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Able to understand the basics of wireless communication used for mobile telephony.
2. Able to understand basic methodologies of cellular system design ·
3. Able to remember components and characteristics of 2.5G network, 3G network architecture. Discuss the various cyber security frame work.
4. Able to understand Spread Spectrum communication and CDMA technology.
5. Able to remember characteristics of emerging wireless technologies.

Module-1	**08 hrs**
Evolution of wireless communication system: History of wireless communication, advantages and disadvantages of wireless communications, wireless network generations, comparison of wireless systems, evolution to next generation networks, application of wireless communications, potential market areas. **TEXT 1**	
Teaching Learning Method: Chalk & Talk, PowerPoint presentation **RBT Level:** L1, L2, L3	

Module-2	**08 hrs**
Principles of cellular Communication: Cellular terminologies, cell structure and cluster, frequency reuse concept, cluster size and system capacity method of locating co channel cells, frequency reuse distance, co- channel interference and reduction methods, A Basic Cellular system: Limitations of conventional mobile telephone system, **TEXT 1**	
Teaching Learning Method: Chalk & Talk, PowerPoint presentation **RBT Level:** L1, L2, L3	

Module-3	**07 hrs**
Global System for Mobile (GSM): GSM Network architecture, Signalling protocol Architecture, identifies in GSM system, GSM channels, frame structure, speech coding, authentication and security in GSM, services. **TEXT1**	
Teaching Learning Method: Chalk & Talk, PowerPoint presentation **RBT Level:** L1, L2, L3	

Module-4	**08 hrs**
CDMA digital cellular standards (IS 95): General model of Spread spectrum digital communication system, Direct sequence Spread Spectrum, Frequency hopping Spread Spectrum, Architecture of CDMA system. **3G Digital cellular Technology:** 2.5G TDMA evolution, GPRS Technology, EDGE Technology, UMTS Technology-CDMA: Comparison of W-CDMA and IS 95.**TEXT1**	
Teaching Learning Method: Chalk & Talk, PowerPoint presentation **RBT Level:** L1, L2, L3	

Module-5	**08 hrs**
Emerging wireless Network Technologies: IEEE.802.11 technology, ETSI Hyper LAN Technology, IEEE.802.15 WPAN technology, IEEE.802.16 WMAN technology, Mobile AD-HOC network	

(MANETS), Wireless Sensor Networks (WSNs), Security requirements of wireless Networks, IEEE.802.21 standard-An overview, Interoperability of Wireless Networks.**TEXT1**

Teaching Learning Method:	Chalk & Talk, PowerPoint presentation
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Identify the telecommunication system and networks system, 3G cellular system components; list the components of wireless cellular network and different frequency band used in GSM and CDMA

CO2. Explain cellular systems, list the characteristics of 3G wireless mobile systems and network security

CO3. Explain the architecture of 3G and network Systems and the operation needed for call setup and call release in GSM and TDMA system and concept of CDMA,

CO4. Illustrate the cellular concept, cell sectoring and cell splitting, mobility management, CDMA channel concept, GSM frame concept

CO5. Discuss characteristics of Emerging wireless Network Technologies

Suggested Learning Resources:

Text Books:

1. T L Singal, "Wireless Communications: Tata McGraw-Hill Education, Delmar Cengage Learning,2010.

Reference Books:

1. Garry J Mullet, "Introduction to Telecommunication Systems and Networks", India Edition, Delmar Cengage Learning, 2007
2. Upena Dalal, "Wireless communication", Oxford Higher Education, 6th impression,2013**Web Links:** http://www.nptel.ac.in/courses/106105031/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Activity 1:

Activity 2:

Activity 3:

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

BIO-MECHATRONICS			
Course Code:	18EC754	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Learn basic knowledge about Bio mechanics, Bio sensors and actuators, and bio- mechatronics devices.
2. Impart the bio assist devices.
3. Know the different types, bio imaging and processing.
4. Understand about bio mechatronics devices and their functions.

Module-1	**08 hrs**
Bio Mechanics: Cardiovascular biomechanics, Musculoskeletal and orthopedic biomechanics, human ergonomic, Rehabilitation. **Text1**	
Teaching Learning Method:	Chalk and Board /PPT
RBT Level:	L1, L2
Module-2	**08 hrs**
Bio Sensors and Actuators: Introduction to Bio mechatronics, Electrodes - Types, - Measurement of blood pressure - Blood Gas analyzers: pH of blood, Smart actuators for biological applications **Text1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-3	**08 hrs**
Medical Measurements: Heart rate - Heart sound -Pulmonary function measurements -spirometer -finger-tip oximeter - ESR, GSR measurements **Text1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-4	**07 hrs**
Wearable mechatronics devices: Wearable Artificial Kidney, Wireless capsule endoscope, Wearable Exoskeletal rehabilitation system, Wearable hand rehabilitation. **Text1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3
Module-5	**08 hrs**
Sensory Assist Devices: Hearing aids – Implants, Optical Prosthetics, Visual Neuroprostheses – Sonar based systems, Respiratory aids, Tactile devices for visually challenged. **Text1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Demonstrate the basic knowledge about the Bio mechanics, Bio sensors and actuators, and bio-mechatronics devices.

CO2. Acquire the different bio imaging and processing.

CO3. Analyse the Signal processing with bio sensors and actuators.

CO4. Analyse modern medical measurement devices.

CO5. Understand the properties of bio assist devices.

Suggested Learning Resources:

Text Books:

1. Graham M. Brooker, “Introduction to Bio-Mechatronics”, Sci Tech Publishing, 2012.

Reference Books

1.Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, “Bio-Medical Instrumentation and Measurements”, II edition, Pearson Education, 2009.

2. Raymond Tong Kaiyu. “Bio-mechatronics in Medicine and Healthcare” Pan Stanford Publishing, CRC Press, 2011

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Seminar, Mini projects, Group discussion

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

INTRODUCTION TO UNMANNED AERIAL VEHICLE (UAV)			
Course Code:	18EC755	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	3:0:0:0	**SEE Marks:**	50
Total Hours of Pedagogy:	39	**Total Marks:**	100
Credits:	03	**Exam Hours:**	03

Course objectives:

1. Understand the basic aviation history and UAV systems
2. Acquire the knowledge of basic aerodynamics, performance, stability and control.
3. Understand the mission and control of UAVs.
4. Understand the launch and recovery of UAVs.

Module-1	**07 hrs**
Introduction: Aviation History and Overview of UAV systems. Classes and Missions of UAVs: Examples of UAV systems-very small, small, Medium and Large UAVs, Classes of UAV systems. Missions of UAV systems. **Text 1**	
Teaching Learning Method:	Chalk and Board /PPT
RBT Level:	L1, L2

Module-2	**08 hrs**
The Air Vehicle: Basic Aerodynamics: Basic Aerodynamics equations, Aircraft polar, the real wing and Airplane, Induced drag, the boundary layer, Flapping wings. Total Air-Vehicle Drag Performance: Overview, Climbing flight, Range and Endurance – for propeller driven aircraft, range- a jet-propelled aircraft, Guiding Flight. **Text 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Module-3	**08 hrs**
Stability and Control: Overview, Stability, longitudinal stability, lateral stability, dynamic stability, Aerodynamics control, pitch control, lateral control, Autopilots, sensor, controller, actuator, airframe control, inner and outer loops, Flight-Control Classification, Overall Modes of Operation, Sensors Supporting the Autopilot. **Text 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Module-4	**08 hrs**
Mission Planning and Control: Overview, Physical configuration. Air Vehicle and Payload Control: Overview, Modes of control, Piloting the Air vehicle, Controlling the Payloads. **Text 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Module-5	**08 hrs**
Launch and Recovery: UAV Launch Methods for Fixed-Wing Vehicles: Rail Launchers, Pneumatic Launchers, Hydraulic/Pneumatic Launchers. Recovery Systems: Conventional Landings, Vertical Net Systems, Parachute Recovery, Mid-Air Retrieval, Shipboard Recovery. **Text 1**	
Teaching Learning Method:	Chalk and talk, PPT
RBT Level:	L1, L2, L3

Course outcomes:

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

CO1. Able to understand the UAV systems.

CO2. Able to interpret the mission planning and control of UAV.

CO3. Gain the knowledge of the basic aerodynamics and performance of UAVs

CO4. Capable of analysing the stability and control required for UAV.

CO5. Able to apply the knowledge for launch and recovery of UAVs.

Suggested Learning Resources:

Text Books:

1. Paul Gerin Fahlstrom , Thomas James Gleason, "Introduction To UAV Systems", 4th Edition, Wiley Publication, 2012 John Wiley & Sons, Ltd.

Reference Books

1. Landen Rosen, "Unmanned Aerial Vehicle", Alpha Editions, 2015.

2. Valavanis**,** K., Vachtsevanos, George J., Handbook of Unmanned Aerial Vehicles, Springer, 2015.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Seminar, Mini projects, Group discussion

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															
CO5															

High-3, Medium-2, Low-1

VII Semester

ADVANCED COMMUNICATION LAB			
Course Code:18ECL76	18ECL76	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:1:0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	12	**Total Marks:**	100
Credits:	01	**Exam Hours:**	03

Course objectives:

This course will enable students to:

1. Understand the circuit schematic and its working of ASK, FSK, PSK, DPSK and QPSK circuits.
2. Design and test of ASK, FSK, PSK, DPSK and QPSK circuits.
3. Analyzing various losses using OFC kit
4. Measurement of parameters like frequency, guide wavelength, power, VSWR and Attenuation.
5. Learn to measure directivity and gain of different antennas.
6. Demonstrate sampling theorem under different sampling conditions.

Syllabus Contents

1	ASK generation and detection using discrete components.
2	FSK generation and detection using discrete components.
3	PSK generation and detection using discrete components.
4	To prove sampling theorem, to study the effects of under sampling and oversampling.
5	DPSK generation and detection using kit.
6	QPSK generation and detection using kit
7	Establish Analog and Digital communication link using optical fiber and Measure the losses (coupling loss, bending loss, attenuation loss numerical aperture.)
8	Measurement of frequency, guide wavelength, power, VSWR and Attenuation in a microwave test bench.
9	Measurement of directivity and gain of micro strip patch antenna using printed dipole.
10	Measurement of directivity and gain of Yagi antenna (printed) using printed dipole.

Course outcomes:

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

CO1. Understand the working of ASK, FSK, PSK, DPSK and QPSK circuits.
CO2. Design ASK, FSK, PSK, DPSK and QPSK circuits.
CO3. Analyse various losses using OFC kit and parameters like frequency, guide wavelength, power, VSWR and Attenuation.
CO4. Demonstrate the sampling theorem and measurement of antenna parameters.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1															
CO2															
CO3															
CO4															

High-3, Medium-2, Low-1

VII Semester

COMPUTER COMMUNICATION NETWORKS LAB			
Course Code:18ECL76	18ECL77	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:1:0: 0	**SEE Marks:**	50
Total Hours of Pedagogy:	12	**Total Marks:**	100
Credits:	01	**Exam Hours:**	03

Course objectives:

This course will enable students to:

1. Demonstrate the simulation of few protocols of data link layer and network layer.
2. Demonstrate the network communication between source and destination.
3. Demonstrate the detection and correction of error in data communication.
4. Simulate the configuration and verification of networking devices.

	Syllabus Contents
1	Write a C program to implement Bit Stuffing and deStuffing
2	Write a C program to simulate a character stuffing and destuffing for a given message.
3	Write a C program to compute a polynomial checksum for a given binary data frame
4	Write a C program to simulate a shortest path Algorithm.
5	Using TCP/IP Sockets, write a client-server program to make client to communicate with Server using socket programming techniques in python.
	Part B
6	**SERIAL COMMUNICATION USING** (i) RS232 (ii) MODEM COMMUNICATION (iii) FIBER OPTIC COMMUNICATION
7	**Configuring and Verifying LAYER 2 Switches:** Establish a communication between the HOSTS by connecting the Network Devices as given below, configure them and verify the same. Configuration includes HOSTNAME, BANNER, PASSWORD (CONSOLE, TELNET and ENABLE),MANAGEMENT IPand DEFAULT GATEWAY.
8	**Configuring and Verifying VLAN:**Establish a communication between the hosts by connecting the network Devices as given below, configure them and verify the same. Configuration includes Switch port configuration and encapsulation methods.
9	**Configuring and Verifying IP Routing:**Establish a communication between the hosts by connecting the network Devices as given below, configure them and verify the same. Configuration includes: 1. Static Routing 2. Dynamic Routing (RIP/OSPF/EIGRP)
10	**Configuring DHCP Server on a Router:** Configure DHCP server on a router to assign IP address dynamically to the hosts and verify the same **a. For One Broadcast Domain**

	b. For Many Broadcast Domain
12	**PART-C [Simulation Case-Study]** Dr. AIT is granted a block of addresses starting from **192.168.100.0/24**. The Dr. AIT College committee decided to distribute these blocks of addresses to **THREE** Departments with each department receiving just **FOUR** Addresses. **1. Design the sub blocks and give the slash notation to each sub block.**
13	**2. Simulate the above case using Cisco-packet Tracer.** Note: while simulating Consider the following Constraints: a. Establish a communication within the Departments. b. Only HOD's of each Department can communicate (Single user from each Department) with each other.

Course outcomes:

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

CO1 conduct an experiment to simulate various protocols of data link and network layer.

CO2. Configure and verify VLAN and switches.

CO3.write the program to verify the detection and correction of error.

CO4.Demonstrate the data communication between two systems using the communication kit.

Co5. write the program to transfer file and establish connection between two devices.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**
CO2		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**
CO3		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**
CO4		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**
CO5		**2**		**3**	**3**				**3**	**3**		**3**	**2**	**3**	**3**

High-3, Medium-2, Low-1

VII Semester

MAJOR PROJECT PHASE-1			
Course Code:	18ECP78	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:2:0	**SEE Marks:**	50
Total Hours of Pedagogy:	26	**Total Marks:**	100
Credits:	02	**Exam Hours:**	03

Course objectives: The student will be able to learn,

1. How to originate, develop, and analyse ideas and information, as well as how to link knowledge from other fields together, in order to apply these abilities to the project's job.
2. How to effectively connect with others and to convey ideas to a specific audience both orally and in writing.
3. How to work as a team to accomplish a common goal to develop collaboration abilities.
4. To evaluate what they've learned and take the appropriate action to improve it.

Major Project Guidelines:

The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s) before the beginning of the 8th semester. The detailed Synopsis (approved by the department Project Review Committee) has to be submitted during the 1st week after the commencement of 8th semester.

Formation of Groups:

Students are free to choose their project partners from within the programme or any other programme. The project work is to be carried out by a team of two to four students. Each student in the team must contribute towards the successful completion of the project.

The project may be carried out In-house / Industry / R & D Institution.

Selection of Project Topic:

The topics of the project work must be in the field of respective program. The projects as far as possible should have societal relevance with focus on sustainability.

Course outcomes:

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

CO1. Apply their knowledge of science, math, and engineering to the challenges in the relevant engineering domains.

CO2 Create, develop, and showcase novel or multidisciplinary modules.

CO3. Use contemporary engineering tools, software, and equipment to solve problems and continue learning throughout their life to stay with technological advancements.

CO4. Utilize their knowledge of professional ethics and obligations to work effectively as an individual or as a leader in varied teams.

Assessment Details (both CIE and SEE):

CIE Assessment:

The following are the weightings given for the various stages of the project.

1. Identification of Problem and Introduction 20%
2. Literature Survey and Identifying Research Gap 20%
3. Methodology, H/W & S/W Specifications 20%
4. Design requirements and Specifications 20%
5. Presentation and Viva voce 20%

SEE Assessment:

The following are the weightages given during Viva Examination.

1. Written presentation of synopsis 10%
2. Presentation/Demonstration of the project 30%
3. Methodology and Experimental Results & Discussion 30%
4. Report 10%
5. Viva Voce 20%

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1	1		2				2	1	
CO2	3		3	3	3	1	1		2	2			1	1	
CO3	3	2		1	3							1	1	1	
CO4								3	3	2			1	1	

High-3, Medium-2, Low-1

VIII Semester

MAJOR PROJECT PHASE-2			
Course Code:	18ECP81	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):	0:0:3:0	**SEE Marks:**	50
Total Hours of Pedagogy:		**Total Marks:**	100
Credits:	10	**Exam Hours:**	03

Course objectives: The student will be able to learn,

1. How to originate, develop, and analyse ideas and information, as well as how to link knowledge from other fields together, in order to apply these abilities to the project's job.
2. How to effectively connect with others and to convey ideas to a specific audience both orally and in writing.
3. How to work as a team to accomplish a common goal to develop collaboration abilities.
4. To evaluate what they've learned and take the appropriate action to improve it.

Major Project Guidelines:

The project topic, title and synopsis have to be finalized and submitted to their respective internal guide(s) before the beginning of the 8th semester. The detailed Synopsis (approved by the department Project Review Committee) has to be submitted during the 1st week after the commencement of 8th semester.

Formation of Groups:

Students are free to choose their project partners from within the programme or any other programme. The project work is to be carried out by a team of two to four students. Each student in the team must contribute towards the successful completion of the project.

The project may be carried out In-house / Industry / R & D Institution.

Selection of Project Topic:

The topics of the project work must be in the field of respective program. The projects as far as possible should have societal relevance with focus on sustainability.

Course outcomes:

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

CO1. Apply their knowledge of science, math, and engineering to the challenges in the relevant engineering domains.

CO2 Create, develop, and showcase novel or multidisciplinary modules.

CO3. Use contemporary engineering tools, software, and equipment to solve problems and continue learning throughout their life to stay with technological advancements.

CO4. Utilize their knowledge of professional ethics and obligations to work effectively as an individual or as a leader in varied teams.

Assessment Details (both CIE and SEE):

CIE Assessment:

The following are the weightings given for the various stages of the project.

1. Identification of Problem and Introduction 20%
2. Literature Survey and Identifying Research Gap 20%
3. Methodology, H/W & S/W Specifications 20%
4. Design requirements and Specifications 20%
5. Presentation and Viva voce 20%

SEE Assessment:

The following are the weightages given during Viva Examination.

1. Written presentation of synopsis 10%
2. Presentation/Demonstration of the project 30%
3. Methodology and Experimental Results & Discussion 30%
4. Report 10%
5. Viva Voce 20%

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2				1	1		2				2	1	
CO2	3		3	3	3	1	1		2	2			1	1	
CO3	3	2		1	3							1	1	1	
CO4								3	3	2			1	1	

High-3, Medium-2, Low-1

VIII Semester

Course Name: Technical Seminar			
Course Code:	18ECS82	**SEE Marks:**	50
Credits:	01		

Course objectives:

1. Identify and compare technical and practical issues related to the area of course specialization.
2. Outline annotated bibliography of research demonstrating scholarly skills.
3. Prepare a well-organized report employing elements of technical writing and critical thinking.
4. Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting.

Course outcomes:

CO1. Identify recent technical topics from interested domains related to the program.

CO2. Organize a detailed literature survey and build a document with respect to technical publications.

CO3. Analysis and comprehension of proof-of-concept and related data.

CO4. Develop **e**ffective presentation and improve communication skills.

CO5. Make use of new and recent technology for creating technical reports.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	-	-	-	-	2	-	1	-	2	1	-	
CO2	1	2	-	-	-	-	-		-	-	-	2	-	-	
CO3	1	-	-	1	-	-	-	-	-	-	-	2	-	-	2
CO4	1	-	-		-	-	-	-	-	3	-	2	-	-	2
CO5	1	-	-	-	-	-	-	-	-	-	-	2	-	-	2

High-3, Medium-2, Low-1

Semester VIII

INDUSTRY INTERNSHIP			
Course Code:	**18ECI83**	**CIE Marks:**	50
Teaching Hours/Week (L:T:P:S):		**SEE Marks:**	50
Total Hours of Pedagogy:		**Total Marks:**	100
Credits:	2	**Exam Hours:**	3

Course objectives:

1. Understand the process of applying engineering knowledge to industrial products & processes
2. Explain the importance of skilling, training and resource management.
3. Comprehend the importance of team work, communication and sustainable solutions.
4. Imbibe values, professional ethics for lifelong learning.

Guidelines

Research/Industrial Internship - At the End of the sixth / Seventh semester (in two cycles to accommodate all the students of the University) Research/Industrial Internship shall be carried out – Based on industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo a mandatory internship of 24 weeks during the vacation of VI/VII semesters. A University Viva-Voce examination shall be conducted during VII/VIII semester and the prescribed credit shall be included in VII/VIII semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. Research internship Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give you the flavour of current research going on on a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Industry internships: This is an extended period of work experience undertaken by university/Institute students looking to supplement their degree with professional development. The students are allowed to prepare themselves for the workplace and develop practical skills as well as academic ones. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with "unexpected contingencies" helps students recognize, appreciate, and adapt to organization realities by tempering knowledge with practical constraints.

Those, who have not pursued /completed the internship will be declared as failed and have to complete during subsequent SEE examination after they satisfy the internship requirements.

Course outcomes:

At the end of the industrial training the student will be able to:

CO1. Understand the process of applying engineering knowledge to solve industrial problems

CO2. Develop skills through training relevant to industrial requirement

CO3. Communicate effectively and work in teams

CO4. Imbibe the practice of professional ethics and need for lifelong learning.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		2	3	2		2				1			3		2
CO2				3	2	2		1					1	1	2
CO3					1		2	3	3					2	2
CO4					1		3			2	3		2	3	2
CO5															

High-3,Medium-2, Low-1