Dr. Babasaheb Ambedkar Technological University

(Established a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)

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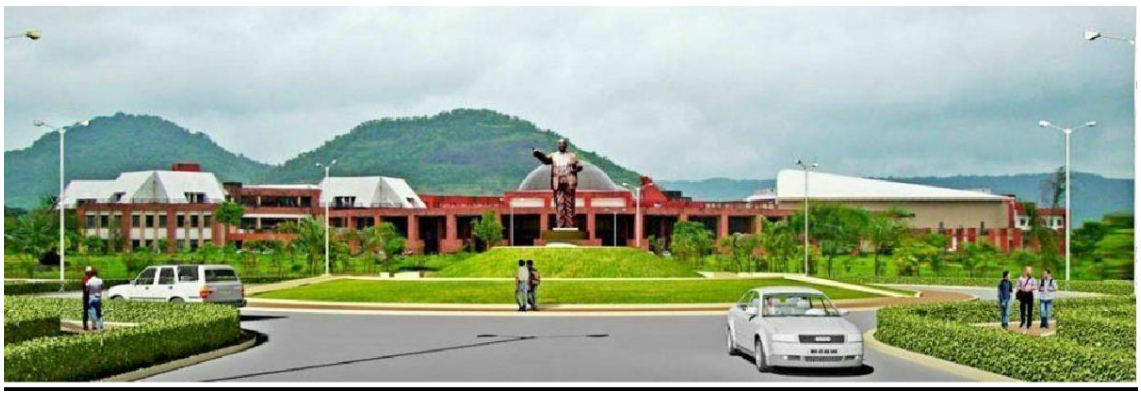
PROPOSED CURRICULUM OF UNDERGRADUATE PROGRAMME B. TECH

Electronics Engineering (VLSI Design and Technology)

Second Year [2024-25]
Third Year [2025-26]
Final Year [2026-27] and onwards



Rules and Regulations

1. The normal duration of the course leading to B. Tech degree will be EIGHT semesters.
2. The normal duration of the course leading to M. Tech. degree will be FOUR semesters.
3. Each academic year shall be divided into 2 semesters, each of 20 weeks duration, including evaluation and grade finalization, etc. The Academic Session in each semester shall provide for at least 90 Teaching Days, with at least 40 hours of teaching contact periods in a five to six days session per week. The semester that is typically from Mid-July to November is called the ODD SEMESTER, and the one that is from January to Mid-May is called the EVEN SEMESTER. Academic Session may be scheduled for the Summer Session/Semester as well. For 1st year B. Tech and M. Tech the schedule will be decided as per the admission schedule declared by Government of Maharashtra.
4. The schedule of academic activities for a Semester, including the dates of registration, mid-semester examination, end- semester examination, inter-semester vacation, etc. shall be referred to as the Academic Calendar of the Semester, which shall be prepared by the Dean (Academic), and announced at least TWO weeks before the Closing Date of the previous Semester.
5. The Academic Calendar must be strictly adhered to, and all other activities including co-curricular and/or extra -curricular activities must be scheduled so as not to interfere with the Curricular Activities as stipulated in the Academic Calendar.

REGISTRATION:

1. Lower and Upper Limits for Course Credits Registered in a Semester, by a Full-Time Student of a UG/PG Programme: A full time student of a particular UG/PG programme shall register for the appropriate number of course credits in each semester/session that is within the minimum and maximum limits specific to that UG/PG programme as stipulated in the specific Regulations pertaining to that UG/PG programme.
2. Mandatory Pre-Registration for higher semesters: In order to facilitate proper planning of the academic activities of a semester, it is essential for the every institute to inform to Dean (Academics) and COE regarding details of total no. of electives offered (Course-wise) along with the number of students opted for the same. This information should be submitted within two weeks from the date of commencement of the semester as per academic calendar.
3. PhD students can register for any of PG/PhD courses and the corresponding rules of evaluation will apply.
4. Under Graduate students may be permitted to register for a few selected Post Graduate courses, in exceptionally rare circumstances, only if the DUGC/DPGC is convinced of the level of the academic achievement and the potential in a student.

Course Pre-Requisites:

1. In order to register for some courses, it may be required either to have exposure in, or to have completed satisfactorily, or to have prior earned credits in, some specified courses.
2. Students who do not register on the day announced for the purpose may be permitted LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.

3. REGISTRATION IN ABSENTIA will be allowed only in exceptional cases with the approval of the Dean (Academic) / Principal.

4. A student will be permitted to register in the next semester only if he fulfills the following conditions:

(a) Satisfied all the Academic Requirements to continue with the programme of Studies without termination

(b) Cleared all Institute, Hostel and Library dues and fines (if any) of the previous semesters;

(c) Paid all required advance payments of the Institute and hostel for the current semester;

(d) Not been debarred from registering on any specific ground by the Institute.

EVALUATION SYSTEM:

1. Absolute grading system based on absolute marks as indicated below will be implemented from academic year 2020-21, starting from I year B. Tech.

Percentage of Marks	Letter Grade	Grade Point
91-100	EX	10.0
86-90	AA	9.0
81-85	AB	8.5
76-80	BB	8.0
71-75	BC	7.5
66-70	CC	7.0
61-65	CD	6.5
56-60	DD	6.0
51-55	DE	5.5
40-50	EE	5.0
<40	EF	0.0

2. Class is awarded based on CGPA of all eight semesters of B. Tech Program.

CGPA for pass is minimum 5.0	
CGPA upto < 5.50	Pass class
CGPA ≥ 5.50 & < 6.00	Second Class
CGPA ≥ 6.00 & < 7.50	First Class
CGPA ≥ 7.50	Distinction
[Percentage of Marks =CGPA*10.0]	

3. A total of 100 Marks for each theory course are distributed as follows:

1	Mid Semester Exam (MSE) Marks	20
2	Continuous Assessment Marks	20
3	End Semester Examination (ESE) Marks	60

4. A total of 100 Marks for each practical course are distributed as follows:

1.	Continuous Assessment Marks	60
2.	End Semester Examination (ESE)Marks	40

It is mandatory for every student of B. Tech to score a minimum of 40 marks out of 100, with a minimum of 20 marks out of 60 marks in End Semester Examination for theory course.

This will be implemented from the first year of B. Tech starting from Academic Year 2023-24.

5. Description of Grades:

EX Grade: An „EX" grade stands for outstanding achievement.

EE Grade: The „EE" grade stands for minimum passing grade.

The students may appear for the remedial examination for the subjects he/she failed for the current semester of admission only and his/her performance will be awarded with EE grade only. If any of the student remain **absent** for the regular examination due to genuine reason and the same will be verified and tested by the Dean (Academics) or committee constituted by the University Authority.

FF Grade: The „FF" grade denotes very poor performance, i.e. failure in a course due to poor performance .The students who have been awarded „FF" grade in a course in any semester must repeat the subject in next semester.

6. Evaluation of Performance:

6.1. Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA)

(A) Semester Grade Point Average (SGPA) The performance of a student in a semester is indicated by Semester Grade Point Average (SGPA) which is a weighted average of the grade points obtained in all the courses taken by the student in the semester and scaled to a maximum of 10. (SGPI is to be calculated up to two decimal places). A Semester Grade Point Average (SGPA) will be computed for each semester as follows:

$$SGPA = \frac{[\sum_{i=1}^{n} c_i g_i]}{[\sum_{i=1}^{n} c_i]}$$

Where

„n" is the number of subjects for the semester,

„ci" is the number of credits allotted to a particular subject, and

„gi" is the grade-points awarded to the student for the subject based on his performance as per the above table.

-SGPA will be rounded off to the second place of decimal and recorded as such.

(B) Cumulative Grade Point Average (CGPA): An up to date assessment of the overall performance of a student from the time he entered the Institute is obtained by calculating Cumulative Grade Point Average (CGPA) of a student. The CGPA is weighted average of the grade points obtained in all the courses registered by the student since s/he

entered the Institute. CGPA is also calculated at the end of every semester (upto two decimal places).Starting from the first semester at the end of each semester (S), a Cumulative Grade Point Average (CGPA) will be computed as follows:

$$CGPA = \frac{[\sum_{i=1}^{m} c_i g_i]}{[\sum_{i=1}^{m} c_i]}$$

Where
„m" is the total number of subjects from the first semester onwards up to and including the semester S,
„ci" is the number of credits allotted to a particular subject, and
„gi" is the grade-points awarded to the student for the subject based on his/her performance as per the above table.
#CGPA will be rounded off to the second place of decimal and recorded as such.

Award of Degree of Honors

Major Degree

The concept of Major and Minors at B. Tech level is introduced to enhance learning skills of students, acquisition of additional knowledge in domains other than the discipline being pursued by the student, to make the students better employable with additional knowledge and encourage students to pursue cross-discipline research.

A. Eligibility Criteria for Majors

1. The Student should have Minimum CGPA of 7.5 up to 4th Semester
2. Student willing to opt for majors has to register at the beginning of 5th Semester
3. The Student has to complete 5 additional advanced courses from the same discipline specified in the curriculum. These five courses should be of 4 credits each amounting to 20 credits. The students should complete these credits before the end of last semester.
4. Student may opt for the courses from NPTEL/ SWAYAM platform. (if the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

Student complying with these criteria will be awarded B. Tech (Honors) Degree.

B. Eligibility Criteria for Minors

1. The Student should have Minimum CGPA of 7.5 up to 4th Semester
2. Student willing to opt for minors has to register at the beginning of 5th Semester
3. The Student has to complete 5 additional courses from other discipline of their interest, which are specified in the respective discipline. These five courses should be of 4 credits each amounting to 20 credits.
4. Student may opt for the courses from NPTEL/ SWAYAM platform. (if the credits of NPTEL/ SWAYAM courses do not match with the existing subject proper scaling will be done)

Student complying with these criteria will be awarded with B. Tech Degree in Engineering with Minor in Engineering.
(For e.g.: B. Tech in Electronics Engineering (VLSI Design and Technology) with Minor in Computer Engineering).

For applying for Honors and Minor Degree the student has to register themselves through the proper system.

ATTENDANCE REQUIREMENTS:

1. All students must attend every lecture, tutorial and practical classes.
2. To account for approved leave of absence (e.g. representing the Institute in sports, games or athletics; placement activities; NCC/NSS activities; etc.) and/or any other such contingencies like Medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes actually conducted.
    a) If the student failed to maintain 75% attendance, he/she will be detained for appearing the successive examination.
    b) The Dean (Academics)/ Principal is permitted to give 10% concession for the genuine reasons as such the case may be.
    c) In any case the student will not be permitted for appearing the examination if the attendance is less than 65%.
3. The course instructor handling a course must finalize the attendance 3 calendar days before the last day of classes in the current semester and communicate clearly to the students by displaying prominently in the department and also in report writing to the head of the department concerned.
4. The attendance records are to be maintained by the course instructor and he shall show it to the student, if and when required.

TRANSFER OF CREDITS

The courses credited elsewhere, in Indian or foreign University/Institutions/ Colleges/ Swayam Courses by students during their study period at DBATU may count towards the credit requirements for the award of degree. The guidelines for such transfer of credits are as follows:

a) 20 % of the total credit will be considered for respective calculations.

b) Credits transferred will be considered for overall credits requirements of the programme.

c) Credits transfer can be considered only for the course at same level i. e UG, PG etc.

d) A student must provide all details (original or attested authentic copies) such as course contents, number of contact hours, course instructor /project guide and evaluation system for the course for which he is requesting a credits transfer. He shall also provide the approval or acceptance letter from the other side. These details will be evaluated by the concerned Board of Studies before giving approval. The Board of Studies will then decide the number of equivalent credits the student will get for such course(s) in DBATU. The complete details will then be forwarded to Dean for approval.

e) A student has to get minimum passing grades/ marks for such courses for which the credits transfers are to be made.

f) Credits transfers availed by a student shall be properly recorded on academic record(s) of the student.

g) In exceptional cases, the students may opt for higher credits than the prescribed.

B. Tech. in Electronics Engineering (VLSI Design and Technology)

Different Categories of Courses and Credits for Degree Requirements

a) Humanities and Social Science including Management Courses

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTEEV403	Basic Human Rights	(3-0-0) 3
2	BTEEV505	Humanities and Social Sciences including Management Elective Course - I A. Economics and Management B. Business Communication C. Profession Ethics and Values D. Project Management	(3-0-0) 3
3	BTEEV605	Humanities and Social Sciences including Management Elective Course (HSSMEC) - II A. Development Engineering B. Employability and Skills Development C. Consumer Behavior	(3-0-0) 3
4	BTEEV706	Humanities and Social Sciences including Management Elective Course (HSSMEC) - III A. Foreign Language Studies B. Universal Human Values and Ethics C. Intellectual Property Rights	(0-0-4) Audit
TOTAL			**9**

b) Basic Science Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTEEV301	Engineering Mathematics – III	(3-1-0) 4
2	BTEEV404	Probability Theory and Random Processes	(3-0-0) 3
		TOTAL	**07**

c) Engineering Science Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTEEV304	Network Theory & Signal and System	(3-1-0) 4
2	BTEEV305	Python Programming	(3-0-0) 3
3	BTEEV308	Python Programming Lab	(0-0-2) 1
		TOTAL	**08**

d) Professional Core Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTEEV302	Electronic Devices & Circuits	(3-0-0) 3
2	BTEEV303	Digital Electronics & Microprocessor	(3-1-0) 4
3	BTEEV401	Digital System Design using HDL	(3-1-0) 4

4	BTEEV402	Analog Circuits	(3-1-0) 4
5	BTEEV501	Introduction to VLSI Life Cycle & Micro-fabrication	(3-0-0) 3
6	BTEEV502	Microcontroller & Embedded System	(3-1-0) 4
7	BTEEV601	Internet of Things & Industry 4.0	(3-1-0) 4
8	BTEEV602	Digital VLSI Design	(3-0-0) 3
9	BTEEV701	Digital Signal Processing	(3-0-0) 3
10	BTEEV702	Analog VLSI Design	(3-0-0) 3
11	BTEEV703	VLSI Verification & Testing	(3-0-0) 3
12	BTEEV306	EDC Lab	(0-0-2) 1

13	BTEEV307	Digital Electronics & Microprocessor Lab	(0-0-2) 1
14	BTEEV406	Analog Circuits Lab	(0-0-2) 1
15	BTEEV407	Digital System Design using HDL Lab	(0-0-2) 1
16	BTEEV506	Introduction to VLSI Life Cycle Lab	(0-0-2) 1
17	BTEEV507	Microcontroller & Embedded System Lab	(0-0-2) 1
18	BTEEV606	Digital VLSI Design Lab	(0-0-2) 1
19	BTEEV707	Digital Signal Processing Lab	(0-0-2) 1
20	BTEEV708	VLSI Verification & Testing Lab	(0-0-2) 1
21	BTEEV709	Analog VLSI Design Lab	(0-0-2) 1
		TOTAL	**48**

e) Professional Elective Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTEEV405	Professional Elective Courses –I A. Analog and Digital Communication B. Electrical Measurement & Instrumentation C. Data Structure & Algorithms using C++ D. Sensors & Actuators	(3-0-0) 3
2	BTEEV408	Professional Elective Courses –I Lab E. Analog and Digital Communication F. Electrical Measurement & Instrumentation G. Data Structure & Algorithms using C++ H. Sensors & Actuators	(0-0-2) 1
3	BTEEV503	Professional Elective Course (PEC) -II A. Control System Engineering B. Electromagnetic Field Theory C. High Speed Devices & Circuits D. Semiconductor Device Modeling	(3-1-0) 4
4	BTEEV603	Professional Elective Course (PEC) -III A. Power Electronics & Drives B. Semiconductor Materials Synthesis & Characterization C. Computer Networks D. Introduction to MEMS	(3-1-0) 4

5	BTEEV607	Professional Elective Course (PEC) –III Lab A. Power Electronics & Drives B. Semiconductor Materials Synthesis and Characterization C. Computer Networks D. Introduction to MEMS	(0-0-2) 1
6	BTEEV704	Professional Elective Course (PEC) -IV A. Low Power VLSI Design B. Semiconductor Packaging and Testing C. System on Chip D. Quantum Computing	(3-1-0) 4
		TOTAL	**17**

f) Open Elective Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTEEV504	Open Elective Course (OEC) - I A. Java Programming B. Database Management Systems C. Software Engineering D. Robotics	(3-0-0) 3
2	BTEEV508	Open Elective Course (OEC) – I Lab A. Java Programming B. Database Management Systems C. Software Engineering D. Robotics	(0-0-2) 1
3	BTEEV604	Open Elective Course (OEC) - II A. Artificial Intelligence & Machine Learning B. Android Programming C. Cloud Computing D. PLC & Automation	(3-0-0) 3
4	BTEEV608	Open Elective Course (OEC) – II Lab A. Artificial Intelligence & Machine Learning B. Android Programming C. Cloud Computing D. PLC & Automation	(0-0-2) 1
5	BTEEV705	Open Elective Course (OEC) -III A. Deep Learning & Data Science B. Linux OS C. Cyber Security D. Advanced Communication Technology	(3-1-0) 4
		TOTAL	**12**

g) Seminar / Mini Project / Internship

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTEEV309	Seminar-I	(0-0-4) 2
2	BTEEV310	Internship –I (Evaluation) / MOOC	Audit
3	BTEEV409	Seminar - II	(0-0-4) 2
4	BTEEV410	Internship –II / MOOC	Audit
5	BTEEV509	Mini Project I	(0-0-4) 2
6	BTEEV510	Internship –II (Evaluation) / MOOC	Audit
7	BTEEV609	Mini Project II	(0-0-4) 2
8	BTEEV610	Internship –III / MOOC	Audit
9	BTEEV710	Project Work	(0-0-4) 2
10	BTEEV711	Internship –IV (Evaluation) / MOOC	Audit
11	BTEEV801	Project Work/ Internship	(0-0-24) 12
		TOTAL	**22**

Category – wise total number of credits

Sr. No	Category	Suggested Breakup of Credits by AICTE	Credits awarded to First year	Credits awarded to Second year to Final Year	Total
1	Humanities and Social Sciences including Management courses	**12***	3	9	**12**
2	Basic Science courses	**25***	18	7	**25**
3	Engineering Science courses including workshop, drawing, basics of electrical / mechanical / computer etc.	**24***	15	8	**23**
4	Professional core courses	**48***	0	48	**48**
5	Professional Elective courses relevant to chosen specialization/branch	**18***	0	17	**17**
6	Open subjects – Electives from other technical and /or emerging subjects	**18***	0	12	**12**
7	Project work, seminar and internship in industry or elsewhere	**15***	1	22	**23**
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]	**NC**	--	--	**--**
	Total	**160***	**37**	**123**	**160**

**Minor variation is allowed as per need of the respective disciplines.*

Suggested Plan of Study

Number of Courses	Semester							
	I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
1	BTBS101	BTBS201	BTEEV301	BTEEV401	BTEEV501	BTEEV601	BTEEV701	BTEEV801
2	BTBS102	BTBS202	BTEEV302	BTEEV402	BTEEV502	BTEEV602	BTEEV702	--
3	BTES103	BTES203	BTEEV303	BTEEV403	BTEEV503 **(PEC-II Elective)**	BTEEV603 **(PEC-III Elective)**	BTEEV703	--
4	BTHM104	BTES204	BTEEV304	BTEEV404	BTEEV504 **(OEC -I Elective)**	BTEEV604 **(OEC -II Elective)**	BTEEV704 **(PEC-IV Elective)**	--
5	BTES105	BTES205	BTEEV305	BTEEV405 **(PEC-I Elective)**	BTEEV505 **(HSSMEC-I Elective)**	BTEEV605 **(HSSMEC-II Elective)**	BTEEV705 **(OEC -III Elective)**	--
6	BTES106	BTES206	BTEEV306	BTEEV406	BTEEV506	BTEEV606	BTEEV706 **(HSSMEC-III Elective)**	--
7	BTBS107L	BTBS207L	BTEEV307	BTEEV407	BTEEV507	BTEEV607	BTEEV707	--
8	BTES108L	BTES208L	BTEEV308	BTEEV408	BTEEV508	BTEEV608	BTEEV708	--
9	BTHM109L	BTES209S	BTEEV309	BTEEV409	BTEEV509	BTEEV609	BTEEV709	--
10	--	BTES211P (Internship-I)	BTEEV310 Internship –I Evaluation)	BTEEV410 (Internship–II)	BTEEV510 (Internship –II Evaluation)	BTEEV610 (Internship–III)	BTEEV710	--
11	--	--	--	--	--	--	BTEEV711 (Internship–III Evaluation)	--

Programme Educational Objectives (PEO)

Name of Programme: B.Tech. Electronics Engineering (VLSI Design and Technology). A graduate in the discipline of VLSI Design and Technology is generally expected to have three kinds of knowledge. First, the graduate should have conceptual knowledge of the core topics of B.Tech. Electronics Engineering (VLSI Design and Technology). Second, she/he should have knowledge of mathematical formalism underlying various programming concepts. Third, graduates in the discipline of B.Tech. Electronics Engineering (VLSI Design and Technology) should have the knowledge of the state of the latest tools and technologies, so that he/she can apply the principles of Electronics Engineering to solve real-life problems from diverse application domains. The programme of B.Tech. Electronics Engineering (VLSI Design and Technology) at Dr. Babasaheb Ambedkar Technological University (DBATU) essentially aims to meet these broad expectations. At the same time, the program intends to comply with the courses and syllabus available at National Program on Technology Enhanced Learning (NPTEL) and SWAYAM. The following specific educational objective aims to achieve these global and regional expectations**.**

Objective Identifier	Objectives
PEO1	Graduates will be able to apply the fundamental concepts of electronics engineering for electronic system design.
PEO2	Graduates will pursue career in VLSI design and allied fields on cutting edge technologies.
PEO3	Graduates will exhibit professional ethics and teamwork in their profession through lifelong learning.

Programme Outcomes (PO)

After undergoing the learning process of four years, students of B.Tech. Electronics Engineering(VLSI Design and Technology) at Dr. Babasaheb Ambedkar Technological University will have an ability to build information systems and provide computer-based solutions to real life problems. The graduates of this programme will demonstrate following abilities and skill sets.

Outcome Identifier	Outcomes
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Outcome Identifier	Outcomes
PSO1	Apply knowledge of mathematics and science to solve advanced engineering problems in the areas of micro-electronic devices & circuits, Signal Processing and computation to pursue higher studies.
PSO2	Accomplish advanced practical exposure in the domain of Electronics, IoT and VLSI using contemporary tools and / or equipments' to acquire professional competencies to meet industry standards.

Graduate Attributes / ABET's Criteria

The Graduate Attributes are the knowledge skills and attitudes which the students have at the time of graduation. These Graduate Attributes identified by National Board of Accreditation are as follows:

(a) Engineering knowledge: An ability to apply knowledge of mathematics, science and engineering.

(b) Problem analysis: An ability to design and conduct experiments as well as to analyze and interpret data.

(c) Design / development of solutions: An ability to design a system, a component, or process, to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

(d) Individual and team work: An ability to function on multidisciplinary teams.

(e) Problem Solving: An ability to identify, formulate and solve engineering problems.

(f) Ethics: An understanding of professional and ethical responsibility.

(g) Communication: An ability to communicate effectively.

(h) Environment and sustainability: The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and social context.

(i) Life-long learning: Recognition of the need for and an ability to engage in life-long learning.

(j) A knowledge of technology: Acknowledge of contemporary issues, and state of art technology

(k) Modern tool usage: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

(l) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply in multidisciplinary environments.

Mapping of Programme Outcomes with Graduate Attributes / ABET's Criteria

	A	B	C	D	E	F	G	H	I	J	K	L
PO1	X									X		
PO2		X			X							
PO3			X		X							
PO4			X		X							
PO5											X	
PO6					X					X		
PO7								X				
PO8						X						
PO9				X								
PO10							X					
PO11												X
PO12									X			

Course Structure for Second Year

B. Tech in Electronics Engineering (VLSI Design and Technology)

Semester III (Term 3)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	BSC	BTEEV301	Engineering Mathematics-III	3	1	-	20	20	60	100	4
2	PCC1	BTEEV302	Electronic Devices & Circuits	3	-	-	20	20	60	100	3
3	PCC2	BTEEV303	Digital Electronics & Microprocessor	3	1	-	20	20	60	100	4
4	ESC11	BTEEV304	Network Theory & Signals and Systems	3	1	-	20	20	60	100	4
5	ESC12	BTEEV305	Python Programming	3	-	-	20	20	60	100	3
6	LC1	BTEEV306	EDC Lab	-	-	2	30	-	20	50	1
7	LC2	BTEEV307	Digital Electronics & Microprocessor Lab	-	-	2	30	-	20	50	1
8	LC3	BTEEV308	Python Programming Lab	-	-	2	30	-	20	50	1
9	Seminar	BTEEV309	Seminar-I	-	-	4	60	-	40	100	2
10	Internship	BTEEV310	Internship –I (Evaluation) / MOOC	-	-	-	-	-	-	-	Audit
	Total for Semester III			**15**	**3**	**10**	**250**	**100**	**400**	**750**	**23**

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Courses

Course Structure for Second Year

B. Tech in Electronics Engineering (VLSI Design and Technology)

Semester IV (Term 4)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC3	BTEEV401	Digital System Design using HDL	3	1	-	20	20	60	100	4
2	PCC4	BTEEV402	Analog Circuits	3	1	-	20	20	60	100	4
3	HSSMC3	BTEEV403	Basic Human Rights	3	-	-	20	20	60	100	3
4	BSC8	BTEEV404	Probability Theory and Random Processes	3	-	-	20	20	60	100	3
5	PEC-1	BTEEV405	Professional Elective Courses –I	3	-	-	20	20	60	100	3
		BTEEV405A	Analog and Digital Communication								
		BTEEV405B	Electrical Measurement & Instrumentation								
		BTEEV405C	Data Structure & Algorithms using C++								
		BTEEV405D	Sensors & Actuators								
6	LC4	BTEEV406	Analog Circuits Lab	-	-	2	30	-	20	50	1
7	LC5	BTEEV407	Digital System Design using HDL	-	-	2	30	-	20	50	1
8	LC6	BTEEV408	PEC-1 Lab	-	-	2	30	-	20	50	1
9	Seminar	BTEEV409	Seminar - II	-	-	4	60	-	40	100	2
10	Internship	BTEEV410	Internship –II / MOOC	-	-	-	-	-	-	-	Audit
	Total for Semester IV			**15**	**2**	**10**	**250**	**100**	**400**	**750**	**22**

Note: The Lab of Professional Elective Courses –I (PEC1) (BTEEVE405) should be conducted as per syllabus contents.

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Course Structure for Third Year

B. Tech in Electronics Engineering (VLSI Design and Technology)

Semester V (Term 5)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC5	BTEEV501	Introduction to VLSI Life Cycle & Micro-fabrication	3	-	-	20	20	60	100	3
2	PCC6	BTEEV502	Microcontroller & Embedded System	3	1	-	20	20	60	100	4
3	PEC-2	BTEEV503	Professional Elective Course (PEC) -II	3	1	-	20	20	60	100	4
		BTEEV503A	Control System Engineering								
		BTEEV503B	Electromagnetic Field Theory								
		BTEEV503C	High Speed Devices & Circuits								
		BTEEV503D	Semiconductor Device Modeling								
4	OEC-1	BTEEV504	Open Elective Course (OEC) - I	3	-	-	20	20	60	100	3
		BTEEV504A	Java Programming								
		BTEEV504B	Database Management Systems								
		BTEEV504C	Software Engineering								
		BTEEV504D	Robotics								
5	HSSMEC-4	BTEEV505	Humanities and Social Sciences including Management Elective Course - I	3	-	-	20	20	60	100	3
		BTEEV505A	Economics & Management								
		BTEEV505B	Business Communication								
		BTEEV505C	Professional Ethics and Values								
		BTEEV505D	Project Management								
6	LC7	BTEEV506	Introduction to VLSI Life Cycle Lab	-	-	2	30	-	20	50	1
7	LC8	BTEEV507	Microcontroller & Embedded System Lab	-	-	2	30	-	20	50	1
8	LC9	BTEEV508	OEC-1 Lab	-	-	2	30	-	20	50	1
9	PROJ	BTEEV509	Mini Project I	-	-	4	60	-	40	100	2
10	Internship	BTEEV510	Internship –II (Evaluation) / MOOC	-	-	-	-	-	-	-	Audit
	Total for Semester V			**15**	**2**	**10**	**250**	**100**	**400**	**750**	**22**

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Course Structure for Third Year

B. Tech in Electronics Engineering (VLSI Design and Technology)

Semester VI (Term 6)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC7	BTEEV601	Internet of Things & Industry 4.0	3	1	-	20	20	60	100	4
2	PCC8	BTEEV602	Digital VLSI Design	3	-	-	20	20	60	100	3
3	PEC-3	BTEEV603	Professional Elective Course (PEC) -III	3	1	-	20	20	60	100	4
		BTEEV603A	Power Electronics & Drives								
		BTEEV603B	Semiconductor Materials Synthesis and Characterization								
		BTEEV603C	Computer Networks								
		BTEEV603D	Introduction to MEMS								
4	OEC-2	BTEEV604	Open Elective Course (OEC) - I	3	-	-	20	20	60	100	3
		BTEEV604A	Artificial Intelligence & Machine Learning								
		BTEEV604B	Android Programming								
		BTEEV604C	Cloud Computing								
		BTEEV604D	PLC & Automation								
5	HSSMEC-5	BTEEV605	Humanities and Social Sciences including Management Elective Course (HSSMEC) - II	3	-	-	20	20	60	100	3
		BTEEV605A	Development Engineering								
		BTEEV605B	Employability and Skill Development								
		BTEEV605C	Consumer Behaviour								
6	LC10	BTEEV606	Digital VLSI Design Lab	-	-	2	30	-	20	50	1
7	LC11	BTEEV607	Internet of Things & Industry 4.0 Lab	-	-	2	30	-	20	50	1
8	LC12	BTEEV608	OEC-2 Lab	-	-	2	30	-	20	50	1
9	PROJ	BTEEV609	Mini Project II	-	-	4	60	-	40	100	2
10	Internship	BTEEV610	Internship –III / MOOC	-	-	-	-	-	-	-	Audit
	Total for Semester VI			**15**	**2**	**10**	**250**	**100**	**400**	**750**	**22**

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Course Structure for Final Year

B. Tech in Electronics Engineering (VLSI Design and Technology)

Semester VII (Term 7)												
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC9	BTEEV701	Digital Signal Processing	3	-	-	20	20	60	100	3
2	PCC10	BTEEV702	Analog VLSI Design	3	-	-	20	20	60	100	3
3	PCC11	BTEEV703	VLSI Verification & Testing	3	-	-	20	20	60	100	3
4	PEC-4	BTEEV704	Professional Elective Course (PEC) -IV	3	1	-	20	20	60	100	4
		BTEEV704A	Low Power VLSI Design								
		BTEEV704B	Semiconductor Packaging and Testing								
		BTEEV704C	System on Chip								
		BTEEV704D	Quantum Computing								
5	OEC-3	BTEEV705	Open Elective Course (OEC) - III	3	1	-	20	20	60	100	4
		BTEEV705A	Deep Learning & Data Science								
		BTEEV705B	Linux OS								
		BTEEV705C	Cyber Security								
		BTEEV705D	Advanced Communication Technology								
6	HSSMEC - 6	BTEEV706	Humanities and Social Sciences including Management Elective Course (HSSMEC) - III	-	-	4	-	-	-	-	Audit
		BTEEV706A	Foreign Language Studies								
		BTEEV706B	Universal Human Value & Ethics								
		BTEEV706C	Intellectual Property Rights								
7	LC13	BTEEV707	Digital Signal Processing Lab	-	-	2	30	-	20	50	1
8	LC14	BTEEV708	VLSI Verification & Testing Lab	-	-	2	30	-	20	50	1
9	LC15	BTEEV709	Analog VLSI Design Lab	-	-	2	30	-	20	50	1
10	PROJ	BTEEV710	Project Work	-	-	4	60	-	40	100	2
11	Internship	BTEEV711	Internship –III (Evaluation)/ MOOC	-	-	-	-	-	-	-	Audit
	Total for Semester VII			**15**	**2**	**14**	**250**	**100**	**400**	**750**	**22**

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Course Structure for Final Year

B. Tech in Electronics Engineering (VLSI Design and Technology)

Semester VIII (Term 8)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	Project/ Internship	BTEEV801	Project Work/ Internship	-	-	24	60	-	40	100	12
	Total for Semester VIII			**0**	**0**	**24**	**60**	**-**	**40**	**100**	**12**

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PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course,
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Third Year (Semester-V)
Introduction to VLSI Life Cycle & Micro-fabrication

BTEEV501	**Introduction to VLSI Life Cycle & Micro-fabrication**	**PCC-5**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week	Continuous Assessment: 20 Marks
Tutorial: 0 hr./week	Mid Semester Exam: 20 Marks
	End Semester Exam: 60 Marks

Pre-requisite: Basics of CMOS VLSI Design & Digital Logic Design

Course Objectives: The aim of this course is to:

1. To understand VLSI fundamentals: Gain a solid grasp of VLSI technology, semiconductor materials, and the basics of transistor operation.
2. To Learn about the various stages of the VLSI design lifecycle, including specification, design, verification, synthesis, layout, and fabrication
3. To Explore design methodologies: Introduce different VLSI design methodologies.

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

CO1: Define system specifications, analyse performance and cost metrics, and effectively categorize functional blocks within a complex VLSI design.

CO2: Apply behavioral description using HDLs, perform logic minimization, and understand the process of logic synthesis and functional verification for digital designs.

CO3: Apply circuit optimization techniques and comprehend the steps of physical design including placement, routing, LVS verification, and Design for Manufacturability.

CO4: Perform post-layout simulations, understand PVT variations, utilize PDKs for design verification, and comprehend the purpose of DRC and GDSII for tape-out.

CO5: Describe the fundamental steps of the CMOS fabrication process and explain various integrated circuit packaging techniques.

UNIT I **[08 Hours]**

System & Architectural Design: Defining a system specification, performance analysis, cost analysis, identifying various functional blocks/modules; categorizing them in terms of digital, analog, RF and mixed signal blocks.

UNIT II **[08 Hours]**

Functional verification, logic design: Verifying the functionality of blocks, behavioural description, logic minimization, synthesis, verification and testing.

UNIT III **[08 Hours]**

Circuit Optimization and Physical Design: Optimization of synthesized blocks for various performance metric, Introduction to placement and route, Layout Vs Schematic (LVS), verification, Design for Manufacturability

UNIT IV **[08 Hours]**

Tape Out: Post layout simulations, Process Voltage Testing, Process Design Kit, Design Rule Check, GDSII Metalorganic CVD (MOCVD), Plasma Enhanced CVD etc.

UNIT V **[08 Hours]**

Fabrication and Packaging: CMOS process flow, dicing, various types of packaging.

TEXTBOOKS:

1. Sneh Saurabh, “Introduction to VLSI Design flow”, Cambridge University Press.
2. N. H. E. Weste and C. Harris, “Principles of CMOS VLSI Design: A System Perspective, 3rd Edition, Pearson Education 2007.

REFERENCE BOOKS

1. M.Morris Mano and Michel.D.Ciletti, Digital Design with an introduction to HDL, VHDL and Verilog, Sixth edition Pearson education.
2. K. Lal Kishore – “VLSI Design”, Pearson Education / PHI Learning.

Third Year (Semester-V)
Microcontrollers and Embedded System

BTEEV502	Microcontrollers and Embedded System	PCC-6	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

1 Understand the architecture and features of microcontrollers and embedded systems.
2 Learn programming and interfacing techniques using the 8051 microcontrollers.
3 Explore various peripherals and their integration with microcontrollers.
4 Study the structure, classification, and applications of embedded systems.
5 Understand embedded firmware design and basics of RTOS-based system design.

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

CO1: Differentiate between microcontrollers and microprocessors and their architectures.
CO2: Develop embedded C programs and interface peripherals using 8051 microcontroller.
CO3: Apply knowledge of communication protocols and interfacing in real-time applications.
CO4: Classify embedded systems and explain their applications in various domains.
CO5: Explore embedded systems using firmware and implement basic RTOS concepts.

Course Contents:

Unit 1: Introduction to Microcontrollers **[08 Hours]**

Microprocessors v/s Micro-controllers, Types of Micro-controllers, Selection of Microcontroller, External Memory, Processor Architecture – Harvard v/s Von Neumann; CISC v/s RISC, 8051 Microcontroller: Features & Pin configuration, Block Diagram of 8051.

Unit 2: 8051 Microcontroller **[08 Hours]**

Port Structure, Memory Organization, Interrupt handling, Timers of 8051, Serial Communication, addressing modes, Instruction Set of 8051, Difference between 'C' and Embedded C, Programming of 8051 using embedded C language.

Unit 3: Interfacing **[09 Hours]**

Interfacing & Microcontroller Applications: LEDs, Push Buttons, Relays, Keyboard, Seven Segment and LCD displays interfacing, I2C bus operation, DC Motor, ADC and DAC. All Programs in embedded c language.

Unit 4: Embedded Systems **[08 Hours]**

Definition of Embedded System, Embedded Systems Vs General Computing Systems, Design Challenge, processor Technology, IC Technology, History of Embedded Systems, Classification of Embedded System, Major Application Areas.

Unit 5: RTOS Based Embedded System Design **[07 Hours]**

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

TEXTBOOKS

1. Mazidi, M. A., Mazidi, J. G., & McKinlay, R.D. (2006). The 8051 microcontroller and embedded systems: using Assembly and C, Pearson/Prentice Hall.
2. Vahid, F.,& Givargis T.D. (2001) Embedded system design: a unified hardware /software introduction, John Wiley & Sons.
3. Raj Kamal, "Embedded Systems", TMH.

REFERENCE BOOKS

1. Kenneth J. Ayala, Dhananjay V. Gadre, "The 8051 Microcontroller & Embedded Systems Using Assembly and C", Cengage Learning India Publication.
2. Shibu K," Embedded Systems", Tata McGraw Hill Publishing.

Third Year (Semester – V)
Control System Engineering

BTEEV503A	Control System Engineering	PEC-2	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives: The aim of this course is to:

1. To Introduce elements of control systems and their modeling using various Techniques.
2. To get acquainted with the methods for analyzing the time response (Time Domain Analysis).
3. To Introduce and analyze the stability of System.
4. To Introduce the concept of Bode plots, Nyquist plots with the help of frequency Domain Analysis.
5. To apply the concepts of state-space representation.

Course Outcomes:

After completion of this course, students will be able:

CO1: To identify basic components of control systems and develop mathematical models using block diagrams and transfer functions.
CO2: To analyze the time response of systems and evaluate performance.
CO3: To determine system stability using Routh-Hurwitz and Root Locus techniques and assess the impact of pole locations on stability.
CO4: To construct and interpret Bode and Nyquist plots for control systems stability in the frequency domain.
CO5: To formulate state-space models of LTI systems using various methods.

Course Contents:

Unit I: Introduction to Control Systems & its modelling [08 Hours]

Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph.

Unit II: Time domain analysis [08 Hours]

Time domain analysis: transient response and steady state response, standard test inputs for time domain analysis, order and type of a system, transient analysis of first and second order systems, time domain specifications of second order under-damped system from its step response, steady state error and static error constants.

Unit III: Stability analysis [08 Hours]

Characteristic equation of a system, concept of pole and zero, response of various pole locations in s-plane, concept of stability, absolute stability, relative stability, stability of system from pole locations, Routh Hurwit stability criterion, Root locus: definition, magnitude and angle conditions, construction of root locus, concept of dominant poles, effect of addition of pole and zero on root locus.

Unit IV: Frequency domain analysis **[08 Hours]**

Frequency response and frequency domain specifications, correlation between time domain and frequency domain specifications, polar plot, Nyquist stability criterion and construction of Nyquist plot, Bode plot, determination of frequency domain specifications and stability analysis using Nyquist plot and Bode plot.

Unit V: State Variable Analysis **[08 Hours]**

State space model representation of LTI systems using physical, phase and canonical variables, Relationship between state variable model and transfer function, state transition matrix and its computation by Laplace transform method only, Solution of state equations. Controllability and Observability.

Textbooks:

1. N. J. Nagrath and M. Gopal, "Control System Engineering", New Age International Publishers, 5th Edition.
2. K. Ogata, "Modern Control Engineering", Prentice Hall India Learning Private Limited; 5th Edition.

Reference Books:

1. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition.
2. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition.
3. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw -Hill.
4. John J. D'Azzo and Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley.

Third Year (Semester –V)
Electromagnetic Field Theory

BTEEV503B	Electromagnetic Field Theory	PEC-2	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-requisite: Engineering Mathematics

Course Objectives: The aim of this course is to:

1. Understand and apply fundamental laws of electrostatics (Coulomb's, Gauss's, Poisson's, Laplace's) to analyze static electric fields and capacitance.
2. Comprehend and apply Bio-Savart's and Ampere's laws to determine static magnetic fields and forces.
3. Grasp Maxwell's equations for time-varying fields and characterize uniform plane wave propagation in different media.
4. Analyze electromagnetic wave behavior including polarization, reflection, refraction, and power flow using the Poynting theorem.
5. Understand transmission line parameters, analyze their behavior, and apply the Smith Chart for impedance matching.

Course Outcomes:

After completion of this course, students will be able to:

CO1: Apply fundamental laws of electrostatics and magnetostatics to solve problems involving electric and magnetic fields.

CO2: Formulate and interpret Maxwell's equations for time-varying fields to characterize wave propagation in various media.

CO3: Analyze electromagnetic wave characteristics, including polarization, reflection, and refraction phenomena at material interfaces.

CO4: Calculate and interpret power flow and energy density in electromagnetic fields using the Poynting vector and theorem.

CO5: Design and analyze transmission line parameters, including impedance matching using the Smith Chart.

Course Contents:

Unit 1: Electrostatics [8 hours]

Coulomb’s Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Energy Density. Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson’s and Laplace’s Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors.

UNIT-2: Magnetostatics [08 hours]

Bio-Savart’s Law, Ampere’s Circuital Law and Applications, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere’s Force Law.

UNIT-3: Maxwell’s Equations (Time Varying Fields) [08 hours]

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definitions, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good

Dielectrics, Polarization. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem.

UNIT-4: EM Wave Characteristics [08 hours]

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definitions, Relation between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation in Good Conductors and Good Dielectrics, Polarization. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem.

UNIT-5: Transmission Lines [08 hours]

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Equivalent Circuit, Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless / Low Loss Characterization, Condition for Distortion less line, Minimum Attenuation, Loading - Types of Loading.SC and OC Lines, $\lambda/4$, $\lambda/2$, $\lambda/8$ Lines, Reflection Coefficient, VSWR Smith Chart – Configuration and Applications, Single Stub Matching.

Textbooks:

1. William H. Hayt Jr. and John A. Buck- Engineering Electromagnetics, 8th Ed., McGraw Hill,2014
2. Matthew N.O. Sadiku and S.V. Kulkarni - Principles of Electromagnetics, 6th Ed., Oxford University Press, Asian Edition, 2015.
3. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, 2ndEd., 2000, PHI

Reference Books:

1. JD. Kraus -Electromagnetics with Applications ,5th Ed., TMH
2. Umesh Sinha, Satya Prakashan -Transmission Lines and Networks, (Tech. India Publications), New
3. GSN Raju, “Electromagnetic Field Theory and Transmission lines”, Pearson Education.
4. Schaum’s out – lines, “Electromagnetics,” Second Edition, Tata McGraw-Hill publications, 2006.
5. John D. Ryder, “Networks, Lines, and Fields,” PHI publications, Second Edition, 2012.

Third Year (Semester-V)
High Speed Devices and Circuits

BTEEV503C	High Speed Devices and Circuits	PEC-2	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Pre-requisite: Basics of CMOS VLSI Design & Digital Logic Design

Course Objectives: The aim of this course is to:

1. Understand the different clocking logic styles in VLSI system design.
2. Identify and evaluate the impact of variations and noise on circuit performance, applying design margining techniques.
3. Comprehend and design various latching strategies for high-speed differential and pre-charged logic.
4. Understand and apply different interface techniques, including signaling standards and ESD protection, for chip-to-chip communication.
5. Analyze and design effective clocking styles and distribution networks, addressing jitter, skew, and asynchronous methods.

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

CO1: Compare and select appropriate clocked and non-clocked logic styles based on specific high-speed VLSI design requirements.

CO2: Quantify and mitigate the effects of design variability and noise on VLSI circuit performance through appropriate margining.

CO3: Implement and optimize various latching strategies, ensuring race-free and robust operation in high-speed designs.

CO4: Evaluate and propose suitable interface techniques, including signaling standards and ESD protection, for reliable chip-to-chip communication.

CO5: Analyze clocking challenges like jitter and skew and design efficient clock generation and distribution networks for VLSI systems.

UNIT I - CLOCKED LOGIC STYLES [08 Hours]

Clocked Logic Styles, Single-Rail Domino Logic Styles, Dual-Rail Domino Structures, Latched Domino Structures, Clocked pass Gate Logic Non-Clocked Logic Styles, Static CMOS, DCVS Logic, Non-Clocked pass Gate Families.

UNIT II - CIRCUIT DESIGN MARGINING AND DESIGN VARIABILITY [08 Hours]

Circuit Design Margining, Design Induced Variations, Process Induced Variations, Application Induced Variations, Noise.

UNIT III - LATCHING STRATEGIES [08 Hours]

Latching Strategies, Basic Latch Design, Latching Differential Logic, Race Free Latches for Precharged Logic, Asynchronous Latch Techniques.

UNIT IV - INTERFACE TECHNIQUES [08 Hours]

Signalling Standards, Chip-to-Chip Communication Networks, ESD Protection, Skew Tolerant Design

UNIT V - CLOCKING STYLES [08 Hours]

Clocking Styles, Clock Jitter, Clock Skew, Clock Generation, Clock Distribution, Asynchronous Clocking Techniques.

TEXTBOOKS:

1. Kerry Bernstein, Keith M. Carrig, "High Speed CMOS Design Styles", Kluwer Academic Publishers, 2002.
2. Evan Sutherland, Bob Stroll, David Harris," Logical Efforts, Designing Fast CMOS Circuits", Kluwer Academic Publishers, 1999
3. David Harris, "Skew Tolerant Domino Design", IEEE Journal of Solid-State Circuits,2001

REFERENCES:

1. David Stauffer, Clarence Ogilivie, Jeanne Trinko Mechler, Amanullah Mohammad, "High Speed Devices and Applications", Springer, 2008.
2. H. Beneking, High Speed Semiconductor Devices, Circuits aspects and fundamental behavior, Springer.
3. Neil H.E. Weste and David Money Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", Pearson.
4. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education

Third Year (Semester-V)
Semiconductor Device Modeling

BTEEV503D	**Semiconductor Device Modelling**	**PEC-2**	**3L- 1T - 0P**	**4 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Prerequisite: Engineering Physics, Differential Equations, Introduction to Basic Electronic Devices

Course Objectives: The aim of this course is to:

1. To understand the fundamental principles of semiconductor physics, including carrier behavior and the operation of various junction devices.
2. To comprehend the operational physics of bipolar junction transistors (BJTs) and semiconductor heterojunctions.
3. To learn the principles and characteristics of Junction Field-Effect Transistors (JFETs) and Metal-Insulator-Semiconductor FETs (MISFETs).
4. To gain a detailed understanding of MOSFET operation, fabrication, and characteristic behaviors, including scaling effects.
5. To study the working principles of optoelectronic devices and to develop proficiency in utilizing SPICE models for semiconductor devices.

Course Outcomes:

After completion of this course, students will be able to:

CO1: Analyze carrier transport mechanisms and predict the current-voltage characteristics and transient behavior of p-n junctions and metal-semiconductor contacts.

CO2: Explain transistor action, analyze static and frequency response characteristics, and understand minority carrier distribution in bipolar devices.

CO3: Describe the current-voltage characteristics of JFETs and MISFETs, and identify high-frequency and high-speed considerations in these devices.

CO4: Explain MOS capacitor principles, analyze MOSFET output and transfer characteristics, and evaluate the impact of short channel and narrow width effects and scaling.

CO5: Describe the operation of various optoelectronic devices and apply SPICE Level 1, Level 2, and Level 3 models for diodes, BJTs, and MOSFETs.

Course Contents:

Unit 1: **[8 hours]**

Semiconductors in Equilibrium and Carrier Transport, Semiconductor Materials, Carrier Concentration, Carrier Drift, Carrier Diffusion, Generation and Recombination Process, Continuity Equation, Thermionic Emission, Tunnelling, Ballistic Transport, High Field Effects, Physics of Junction Devices: Thermal Equilibrium Condition, Depletion region, Depletion, and Diffusion Capacitances, Current-Voltage characteristics, Charge Storage and Transient behavior, Junction Breakdown, Metal Semiconductor Contacts, forward and reverse-biased junctions, reverse-bias breakdown, transient, and a-c conditions.

UNIT-2: **[9 hours]**

Physics of Bipolar devices: Transistor action, Static Characteristics, minority carrier distribution and terminal currents, generalized biasing, secondary effects, Frequency Response and Switching, Semiconductor Heterojunctions.

UNIT-3: **[7 hours]**

Field-Effect Transistors: JFET- current-voltage characteristics, effects in real devices, high-frequency and high-speed issues, Metal Insulator Semiconductor FET.

UNIT-4: **[8 hours]**

MOSFET- basic operation and fabrication, ideal MOS capacitor, Energy band diagram in equilibrium and under bias, Flat band voltage, Potential Balance and charge balance, Effect of gate body voltage on surface condition, Accumulation and depletion, Inversion, CV Characteristics, Frequency response, threshold voltages, output and transfer characteristics of MOSFET, short channel and Narrow width effects, MOSFET scaling.

UNIT-5: **[8 hours]**

Optoelectronics Devices: Light emitting diodes, Lasers, Photoconductors, Junction Photodiodes, Avalanche Photodiodes, Solar Cells, SPICE Models for Semiconductor Devices: MOSFET Level 1, Level 2 and level 3 model, Model parameters; SPICE models of p-n diode and BJT.

Textbooks:

1. B. G. Streetman and S. Banerjee, Solid State Electronic Devices, 6th Edition, PHI Private Limited, 2011.
2. T. A. Fjeldly, T. Ytterdal, and M. Shur, “Introduction to Device Modelling and Circuit Simulation”, John Wiley, 1998.
3. Introduction to Semiconductor Materials and devices by M.S Tyagi, John Wiley & Sons, 5th Edition, 2005.
4. G. Massobrio and P. Antognetti, Semiconductor Device Modelling with SPICE, 2nd Edition, TMH, 2010.

Reference Books:

1. C. C. Hu, Modern Semiconductor Devices for Integrated Circuits, Pearson Education, 2010.
2. P. Bhattacharya, Semiconductor Optoelectronics Devices, 2nd Edition, PHI, 2009.
3. A.K. Maini, N. Maini, All-in-One Electronics Simplified, Khanna Book Publishing, New Delhi, 2021.
4. A.K. Maini, Analog Electronics, Khanna Book Publishing, New Delhi, 2022.

Third Year (Semester-V)
Java Programming

BTEEV504A	Java Programming	OEC-1	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. To introduce students to the Java programming environment, its architecture, and core features.
2. To develop the ability to write and debug Java programs using variables, operators, and control flow statements.
3. To enable students to design and implement modular code using methods, method overloading, and recursion.
4. To provide a solid foundation in Object-Oriented Programming (OOP) principles such as classes, inheritance, polymorphism, and abstraction using Java.
5. To familiarize students with handling arrays, strings, exceptions, and Java's built-in utility classes for building reliable and maintainable applications.

Course Outcomes:

After completion of this course, students will be able to:

CO1: Set up Java's environment setup and elaborate Java's architecture, features.
CO2: Apply basic syntax, operators, and control structures to solve programming problems.
CO3: Design and implement methods, including overloading and recursion.
CO4: Develop programs using OOP principles (classes, inheritance, polymorphism, abstraction).
CO5: Utilize arrays, strings, exception handling, and utility classes for robust applications.

Course Contents:

Unit 01: Introduction to Java Programming **[08 hours]**

Overview of Java: History and evolution of Java, Key features (platform independence, OOP, robustness), Java vs. other languages (C/C++/Python)

Java Environment Setup: Understanding JVM, JRE, JDK, Installing JDK (latest LTS version), Setting up IDE (IntelliJ IDEA/Eclipse/VS Code)

First Java Program: Structure of a Java program

Basic Debugging: Common errors (syntax, runtime), Using IDE debugger

Variables and Data Types: Primitive types (int, double, boolean, char), Type casting (implicit/explicit), var keyword (Java 10+)

Operators: Arithmetic, Relational, Logical, Bitwise.

Strings and string methods.

Unit 2: Java Basic Syntax & Control Flow **[08 hours]**

Control Statements: Conditional (if-else, switch-case with -> syntax), Loops (for, while, do-while, enhanced for), Jump statements (break, continue, return), User Input.
Arrays: 1D/2D arrays, Arrays and utility classes.

Unit 3: Classes and Objects, Methods **[08 hours]**
Defining and Calling Methods, Method Parameters and Return Types, Methods overloading and recursion, Defining classes, creating objects, Constructors (default, parameterized), this keyword, final keywords

Unit 4: Inheritance and Interfaces **[08 hours]**
Access Modifier (Public, Private, Protected, Default)
Inheritance: Types of inheritance, super keyword
Abstraction & Interfaces: Abstract classes/methods, Interfaces (default, static methods)
Packages: Inbuilt, user defined

Unit 5: Multithreading and exception handling **[08 hours]**
Exception Handling: try-catch-finally, Custom exceptions, throws keyword
Multi-Threading: Lifecycle, Interface runnable and Thread class

Textbooks:

1. E Balagurusamy, “Programming with JAVA”, Tata McGraw Hill, 6th Edition.
2. Herbert Schildt, “Java: The complete reference”, Tata McGraw Hill, 7th Edition.

Reference Books:

1. T. Budd, “Understanding OOP with Java”, Pearson Education, 2nd Updated Edition.
2. Y. Daniel Liang (2010), “Introduction to Java programming”, Pearson Education, India, 7th Edition.
3. Deitel & Deitel, “Java: How to Program”, PHI.
4. Bert Bates, Kathy Sierra, “Head First Java”, O'Reilly Media, Inc.

Third Year (Semester-V)
Database Management Systems

BTEEV504B	Database Management Systems	OEC-1	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. Understand core database concepts, DBMS architectures, and their advantages over traditional file systems.
2. Design entity-relationship (ER) models to represent real-world data requirements and convert them into relational schemas.
3. Apply SQL commands (DDL, DML, DQL) to create, manipulate, and query relational databases.
4. Analyze relational database designs using normalization (1NF–BCNF) and integrity constraints for efficiency and correctness.
5. Explain transaction management, concurrency control, and serializability in multi-user database environments.

Course Outcomes: After completion of this course, students will be able to:

CO1: Explain fundamental database concepts, DBMS architectures, and advantages over file systems.

CO2: Design Entity-Relationship (ER) models for real-world scenarios and convert them into relational tables with constraints.

CO3: Develop SQL queries using DDL, DML, and DQL commands to create, manipulate, and retrieve data.

CO4: Apply normalization (1NF–BCNF), relational integrity rules, and Codd's principles to optimize database schemas.

CO5: Analyze transaction properties (ACID), concurrency control mechanisms, and serializability for reliable multi-user operations.

Course Contents:

Unit 1: Introduction to Databases and the Relational Model [7 hours]

Database, Management Systems, Comparison with File Systems. Advantages and Disadvantages of Database Management Systems, Applications. Database Architecture: Components of DBMS and Overall structure of DBMS; Various types of databases.

Unit 2: Data Modelling [7 hours]

Need of Data Modelling, Types of Data Models. Entity Relationship Model: Entities, Attributes, Relationships- types, Constraints, Keys, Design Process, ER-Model, ER Diagram. Converting ER models to Database Tables. Case Study- Design ER Model for Railway Reservation System converts it to Database tables.

Unit 3: Structures Query Language (SQL) Basics [12 hours]

Introduction to SQL: SQL as a Language, SQL Categories (briefly): DDL, DML, DQL.
Data Definition Language (DDL): CREATE TABLE, ALTER TABLE and DROP TABLE
Data Manipulation Language (DML): INSERT INTO, UPDATE and DELETE FROM
Basic Queries: The SELECT Statement, SELECT and FROM, WHERE Clause, ORDER BY, DISTINCT Aggregate Functions: COUNT, SUM, AVG, MIN, MAX.

Unit 4: Relational Databases [7 hours]

Relational Model: Basic concepts, Attributes and Domains, CODD's Rules. Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, 2NF, 3NF, BCNF.

Unit 5: Database Transaction Management and Applications [7 hours]

Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Concurrency Control: Need, Locking Methods, Deadlocks, Time stamping methods.

Textbooks:

1. Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, TMH (7th Edition)
2. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, Addison-Wesley (7th Edition)

Reference Books:

1. Database Systems Connally T, Begg C. Pearson Education, ISBN 81-7808-861-4 4th edition.
2. Database Management System by Raghu Ramkrishnan, Johannes Gehrke McGraw Hill International Editions, ISBN 978-0072465631 2nd edition
3. Online resources and tutorials for SQL and database design are essential for hands-on learning.

Third Year (Semester-V)
Software Engineering

BTEEV504C	Software Engineering	OEC-1	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. To introduce the basic concepts of software engineering and the software development life cycle.
2. To understand various software development models and agile practices.
3. To study the process of software requirements, design, and modelling.
4. To learn architectural and design approaches in software development.
5. To understand object-oriented implementation and use of design patterns.

Course Outcomes:

After completion of this course, students will be able to:

CO1: Explain the fundamentals of software engineering and ethics in professional practice.
CO2: Apply agile methodologies and understand requirement engineering practices.
CO3: Develop system models and apply architectural design techniques.
CO4: Design software using UML and implementing basic design patterns.
CO5: Participate in open-source development and understand practical implementation issues.

Course Contents:

Unit I: Introduction to Software Engineering [08 Hours]

Introduction to software engineering, Characteristics of software, Professional software development, Software engineering ethics, Overview of software development processes, Software process models (Waterfall, Incremental, Spiral, V-model), Introduction to Rational Unified Process (RUP), Coping with change in software development

Unit II: Agile Software Development [08 Hours]

Agile principles and manifesto, Agile vs Plan-driven development, Introduction to Extreme Programming (XP), Agile project management, Scrum framework basics, Scaling agile methods for large systems.

Unit III: Requirements Engineering [08 Hours]

Types of requirements: Functional and Non-functional, Software requirements document, Requirement specification techniques, Requirements engineering process, Requirements elicitation and analysis, Requirements validation, Requirements management.

Unit IV: System Modelling and Architecture [08 Hours]

Introduction to system modelling, Context models, Interaction models, Structural models, Behavioural models, Model-Driven Engineering (MDE), Architectural design principles, Architecture views and decisions, Architectural patterns and application architectures.

Unit V: Design and Implementation [08 Hours]

Object-Oriented Design using UML, Introduction to design patterns, Implementation issues in real-world software, Basics of open-source software development, Code organization, version control systems overview.

Textbooks:

1. Ian Sommerville, Software Engineering, 10th Edition, Pearson Education.
2. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill.

Reference Books:

1. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing.
2. Craig Larman, Applying UML and Patterns, Pearson Education.
3. Martin Fowler, UML Distilled, Addison-Wesley.

Third Year (Semester-V)
Robotics

BTEEV504D	Robotics	OEC-1	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1 To introduce the fundamentals, classifications, and applications of robotic systems.
2 To develop an understanding of kinematics and dynamics of robotic manipulators.
3 To explore various actuators and sensors used in robotic systems.
4 To impart knowledge on microcontroller-based interfacing and real-time control.
5 To familiarize students with motion planning and basic control strategies in robotics.

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

CO1: Explain and classify different types of robots and their applications.
CO2: Analyze and solve problems related to robot kinematics and dynamics.
CO3: Select and integrate appropriate actuators and sensors for robotic systems.
CO4: Interface and program microcontrollers to control robotic components.
CO5: Apply motion planning and basic control algorithms in robotic applications.

Course Contents:

Unit-1: Introduction To Robotics [08 Hours]

History and scope of robotics, Types of robots and their classifications, Degrees of Freedom (DOF), workspace, end-effectors, Laws of Robotics (Asimov's Laws), Industrial and emerging applications: Electronics manufacturing, defense, medical, agriculture, Robot specifications: resolution, repeatability, accuracy.

Unit-2: Robot Kinematics and Dynamics [08 Hours]

Coordinate transformations (2D/3D, rotation, translation), Forward and inverse kinematics using Denavit-Hartenberg (DH) notation, Euler angles and Roll-Pitch-Yaw, Velocity and acceleration analysis, Introduction to robot dynamics: Newton-Euler and Lagrangian formulation, Torque calculation for robotic joints.

Unit-3: Sensors and Actuators in Robotics [08 Hours]

Types of actuators: DC motors, BLDC, servo motors, stepper motors, Interfacing motors using motor drivers (e.g., L293D, H-bridge), Types of sensors: Position (Encoders, Potentiometers), Proximity (IR, Ultrasonic), Tactile, Force, Temperature, Characteristics and selection of sensors, Interfacing sensors with microcontrollers.

Unit-4: Embedded Systems and Microcontroller Interfacing for Robotics [08 Hours]

Introduction to microcontrollers (Arduino, ARM Cortex, Raspberry Pi), Digital/Analog I/O, PWM, ADC, Serial communication: UART, SPI, I2C, Real-time interfacing with sensors and actuators, Basic robot coding in Embedded C / Arduino IDE / MicroPython.

Unit No 5: Robot Motion Planning, Control, and Applications [08 Hours]

Trajectory generation: Linear and polynomial functions, Motion planning: Visibility graph, Voronoi diagram, potential field, Path velocity decomposition, Basic control: PID, feedback systems in robotics, Introduction to Robot Operating System (ROS) (**concept only**). Case studies and trends: IoT in robotics, AI-enabled robots, cobots, autonomous navigation.

TEXTBOOKS: -

1. Fu. K.S, Gonzalez. R.C., Lee. C.S.G "Robotics –Control, Sensing, Vision, and Intelligence", McGraw Hill, 2015.
2. Pratihar D. K, "Fundamentals of Robotics", Narosa Publishing House, India,2019.
3. John J. Craig – *Introduction to Robotics: Mechanics and Control*, Pearson Education
4. S.R. Deb – *Robotics Technology and Flexible Automation*, Tata McGraw Hill

REFERENCE BOOKS: -

1. Groover Mikell. P, "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2014
2. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 2013.
3. Koren Y., "Robotics for Engineers", McGraw Hill Book Co., 1992.
4. Maja J Mataric, "The Robotics Primer "Universities Press. 2013.
5. John J. Craig, "Introduction to Robotics Mechanics and Control", Pearson Education India,2008.
6. Simon Monk – Programming Arduino: Getting Started with Sketches, McGraw Hill.
7. Jonathan W. Valvano – Embedded Systems: Introduction to the MSP432 Microcontroller, Volume 1, CreateSpace.
8. Derek Molloy – Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, Wiley
9. Peter Corke – Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer
10. Bruno Siciliano and Lorenzo Sciavicco – Robotics: Modelling, Planning and Control, Springer

Third Year (Semester-V)
Economics and Management

BTEEV505A	Economics and Management	HSSMEC- 4	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To introduce students to basic economic principles such as demand, supply, cost, and profit-volume relationships applicable in engineering and business contexts.
2. To equip students with tools of managerial accounting including cost allocation, budgeting, and variance analysis for informed decision-making.
3. To enable students to analyze financial statements and apply techniques such as time value of money and alternative comparison for investment decisions.
4. To familiarize students with concepts of depreciation and management principles essential for understanding organizational finance and function.
5. To develop understanding of product development and operations management including forecasting, capacity planning, and production strategies.

Course Outcomes:
After completion of this course, students will be able to:

CO1: Apply basic microeconomic concepts such as demand-supply analysis and cost-volume-profit relationships in engineering scenarios.

CO2: Perform cost allocation and budgeting through double-entry bookkeeping and variance analysis to support management decisions.

CO3: Interpret financial statements and investment options using financial ratios and time value of money techniques.

CO4: Explain depreciation methods and management functions and their relevance to accounting and decision-making

CO5: Design effective production strategies and layouts using forecasting, capacity planning, and product/service strategy techniques.

Course Contents:

Unit No 1: Introduction: **[08 Hours]**

Market Equilibrium: Demand and Supply, Elasticity of Demand Forecasting, Production, Exercises on Economics, Cost-Volume-Profit Relationships, Cost Management Systems and Activity Costing System.

Unit No 2: Relevant Information and Decision Making **[08 Hours]**

Cost Allocation, Exercises on Economics, Double-Entry Bookkeeping, Job Casting, Process Costing, The Master Budget, Flexible Budgets and Variance Analysis.

Unit No 3: Financial Statements **[08 Hours]**

Analysis of Financial Statements, Time Value of Money, Comparison of Alternatives.

Unit No 4: Depreciation Accounting **[08 Hours]**

Evolution of Management Thoughts, Functions of Management Directing.

Unit No 5: Product Development **[08 Hours]**

Forecasting Revisited, Capacity Planning, Product / Services Strategies and Plant Layout, Production Planning and Control.

Textbooks:

1. R. Paneerselvam, Engineering Economics, PHI publication.

Reference Books:

1. Robbins S.P. and Decenzo David A., Fundamentals of Management: Essential Concepts and Applications, Pearson Education.
2. L. M. Prasad, Principles and Practices of Management, Sultan Chand & Sons.
3. K. K. Dewett & M. H. Navalur, Modern Economic Theory, S. Chand Publications.

Third Year (Semester-V)
Business Communication

BTEEV505B	**Business Communication**	**HSSMEC- 4**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. To introduce key concepts and definitions related to communication and communicative competence.
2. To develop understanding of intercultural and nonverbal communication and related challenges.
3. To identify and analyze barriers that affect effective communication.
4. To enhance interpersonal, organizational, and group communication skills.
5. To equip students with negotiation, leadership, and conflict management skills in international business communication.

Course Outcomes: After completion of this course, students will be able to:

CO1: Define and explain communicative competence and foundational communication concepts.

CO2: Demonstrate awareness of cultural differences and complexities in thought, speech, and translation.

CO3: Recognize communication barriers and apply strategies to overcome them.

CO4: Apply communication strategies effectively in personal, team, and organizational contexts.

CO5: Demonstrate proficiency in managing conflicts, negotiating effectively, and using communication technology ethically.

Course Contents:

Unit No 1: Introduction: **[08 Hours]**

Introduction, Definitions & Concepts, Communicative Competence.

Unit No 2: Intercultural Communication **[08 Hours]**

Intercultural Communication, Nonverbal Communication, Thought and Speech, Translation as Problematic Discourse.

Unit No 3: Barriers to Communication **[08 Hours]**

Barriers to Communication, Listening, Communication Rules, Communication Style.

Unit No 4: Interpersonal Communication **[08 Hours]**

Interpersonal Communication, Relational Communication, Organizational Communication.

Collaboration, Communication in Groups and Teams, Persuasive Communication.

Unit No 5: Negotiation and Conflict Management [08 Hours]

Negotiation and Conflict Management, Leadership, Written Communication in International Business, Role of Technology in International Business Communication, Moving to Another Culture, Crisis Communication, Ethics in Business Communication.

Textbooks:

1. Mary Ellen Guffey, Essentials of Business Communication, Sixth Edition, South-Western College Publishing.

Reference Books:

1. Bovee, Courtland, John Thill & Mukesh Chaturvedi, Business Communication Today: Dorling kindersley,Delhi.
2. Kaul, Asha, Business Communication, Prentice-Hall of India, Delhi.
3. Monippally, Matthukutty M. Business Communication Strategies. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Sharma, Sangeeta and Binod Mishra, Communication Skills for Engineers and Scientists, PHI Learning Pvt.Ltd., New Delhi.

Third Year (Semester-V)
Professional Ethics and Values

BTEEV505C	**Professional Ethics & Values**	**HSSMEC- 4**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is:

1. To instill fundamental human values such as integrity, empathy, self-discipline, and spiritual well-being for holistic personality development.
2. To provide a comprehensive understanding of ethical theories and professional responsibilities in engineering practice.
3. To expose students to the concept of engineering as a social experiment and the ethical obligations that engineers must uphold.
4. To sensitize students to professional responsibilities, workplace rights, and safety standards in engineering environments.
5. To create awareness about global ethical challenges in engineering, including environmental concerns, corporate responsibilities, and professional conduct.

Course Outcomes: After completion of this course, students will be able to:

CO1: To demonstrate ethical behavior, time management, teamwork, and stress management techniques for professional excellence.

CO2: To analyze moral dilemmas and apply ethical reasoning to resolve professional conflicts in engineering contexts.

CO3: To interpret professional codes of ethics and apply legal and moral responsibility in real-world engineering projects.

CO4: To assess safety and risk factors and identify ethical and legal rights of professionals in engineering practice.

CO5: To evaluate ethical practices in global engineering scenarios and uphold professional integrity in international and multicultural workspaces.

Course Contents:

Unit No 1: HUMAN VALUES [08 Hours]

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self Confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

Unit No 2: ENGINEERING ETHICS [08 Hours]

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

Unit No 3: ENGINEERING AS SOCIAL EXPERIMENTATION [08 Hours]

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

Unit No 4: SAFETY, RESPONSIBILITIES AND RIGHTS [08 Hours]

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Unit No 5: GLOBAL ISSUES [08 Hours]

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.

Textbooks:

1. Mike W. Martin and Roland Schinzinger, Ethics in Engineering, Tata McGraw Hill, New Delhi,2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, Engineering Ethics, Prentice Hall of India, New Delhi, 2004.

Reference Books:

1. Charles B. Fleddermann, ―Engineering Ethics, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, ―Engineering Ethics – Concepts and Cases, Cengage Learning, 2009.
3. John R Boatright, ―Ethics and the Conduct of Business, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, ―Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, ―Business Ethics: Decision Making for Personal Integrity and Social Responsibility Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, Value Education‘, Vethathiri publications, Erode, 2011.

Third Year (Semester-V)
Project Management

BTEEV505D	Project Management	HSSMEC- 4	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture:3hrs./week Tutorial:0 hr./week	Continuous Assessment: 20Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks(Duration 03 hrs.)

Course Objectives:

1. The basics of project management and its life cycle.
2. The process of project identification, selection criteria of the project and how the project planning is undertaken.
3. The organizational structure within a project and issues related to project management.
4. The techniques for effective project scheduling and resource considerations in project.
5. The basics of effective handling the risks as well as managing finances within the project.

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

- **CO1:** Apply the fundamental knowledge of project management for effectively handling the projects.
- **CO2 :** Identify and select the appropriate project based on feasibility study and undertake its effective planning
- **CO3 :** Assimilate effectively within the organizational structure of project and handle project management related issues in an efficient manner.
- **CO4 :** Apply the project scheduling techniques to create a Project Schedule Plan and accordingly utilize the resources to meet the project deadline.
- **CO5 :** Identify and assess the project risks and manage finances in line with Project Financial Management Process.

Course Contents:

Unit-1: Fundamentals of Project Management [08 Hours]

Basics of Project Management: Definition of Project, The Project Life Cycle, Definition of project management, Need of Project management, Project Management process and its importance, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles.

Unit-2: Project Identification, Selection & Planning [08 Hours]

Project Identification and Selection: Introduction, Project Identification Process, Project Initiation, Prefeasibility Study, Feasibility Studies, Project Break-even point. Project Planning: Introduction and need for Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS).

Unit-3: Project Organizational Structure & Issues [08 Hours]

Organizational Structure and Organizational Issues: Introduction, Concept of Organizational Structure, Roles and Responsibilities of Project Leader, Relationship between Project Manager and Line Manager, Leadership Styles for Project Managers, Conflict Resolution, Team Management and Diversity Management, Change management.

Unit-4: Project Scheduling [08 Hours]

PERT and CPM: Introduction, Development of Project Network, Time Estimation, Determination of the Critical Path, PERT Model, Measures of variability, CPM Model, Network Cost System Resources Considerations in Projects: Introduction, Resource Allocation, Scheduling, Project Cost Estimate and

Budgets.

Unit No 5: Project Risk, Financial Management, Product Development [08 Hours]

Project Risk Management: Introduction, Risk, Risk Management, Role of Risk Management in Overall Project Management, Steps in Risk Management.

Financial Management in Projects: Project Finance structure, Process of Project Financial Management: Conducting Feasibility Studies, Planning the Project Finance.

Product Development: Introduction, Development Process and organizations, product planning, identifying customer needs, Product Significations, concept generation, selection, testing, Prototyping.

TEXTBOOKS: -

1. H. Kerzer, "Project Management: A Systems Approach to Planning, Scheduling, and Controlling", John Wiley & Sons, Inc., 10th Edition, 2009.
2. Chandra, P., "Projects", Tata McGraw-Hill Education, 8th Edition, 2009.

REFERENCE BOOKS: -

1. Morris, P. W. G. and Pinto, J. K., "The Wiley Guide to Managing Projects", John Wiley & Sons, 2004.
2. Karl Ulrich, Steven Eppinger, "Product Design and Development", McGraw Hill / Irvin, 3rd Edition 2009.
3. R. Majumdar, "Product Management in India", PHI, 2nd Edition, 2010.
4. G.S. Batra, "Development of Entrepreneurship", Deep and Deep publications, New Delhi.
5. Christine Petersen, "The Practical Guide to Project Management", PMP,1st Edition, 2013.
6. Russell W. Darnall, John M. Preston, "Project Management from Simple to Complex", The Saylor Foundation.
7. Levy, F. K. and Wiest, J. D., "A Management Guide to PERT/CPM", Prentice Hall, 2nd Edition, 1969.
8. Lewis, R., "Project Management: Strategic Design and Implementation", McGraw-Hill, 5th Edition. 2006.
9. Venkataraman. R., J.K. Pinto, "Cost and Value Management in Projects", John Wiley & sons.

Third Year (Semester-V)
Introduction to VLSI Life Cycle Lab

BTEEV506	Introduction to VLSI Life Cycle Lab	LC7	0L- 0T - 2P	1 Credits

Teaching Scheme	Examination Scheme
Practical: 02 hrs./week	Continuous Assessment: 30 Marks End Semester Exam: 20 Marks

Practical based on the syllabus of the subject of Introduction to VLSI Life Cycle & Micro-fabrication.
Sample List of Practical's:

1. Design a digital system block diagram using FOSS EDA Tools and define performance parameters (delay, cost, power).
2. Identify and classify functional blocks as digital, analog, RF, or mixed-signal for a given application.
3. Implement combinational logic circuits (gates, adders, multiplexers) using FOSS EDA Tools and verify outputs.
4. Implement a 1-bit ALU in Vivado or using FOSS EDA Tools using behavioral description (Verilog/VHDL).
5. Design and simulate sequential circuits (counters, shift registers) using FOSS EDA Tools.
6. Create and run a testbench using FOSS EDA Tools for functional verification of an HDL design.
7. Synthesize a combinational circuit using FOSS EDA Tools, compare area and delay reports.
8. Analyze LUT, flip-flop, and DSP usage for different HDL coding styles using FOSS EDA Tools.
9. Perform placement and routing of a small design in Vivado and observe the timing report.
10. Generate FPGA programming bitstream for a digital system in Vivado or using FOSS EDA Tools.
11. Run post-implementation timing simulation in Vivado or using FOSS EDA Tools.
12. Perform a Design Rule Check (DRC) in Vivado or using FOSS EDA Tools and document violations.
13. Prepare a CMOS process flow diagram and explain each fabrication step.
14. Study FPGA IC packages (BGA, QFP, DIP) and create a comparative chart.

Third Year (Semester-V)
Microcontrollers and Embedded System Lab

BTEEV507	Microcontrollers and Embedded System Lab	LC8	0L-0T-2P	1 Credits

Teaching Scheme	Examination Scheme
Practical: 02 hrs./week	Continuous Assessment: 30 Marks End Semester Exam: 20 Marks

Microcontrollers and Embedded System Lab

(Minimum 8-10 experiments are to be performed based on contents from syllabus)
Sample List of Practical's:

1. LED Blinking using 8051 Microcontroller
2. Interfacing Push Buttons and Generating Output Patterns
3. Seven Segment Display Interfacing
4. LCD (16x2) Display Interfacing
5. Timer Programming for Delay Generation using 8051
6. Interrupt Handling in 8051
7. Serial Communication using UART
8. I2C Communication: Interfacing 24C02 EEPROM
9. Relay and Buzzer Interfacing
10. Real-Time Clock (RTC) Interfacing using I2C
11. Temperature Sensor (LM35) Interfacing with 8051
12. DC Motor Control using Relay or Transistor Driver
13. Keyboard Matrix (4x4) Interfacing
14. Watchdog Timer Simulation and Reset Handling
15. Mini project.

Third Year (Semester-V)
OEC-1 Lab

BTEEV508	OEC-1 Lab	LC8	0L-0T-2P	1 Credits

Teaching Scheme	Examination Scheme
Practical: 02 hrs./week	Continuous Assessment: 30 Marks End Semester Exam: 20 Marks

BTEEV508A JAVA Programming Lab

(Minimum 8-10 experiments are to be performed based on contents from syllabus)

Sample List of Practical's:

1. To successfully install the JDK and IDE and execute a fundamental Java program.
2. To practice using different data types, operators, and taking input from the console.
3. To apply conditional and looping constructs for problem-solving.
4. To understand and implement methods, including method overloading and recursion.
5. To grasp the basic concepts of Object-Oriented Programming (OOP) by defining classes and creating objects.
6. To understand and implement inheritance and runtime polymorphism in Java.
7. To implement abstraction using abstract classes and interfaces.
8. To practice using one-dimensional and two-dimensional arrays, and to manipulate strings.
9. To implement robust code using exception handling and organize code using packages.
10. To use common utility classes for practical programming tasks.

BTEEV508B Database Management Systems Lab

(Minimum 8-10 experiments are to be performed based on contents from syllabus)

Sample List of Practical's:

1. To understand the fundamental concepts of databases, DBMS architecture, and compare DBMS with traditional file systems.
2. To design Entity-Relationship (ER) models for real-world scenarios and convert them into relational database schemas.
3. To execute Data Definition Language (DDL) commands for schema management.
4. To perform Data Manipulation Language (DML) operations on database tables.
5. To formulate basic queries using the SELECT statement and its clauses.
6. To apply Aggregate Functions for summarizing data.
7. To understand and enforce Relational Integrity Constraints.
8. To apply Normalization techniques for database design.
9. To understand the basic concepts of Database Transactions and their properties.
10. To comprehend the principles of Concurrency Control and Deadlocks.

BTEEV508C Software Engineering Lab

(Minimum 8-10 experiments are to be performed based on contents from syllabus)
Sample List of Practical's:

1. To understand the foundational concepts of software engineering and differentiate various software process models.
2. To apply Agile principles and basic Scrum framework components to a software development scenario.
3. To practice identifying, eliciting, specifying, and validating functional and non-functional software requirements.
4. To create and interpret different system models (context, interaction, structural, behavioral) for a given software system.
5. To design software architectures using established principles and patterns.
6. To apply Object-Oriented Design (OOD) principles using UML for a given problem.
7. To implement a software module, demonstrating code organization and basic version control.
8. To analyse the characteristics of professional software development and ethical considerations.
9. To compare plan-driven versus agile software development approaches.
10. To evaluate common implementation issues in real-world software development, including open-source practices.

BTEEV508D Robotics Lab

(Minimum 8-10 experiments are to be performed based on contents from syllabus)
Sample List of Practical's:

1. Study and Demonstration of Different Types of Robots (Using physical models or simulations: industrial arms, mobile robots, and humanoids)
2. Forward Kinematics of a 2-DOF Robotic Arm Using Denavit-Hartenberg (DH) Parameters (Implemented via MATLAB/Python or Arduino-controlled model)
3. Interfacing a DC Motor or Servo Motor with Arduino for Motion Control (Using L293D/H-Bridge driver)
4. Sensor Interfacing: Obstacle Detection Using IR and Ultrasonic Sensors (With serial output or LED indicator)
5. Building a Line-Following Robot Using IR Sensors and Motor Driver (Combining sensor logic and basic motion control)
6. PWM Generation for Speed Control of DC Motor Using Arduino (With serial monitor output and variation in duty cycle)
7. Simulation of Robot Trajectory Generation Using Polynomial Functions (Plot trajectory in MATLAB or Python using NumPy & Matplotlib)
8. PID Control for a Line-Following or Speed-Regulated Robot (Basic implementation in Arduino IDE)
9. Interfacing Rotary Encoder with Arduino for Position Feedback (Display rotation count and direction)
10. Mini Project: Obstacle-Avoiding Autonomous Robot (Integrating sensors, motor drivers, and logic control)

Third Year (Semester-V)
Mini Project I

BTEEV509	Mini Project I	PROJ	0L-0T-4P	2 Credits

Teaching Scheme	Examination Scheme
Practical: 04 hrs./week	Continuous Assessment: 60 Marks End Semester Exam: 40 Marks

Guidelines for Mini Project I

The students shall study in group of two members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Electronics Engineering (VLSI Design and Technology), Electronics & Computer Engineering, Artificial Intelligence, Data Science, Electronics Engineering and Computer Science Engineering or inter discipline branch from current literature, by referring to the current technical journal or reference books, under the guidance of the teacher.

In this subject head, it is expected that the student should complete the following tasks:

1. Identify problem statement / idea which is solving one problem preferably local problem may being their University / College / nearby vicinity.
2. Do the literature survey,
3. Design the solutions
4. Implement a solution using the latest technology
5. Write 20-25 pages report (use of latex is more suitable).
6. Present / demonstrate the solution in front of faculty member

The students shall prepare his report and execution of projects for other students of his class in the presence of his guide and examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment:
The Continues Assessment for this head will consist of the report written in a technical reporting manner and the execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Third Year (Semester-VI)
Internet of Things & Industry 4.0

BTEEV601	Internet of Things & Industry 4.0	PCC7	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

1 Understand the fundamentals and architecture of the Internet of Things (IoT).
2 Learn programming C and Python for embedded and IoT applications.
3 Explore hardware platforms like Node MCU and Raspberry Pi and their interfacing techniques.
4 Understand various IoT communication protocols and APIs.
5 Gain insights into Industry 4.0 technologies, applications, and business models.

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

CO1: Understand IoT, its characteristics, communication models, and enabling technologies.
CO2: Develop and debug programs in C and Python for sensor-based applications.
CO3: Interface analog and digital sensors using Node MCU and Raspberry Pi platforms.
CO4: Apply knowledge of various IoT protocols for device communication.
CO5: Explain the concepts and technological pillars of Industry 4.0 and IIoT.

Course Contents:

Unit-1: Introduction to IoT [08 Hours]
Definition, characteristics of IoT, logical design of IoT, IoT communication models, IoT communication APIs: REST, WebSocket, IoT Enabling Technologies: Wireless sensor networks, Cloud computing, Big data analytics, communication protocols, Embedded systems, IoT vs M2M.

Unit-2: Introduction to C and Node MCU [08 Hours]
C: Introduction, Data types, variable, operator, branches, loops, functions, Debugging and Optimization of C programs. **Node MCU:** 8266 Wi-Fi module, hardware and pin diagram, Interface with Arduino IDE. Interfacing of analog and digital sensors.

Unit-3: Introduction to Python and Raspberry Pi [08 Hours]
Python: Python IDE, Data types, variable, operator, branches, loops, functions, List, Dictionary, writing to a File, Reading from a File, handling exceptions.
Raspberry Pi: Models of Raspberry Pi, R Pi4 hardware, GPIO pins, operating system for R Pi4, Basic of Linux commands, configuring R Pi4, Interfacing of Digital and Analog sensors.

Unit-4: IoT Protocols [08 Hours]
UART, Wi-Fi, Ethernet, Bluetooth Low Energy (BLE), Message Queue Telemetry Transport (MQTT), Extensible Messaging and Presence Protocol (XMPP), Data Distribution Service (DDS), Advanced Message Queuing Protocol (AMQP).

Unit-5: Introduction to IOT in Industry 4.0 [08 Hours]
Introduction, core idea of Industry 4.0, Globalization and Emerging Issues, The Fourth Revolution, Smart and Connected Business Perspective, Smart Factories, Technology Roadmap of for Industry 4.0. Industrial Internet of Things (IIoT), IIoT Business Model and Reference Architecture, IIOT Layers:

Sensing, Processing, Communication, and Analytics.

TEXTBOOKS: -

1. Internet of Things (A Hands-On Approach) – Arshdeep Bahga, Vijay Madisetti — Universities Press.
2. Get Started with ESP8266 Programming NodeMCU Using Arduino – Up Skill Learning — Notion Press.
3. Internet of Things with Raspberry Pi 3 – Maneesh Rao — Packt Publishing.
4. Internet of Things with ESP8266 – Marco Schwartz — Packt Publishing.
5. Internet of Things with Arduino Cookbook – Marco Schwartz — Packt Publishing.
6. Industry 4.0: Managing the Digital Transformation – Alp Ustundag, Emre Cevikcan — Springer.

REFERENCE BOOKS: -

1. Raspberry Pi Cookbook for Python Programmers – Tim Cox — Packt Publishing
2. Learning Internet of Things – Peter Waher — Packt Publishing

Third Year (Semester-VI)
Digital VLSI Design

BTEEV602	Digital VLSI Design	PCC8	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives: The aim of this course is to:

1. To introduce the fundamental concepts of VLSI design, including design methodologies, styles, and physical design aspects.
2. To analyze the characteristics and operation of traditional MOS logic, focusing on Pseudo NMOS and CMOS inverters.
3. To design and analyze various combinational logic circuits using different MOS logic families.
4. To understand the operation and design of sequential MOS logic circuits and circuits based on transmission gates.
5. To explore the principles and challenges associated with dynamic CMOS logic families for high-speed circuit design.

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

CO1: Explain the VLSI design flow, interpret Y-charts and design styles, and apply design rules for basic physical layouts.

CO2: Analyze the characteristics and operation of traditional MOS logic, focusing on Pseudo NMOS and CMOS inverters

CO3: Illustrate and design the working of Combinational MOS Logic Circuits.

CO4: Design & Illustrate the working of Sequential MOS Logic Circuits.

CO5: Analyze dynamic CMOS logic, identify issues like charge sharing and leakage, and understand various high-speed dynamic logic families.

Course Contents:

Unit-I INTRODUCTION [08 Hours]

Introduction: Moore's law, Trends & Projections in VLSI Circuits, Flow diagram of VLSI Circuit Design, VLSI Design issues, Y-Chart, VLSI Design Styles, Full Custom and Semi-Custom.
Physical design: Design Rules, Stick Diagrams; Layout Designing; Euler's Rule for VLSI Physical Design

UNIT II TRADITIONAL MOS DESIGN [08 Hours]

Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT –III COMBINATIONAL MOS LOGIC CIRCUITS [08 Hours]

MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates, AOI and OIA gates, CMOS full adder, Ratioed Logic.

UNIT IV SEQUENTIAL MOS LOGIC CIRCUITS & TRANSMISSION GATE LOGIC CIRCUITS [08 Hours]

Sequential Mos Logic Circuits: Behavior of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flipflop.

Transmission Gate Logic Circuits: TG as a tristate controller, TG-based Switch Logic Gates: Basic Multiplexer, OR Gate, XOR and equivalence, Transmission-gate Adders, TG Registers.

UNIT V DYNAMIC CMOS CIRCUITS [08 Hours]

Precharge / Evaluate Logic: Dynamic nMOS Gate Examples, nMOS-nMOS Cascades, Domino Logic: Gate characteristics, Domino Cascades, Charge Sharing and Charge leakage problems, Sizing of MOSFET Chains, High Speed Cascades, Multiple-Output Domino Logic, NORA logic, An overview of Dynamic logic families, Zipper CMOS circuits.

TEXTBOOKS:

1. Sung-Mo Kang, Yusuf Leblebici "CMOS Digital Integrated Circuits Analysis and Design", TMH, 3rd Ed., 2011.
2. John P. Uyemura, "CMOS LOGIC CIRCUIT DESIGN", KLUWER ACADEMIC PUBLISHERS, 2002
3. Ken Martin, "Digital Integrated Circuit Design", Oxford Press, 2000.

REFERENCE:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits – A Design Perspective", 2nd Ed., PHI.
2. N. H. E. Weste and C. Harris, "Principles of CMOS VLSI Design: A System Perspective, 3rd Edition, Pearson Education 2007.
3. Neil H.E. Weste and Harris,"CMOS VLSI Design: A Circuits and Systems Perspective" Pearson.
4. Ming-BO Lin, "Introduction to VLSI Systems: A Logic, Circuit and System Perspective", CRC Press, 2011
5. John Wakerly, "Digital Design – Principles and Practices", Pearson.

Third Year (Semester – VI)
Power Electronics & Drives

BTEEV603A	Power Electronics & Drives	PEC-3	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. To understand the working principles, construction, characteristics, and applications of various power semiconductor devices and their triggering and commutation methods.
2. To study the principles and operation of phase-controlled rectifiers and their performance with different types of loads.
3. To explain the operating principles and control strategies of AC voltage controllers and cycloconverters for various load conditions.
4. To impart knowledge about the working principles, types, and control techniques of inverters and choppers.
5. To introduce the fundamentals of electric drives and their control using different types of power electronic converters.

Course Outcomes: After completion of this course, students will be able to:

CO1: Identify and compare the characteristics and applications of power semiconductor devices and analyze SCR triggering and commutation circuits.
CO2: Evaluate the performance of single-phase controlled rectifiers and calculate output parameters for different load conditions.
CO3: Analyze the operation of single-phase AC voltage controllers and cycloconverters for R and R-L loads.
CO4: Design and analyze inverter and chopper circuits for single-phase and three-phase applications.
CO5: Apply appropriate converter configurations to control the speed and torque of single-phase electric drives.

Course Contents:

Unit I: Power Semiconductor Devices: [09 Hours]

Principle of operation, construction, characteristics, ratings and applications of: Power Diodes, Power BJT, Power MOSFET, SCR, IGBT, DIAC, TRIAC and GTO. Triggering circuits (R, R-C, and UJT) and Commutation circuits for SCRs.

Unit II: Power Converters: [08 Hours]

Principle of phase control, single phase half wave-controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of freewheeling diode, single phase dual converters.

Unit III: A.C. Voltage controllers: **[08 Hours]**

Integral cycle and phase angle control, single phase A.C. Voltage controller with R, R-L loads. Cyclo-converter Single phase Step-Up Cyclo-converters and Step down cycloconverter.

Unit IV: Inverters and Chopper **[08 Hours]**

Inverters: Single phase series and parallel inverters, l-Φ bridge Inverter, 3-Φ inverters: 180 mode and 120 mode operation.
Chopper: Basic chopper operation, Four quadrant chopper, voltage commutated and current commutated chopper.

Unit V: Electrical Drives: **[07 Hours]**

Concept of Electric drives, Single phase electrical drives: Half wave converter drives, Semi converter drives, Full converter drives, Dual converter drives.

Textbooks:

1. P.S. Bhimra, “Power electronics”, Khanna Publication.
2. M.D.Singh, K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill.
3. Muhammad H. Rashid, “Power electronics” Prentice Hall of India

Reference Books:

1. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
2. General Electric, “SCR Manual”, Prentice Hall; 6th edition
3. B. K. Bose, “Power Electronics & A.C. Drives”, PHI.

Third Year (Semester-VI)
Semiconductor Materials Synthesis and Characterization

BTEEV603B	Semiconductor Materials Synthesis and Characterization	PCC8	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives: The aim of this course is to:

1. To provide foundational knowledge of semiconductor material synthesis principles.
2. To introduce various industrial production methods for silicon.
3. To explain the fundamentals and techniques of crystal growth.
4. To familiarize students with reactor design and molten liquid behavior.
5. To equip students with the ability to utilize material characterization techniques.

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

CO1: Analyze metallurgical extraction processes using thermodynamic and kinetic principles.
CO2: Describe industrial production methods for MG and EG silicon.
CO3: Explain various crystal growth techniques and associated phenomena
CO4: Apply knowledge of molten liquids and reactor design to synthesis challenges.
CO5: Interpret data from advanced characterization techniques for semiconductor materials.

Unit-I **[08 Hours]**

Principles of extraction, pyrometallurgical processes, material and heat balance of processes, thermodynamics of processes; introduction to laws, thermodynamic equilibrium, thermochemistry, Ellingham diagram.

Unit II **[08 Hours]**

Process kinetics; introduction to chemical kinetics and rate processes, heterogeneous kinetics, kinetics of liquid-liquid reactions, concepts of reactor design. Structure & properties of molten liquids.

Unit III **[08 Hours]**

Production of metallurgical grade (MG) Si: Carbothermic reduction, principle, operation and practice of sub-merged arc furnace, energy and process calculation, refining & impurities control in molten MG Si. Production of electronic grade (EG)

Unit IV **[08 Hours]**

Si: Concept of fluidized bed reactor, Siemens Process. Crystal Growth: Crystal growth processes (Bridgman and its variants, Czochralski), heat and species transfer during non-steady and steady state plane-front growth, interface instability and effect of convection on interface stability

Unit V **[08 Hours]**

XRD (Bulk and thin film), Microscopy (Optical, SEM, TEM, SPM), UV-Visible spectroscopy, Photoluminescence, Raman spectroscopy

Textbooks:

1. Principles of Extractive Metallurgy, Terkel Rosenqvist, McGraw-Hill Book Company, 1973
2. Stoichiometry and Thermodynamics of Metallurgical Processes: Y K Rao, Cambridge University Press, 2009
3. Handbook of Extractive Metallurgy: Fathi Habashi; Wiley-VCH, 1997

Reference Books

1. Solar-Grade Silicon: Refining and Recycling: L Zhang et al, CRC Press, 2013
2. Scheel and Capper: Crystal Growth Technology: From Fundamentals and Simulation to Large-scale Production, John Wiley & Sons, 2008
3. Nakajima and Usami: Crystal Growth of Si for Solar Cell, Springer, 2009
4. Essentials of Metallurgical Thermodynamics, R.H. Tupkary, Khanna Book Publishing, 2016.

Third Year (Semester –VI)
Computer Networks

BTEEV603C	Computer Networks	PEC-3	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is:

1. To introduce students to the fundamental concepts of computer networks and layered architectures (OSI & TCP/IP models).
2. To explain the principles, issues, and protocols at the data link and medium access layers.
3. To provide insight into routing algorithms, internetworking, and congestion control at the network layer.
4. To help students understand transport layer protocols and connection management techniques.
5. To explore various application layer protocols and real-world services such as DNS, email, and web applications.

Course Outcomes: After completion of this course, students will be able to:

CO1: Describe the basic structure and functioning of computer networks and reference models (OSI & TCP/IP). (Bloom's: Understand)

CO2: Explain error detection, correction methods, and medium access protocols used in data communication. (Bloom's: Apply)

CO3: Analyze routing techniques, congestion control algorithms, and quality of service mechanisms. (Bloom's: Analyze)

CO4: Compare and evaluate the features of transport layer protocols, especially TCP and UDP. (Bloom's: Evaluate)

CO5: Demonstrate understanding of application layer protocols like DNS, HTTP, SNMP, and email systems. (Bloom's: Apply)

COURSE CONTENTS:

Unit I INTRODUCTION **[08 Hours]**

Network hardware, Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet. Physical Layer: Guided Transmission media: twisted pairs, coaxial cable, fiber optics, Wireless transmission.

Unit II THE DATA LINK LAYER **[08 Hours]**

Design issues, error detection and correction, elementary data link protocols, sliding window protocols, example data link protocols - HDLC, the data link layer in the internet. THE MEDIUM ACCESS SUBLAYER: Channel allocations problem, multiple access protocols, Ethernet, Data Link Layer switching, Wireless LAN, Broadband Wireless, Bluetooth

Unit III THE NETWORK LAYER: **[08 Hours]**

Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, The Network layer in the internet.

Unit IV THE TRANSPORT LAYER: [08 Hours]

Transport Layer: Transport Services, Elements of Transport protocols, Connection management, TCP and UDP protocols.

Unit V: THE APPLICATION LAYER: [08 Hours]

Application Layer –Domain name system, SNMP, Electronic Mail; the World WEB, HTTP, Streaming audio and video.

Textbooks:

1. A. S. Tanenbaum (2003), Computer Networks, 4th edition, Pearson Education/ PHI, New Delhi, India.

Reference Books:

1. Behrouz A. Forouzan (2006), Data communication and Networking, 4th Edition, Mc Graw-Hill, India.
2. 2. Kurose, Ross (2010), Computer Networking: A top-down approach, Pearson Education, India.

Third Year (Semester-VI)
Introduction to MEMS

BTEEV603D	Introduction to MEMS	OEC-1	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

1 To introduce the basic concepts, design, and applications of MEMS technology.
2 To understand MEMS fabrication processes and scaling issues.
3 To explore the materials and control strategies used in MEMS devices.
4 To explain micromachining techniques for microsystem development.
5 To study the mechanical behavior and modeling of MEMS/NEMS structures.

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

CO1: Understand the principles and applications of MEMS and transduction methods.
CO2: Select appropriate materials and apply control strategies for MEMS devices.
CO3: Analyze fabrication techniques including lithography, deposition, and etching.
CO4: Compare different micromachining methods for micro-device fabrication.
CO5: Apply mechanics of solids and modeling techniques to MEMS/NEMS systems.

Course Contents:

Unit-1: Introduction to MEMS **[08 Hours]**

Introduction, History, Concepts of MEMS: Principles, application and design, Scaling Properties/Issues, Micromachining Processes: Substrates, lithography, wet/dry etching processes, deposition processes, film stress, exotic processes. Mechanical Transducers: transduction methods, accelerometers, gyroscopes, pressure sensors, MEMS microphones, mechanical structures, actuators.

Unit-2: Control and Materials of MEMS **[08 Hours]**

Controls of MEMS: Analog control of MEMS, Sliding mode control of MEMS, Digital control of MEMS, Materials for MEMS: Substrate and wafers, Active substrate material, silicon, Silicon compound, Silicon pezoresisters, Gallium arsenide, Quartz, piezoelectric crystals, Polymers.

Unit-3: Review of Basic MEMS Fabrication Modules **[08 Hours]**

MEMS fabrication modules, Oxidation, Deposition Techniques, Lithography (LIGA), and Etching.

Unit-4: Micromachining **[08 Hours]**

Micromachining, Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Unit No 5: Mechanics of solids in MEMS/NEMS **[08 Hours]**

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes‟s law, Poisson effect, Linear Thermal Expansion, Bending, Energy methods. Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

TEXTBOOKS: -

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers,2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press,1997.
5. Tai-Ran Hsu – *MEMS and Microsystems: Design and Manufacture*, Tata McGraw Hill, 2nd Edition, 2008.
6. Chang Liu – *Foundations of MEMS*, Pearson Education, 2nd Edition, 2012

REFERENCE BOOKS: -

1. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston,1998.
2. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers and Gyroscopes, Elsevier, New York,2000.

Third Year (Semester –VI)
Artificial Intelligence and Machine Learning

BTEEV604A	**Artificial Intelligence and Machine Learning**	**OEC-2**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. Know about the basic building block of AI & the concept of machine thinking
2. Explain the evolution of AI and modern concepts and programming platforms for AI
3. Introduce the fundamental problems of machine learning.
4. Provide understanding of techniques, mathematical concepts, and algorithms used in machine learning to facilitate further study in this area.
5. Provide pointers into the literature and exercise a project based on literature search and one or more research papers.

Course Outcomes: After completion of this course, students will be able:

CO1: To know about the basic principle of AI & To understand the concept of machine thinking
CO2: To understand the evolution of AI and modern concepts and programming platforms for AI
CO3: To understand the fundamental problems of machine learning
CO4: To provide understanding of the limitations of various machine learning algorithms and the way
to evaluate performance of machine learning algorithms.
CO5: To investigate current literature and implement a project based on research in AI/ML.

Course Contents:

Unit 01: General Concept and Philosophy of AI [8 Hours]

Defining AI: AI what and what not?- Basic principle and concept of AI-The intellectual History of AI -Foundations of AI-Frontiers of artificial intelligence-Parallel and distributed AI--AI and the programming platform-Uses and application of AI.
Introduction to agent-Agent performance –Example of Agents- Agent
Faculties- Can machine think?: 'Turning and testing-The Chinese room. Computation and representation-Applications eras of AI-Computationalism-Ethics of AI-Impacts of AI

Unit 02: Intelligent System and Modern AI [8 Hours]

What is intelligence?-Structure of intelligent system-Biological brain –Basic neural model- Intelligent Agents- Rationality- Agent Environment- Agent architectures-the concept of rationality-The structure of agent-The impact of AI in human labor-AI and the social equality.
Technology that precursors to AI era -The concept of bot-AI and Automation-Super intelligence and AI-paths to super intelligence-Forms of super intelligence-Future impacts of AI-AI programming platforms.

Unit 03: Basic Maths [8 Hours]

Probability, Linear Algebra, Convex Optimization, Background: Statistical Decision Theory, Bayesian Learning (ML, MAP, Bayes estimates, Conjugate priors)
Regression : Linear Regression, Ridge Regression, Lasso, Dimensionality Reduction : Principal Component Analysis, Partial Least Squares

Unit 04: **[8 Hours]**

Classification

Linear Classification, Logistic Regression, Linear Discriminant Analysis, Quadratic Discriminant Analysis, Perceptron, Support Vector Machines Kernels, Artificial Neural Networks Back Propagation, Decision Trees, Bayes Optimal Classifier, Naive Bayes

Evaluation measures: Hypothesis testing, Ensemble Methods, Bagging Adaboost Gradient Boosting, Clustering, K-means, K-medoids, Density-based Hierarchical, Spectral

Unit 05: **[8 Hours]**

Miscellaneous topics: Expectation Maximization, GMMs, Learning theory Intro to Reinforcement Learning

Graphical Models: Bayesian Networks.

Textbooks:

1. Artificial Intelligence – Elaine Rich & Kevin Knight, McGraw-Hill Education
2. Artificial Intelligence: The Basics – Kevin Warwick, Routledge
3. Artificial Intelligence: A Systems Approach – M. Tim Jones, Infinity Science Press / Jones & Bartlett Learning
4. Pattern Recognition and Machine Learning – Christopher M. Bishop, Springer
5. Machine Learning – Tom M. Mitchell, McGraw-Hill Education

Reference Books:

1. Artificial Intelligence: Foundations Of Computational Agents- D. Poole- Cambridge University Press, 2010
2. "Artificial Intelligence and Intelligent Systems"- Padhy N.P-4th impression, Oxford University Press, 2007.

Third Year (Semester –VI)
Android Programming

BTEEV604B	Android Programming	OEC-2	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. Introducing the Android platform, architecture, and development tools.
2. Understand UI components, layouts, and user interaction in Android apps.
3. Work with data storage, databases, content providers, and web services.
4. Explore device capabilities like sensors, telephony, and location services.
5. Develop, test, and debug Android applications effectively.

Course Outcomes: After completion of this course, students will be able to**:**

CO1: Explain Android architecture and application structure.
CO2: Design user interfaces using layouts, views, and fragments.
CO3: Handle app communication using intents and manage data using preferences and files.
CO4: Work with SQLite, Firebase, and content providers for data management.
CO5: Integrate telephony, sensors, network, and location-based services in Android apps.

Course Contents:

Unit I: Introduction to Android [08 Hours]
Mobile Technologies Overview, Android Platform & Architecture, Android SDK & Development Setup, Creating First App (AVD/Real Device Testing), Android Manifest & Project Structure

Unit II: User Interface & Activities [08 Hours]
Activity Lifecycle & UI Components, Layouts (Linear, Relative, Constraint), Views, Fragments & Lifecycle, Advanced UI: Adapters, Menus, Dialogs, Navigation Drawer, Material Design Basics

Unit III: Intents, Broadcast Receivers & Storage [08 Hours]
Intents & Intent Filters, Notifications & Dialogs, Shared Preferences & File Storage, Internal & External Storage

Unit IV: Database & Content Providers [08 Hours]
SQLite Database (CRUD Operations), Cursors & SQLite Open Helper, Content Providers (Native & Custom), Firebase Introduction & MySQL via JSON

Unit V: Telephony, Hardware & Networking [08 Hours]
Telephony (Calls, SMS/MMS), Bluetooth & Wi-Fi Management, Google Maps Integration (Markers, Customization)

Textbooks:

1. Android Programming: The Big Nerd Ranch Guide – Bill Phillips, Chris Stewart, Kristin Marsicano, Big Nerd Ranch / Addison-Wesley Professional, 5th Edition (2021)
2. Headfirst Android Development – Dawn Griffiths, David Griffiths, O'Reilly Media, 2nd Edition (2021)
3. Android App Development for Dummies – Michael Burton, For Dummies / Wiley, 3rd Edition (2019)
4. Android Application Development Black Book – Pradeep Kothari, Dreamtech Press

Reference Books:

1. Android Programming with Kotlin for Beginners – John Horton, Packt Publishing, 1st Edition (2019).
2. Android Cookbook – Ian Darwin, O'Reilly Media, 2nd Edition (2022).

Third Year (Semester –VI)
Cloud Computing

BTEEV604C	Cloud Computing	OEC-2	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment:20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. Understand cloud computing fundamentals, reference models, benefits, and challenges.
2. Analyze virtualization techniques, architecture, and their role in cloud environments.
3. Evaluate cloud service models (IaaS/PaaS/SaaS) and deployment strategies (public/private/hybrid).
4. Design enterprise cloud solutions (storage, database, disaster recovery) with scalability.
5. Apply cloud technologies to scientific, business, and consumer applications.

Course Outcomes: After completion of this course, students will be able to:

CO1: Explain cloud computing concepts, historical evolution, and reference models.
CO2: Compare virtualization techniques (VMware/Hyper-V) and their pros/cons in cloud systems.
CO3: Differentiate cloud service models (IaaS/PaaS/SaaS) and deployment types(public/private/hybrid).
CO4: Implement enterprise cloud services (DBaaS, DR planning) and scaling strategies.
CO5: Propose cloud-based solutions for healthcare, business (CRM/ERP), and media applications.

Course Contents:

Unit I: Introduction to Cloud [08 Hours]
Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model. Characteristics and Benefits, Challenges Ahead, Historical Developments.

Unit II: Virtualization [07 Hours]
Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples- VMware and Microsoft Hyper-V.

Unit III: Cloud Computing Architecture [09 Hours]
Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance.

Unit IV: Defining the Clouds for Enterprise [08 Hours]
Storage as a service, Database as a service, Process as a service, Information as a service, Integration as a service and Testing as a service. Scaling a cloud infrastructure - Capacity Planning, Cloud Scale. Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.

Unit V: Cloud Application [0 Hours]
Scientific Applications – Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming.

Textbooks:

1. Cloud Computing: Theory and Practice – Dan C. Marinescu, Morgan Kaufmann (3rd Edition).
2. Virtualization: A Manager's Guide – Dan Kusnetzky, O'Reilly Media (1st Edition).

Reference Books:

1. Cloud Architecture Patterns – Bill Wilder, O'Reilly Media (1st Edition).
2. Enterprise Cloud Computing – Gautam Shroff, Cambridge University Press (1st Edition).
3. Cloud Native: Using Containers, Functions, and Data – Boris Scholl, Trent Swanson, Peter Jausovec, O'Reilly Media (1st Edition).
4. Case Studies: Google Cloud Case Studies – Google Cloud (Online Resource: https://cloud.google.com/customers).

Third Year (Semester – VI)
PLC & Automation

BTEEV604D	PLC & Automation	OEC-2	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is:

1. To introduce the fundamentals of process control, automation systems, and their global significance
2. To familiarize students with various transmitters and signal conditioning techniques for industrial sensors.
3. To provide knowledge on controllers and various electrical and mechanical actuators used in automation
4. To introduce the architecture, programming, and operation of PLCs in automation systems.
5. To acquaint students with the concepts and architectures of DCS and SCADA systems in industrial environments

Course Outcomes: After completion of this course, students will be able to:

CO1: Analyze the role of modern automation in industrial competitiveness.
CO2: Classify different transmitters and evaluate signal conditioning methods for temperature and **p**ressure sensors.
CO3: Design Automation systems for industrial applications
CO4: Develop ladder logic diagrams for basic automation tasks using timers and counters.
CO5: Analyze their applications in real-time industries using DCS and SCADA.

Course Contents:

Unit No 1: Process Control & Automation **[7 Hours]**

Process control principles, Servomechanisms, Control System Evaluation, Analog control, Digital control, Types of Automation; Architecture of Industrial Automation Systems, Advantages and limitations of Automation, Effects of modern developments in automation on global competitiveness.

Unit No 2: Transmitters and Signal Conditioning **[8 Hours]**

Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for RTD, Thermocouple, DPT etc , Smart and Intelligent transmitters.

Unit No 3: Controllers and Actuators **[7 Hours]**

PID Controller, Cascade PID control, Microprocessor Based control, PAC (Programmable automation controller), Mechanical switches, Solid state switches,Electrical actuators: Solenoids, Relays and Contactors, AC Motor, VFD, energy conservation schemes through VFD, DC Motor, BLDC Motor, Stepper Motor, Servo Motor, Pneumatic and hydraulic actuators.

Unit No 4: Introduction to PLC **[7 Hours]**

PLC: Characteristics, Operation, function, Types of PLC, Architecture Of PLC, Applications of PLC, PC v/s PLC, PLC programming, Ladder diagram: of logic gates, multiplexer, Ladder diagram for different logical conditions or logical equations or truth table. Timers: types of timer,Characteristics, Function of timer in PLC, Classification of a PLC timer, Ladder diagram using timer, PLC counter, Ladder diagram using counter.

Unit No 5: Industrial Automation **[7 Hours]**

Basic Concept, History and Hierarchy of DCS, Functions of each level, Advantages and Disadvantages, Architecture of SCADA, MTU- functions of MTU, RTU- Functions of RTU, Working of SCADA, Comparison, suitability of PLC, DCS and SCADA, Applications: Thermal power plant, Irrigation and Cement factory.

Textbooks:

1. Curtis Johnson, Process Control Instrumentation Technology; 8th Edition, Pearson Education.
2. Madhuchhanda Mitra, Samarjit Sen Gupta, "Programmable Logic controllers and Industrial Automation"; Penram International Publishing India Pvt. Ltd.

Reference Books:

1. Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication.
2. John W. Webb, Ronold A Reis, Programmable Logic Controllers, Principles and Applications; 5th Edition, Prentice Hall of India Pvt. Ltd.
3. Kilian, Modern control technology: components & systems, Delmar 2nd edition.
4. Bela G Liptak, Process software and digital networks, 3rd edition, 2002.
5. Pollack. Herman, W & Robinson, T. Computer Numerical Control, Prentice Hall. NJ. Pabla, B.S. &Adithan, M. CNC Machines, New Age Publishers, New Delhi.

Third Year (Semester-VI)
Development Engineering

BTEEV605A	Development Engineering	HSSMEC5	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives: The aim of this course is:

1. To introduce Development Engineering and its scope.
2. To explore global and Indian poverty, sustainable development, and the engineer's role.
3. To examine the intersection of social justice with engineering from various perspectives.
4. To survey diverse strategies for development, including economic, health, and social business approaches.
5. To illustrate the engineer's role in participatory community development and humanitarian technology.

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

CO1: Improve the skills of development engineering.
CO2: Get knowledge of world poverty and development.
CO3: Aware about social justice
CO4: Apply development strategies.
CO5: Understand engineering for sustainable community development.

Course Contents:

Unit No 1: Introduction **[08 Hours]**

Introduction, Various Definitions of Development Engineering.

Unit No 2: World Poverty and Development **[08 Hours]**

World Poverty and Development, Poverty in the India, Sustainable Development, Culture and Global Competence, The Engineer ‘s Role.

Unit No 3: Social Justice **[08 Hours]**

Social Justice, Social Justice and Engineering, Religious Perspectives, Secular Perspectives.

Unit No 4: Development Strategies **[08 Hours]**

Development Strategies: Society, Technological Change, and Development, Development Economists Perspectives, Global Health Perspective, International Education Perspective, Social Business Perspectives.

Unit No 5: Engineering for Sustainable Community Development **[08 Hours]**

The Engineer as a Helper Participatory Community Development, Teamwork and Project Management, Community Assessment: Learning About a Community, Project Selection, Humanitarian Technology, Participatory Technology Development, Humanitarian STEM Education. ICT for Development, AI for Humanitarian purposes, Blockchain and Social Development.

Textbook:

1. Kevin M. Passino – Humanitarian Engineering: Advancing Technology for Sustainable Development, Springer (1st Edition, 2022).

Third Year (Semester-VI)
Employability and Skill Development

BTEEV605B	Employability & Skill Development	HSSMEC-5	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

1 To introduce key soft skills essential for professional and personal growth.
2 To develop interpersonal and workplace communication skills.
3 To enhance grammar, writing, and comprehension skills for effective communication.
4 To prepare students for interviews, group discussions, and presentations.
5 To enable students to apply structured problem-solving techniques.

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

CO1: Distinguish and apply essential soft skills in professional environments.
CO2: Demonstrate effective interpersonal communication and time management.
CO3: Write and comprehend structured English content such as reports, letters, and emails.
CO4: Confidently participate in interviews, GDs, and professional discussions.
CO5: Apply systematic problem-solving and decision-making strategies.

Course Contents:

Unit-1: Soft Skills & Communication basics [08 Hours]

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills, Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation planning, preparing and delivering presentation, Technical writing.

Unit-2: Interpersonal Skills & Commercial Awareness [08 Hours]

Interpersonal Skills: Critical Thinking, Assertiveness, Decision Making, Problem Solving, Negotiation, Building Confidence, Time Management, Personal Presentation, Assertiveness, negotiation, avoiding Stress.

Commercial Awareness: Professional etiquettes and manners, Global negotiating and Persuading, Integrity. Global trends and statistics about civil engineering businesses.

Unit-3: Grammar and Comprehension [08 Hours]

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing.

Unit-4: Skills for interviews [08 Hours]

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time.

Unit No 5: Problem Solving Techniques [08 Hours]

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions. Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

TEXTBOOKS: -

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, “Soft Skills- An integrated approach to maximize personality”, ISBN: 987-81-265-5639-7, First Edition 2016.
2. Wiley Wren and Martin, "English grammar and Composition", S. Chand publications.

REFERENCE BOOKS: -

1. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.
2. Philip Carter, "The Complete Book of Intelligence Test", John Willey & Sons Ltd.
3. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page.
4. Eugene Ehrlich, Daniel Murphy, "Schaum’s Outline of English Grammar", McGraw Hills.
5. David F. Beer, David A. McMurrey, “A Guide to Writing as an Engineer”, ISBN: 978- 1-118-30027-5 4th Edition, 2014, Wiley.

Third Year (Semester –VI)
Consumer Behaviour

BTEEV605C	Consumer Behaviour	HSSMEC-5	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment:20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives: The aim of this course is to:

1. To introduce static characteristics of ideal two terminal and three terminal devices.
2. To discuss working principle of semiconductor devices such as FET & MOSFET.
3. To explore the applications of amplifier & Oscillator in electronic system design.
4. To explore the use of voltage regulators for power supply design

Course Outcomes:

After completion of this course, students will be able to:

CO1. To explain the concept of Consumer Behaviour & describe Consumer research process in detail.
CO2. To evaluate the factors affecting consumer behaviour in detail.
CO3. To analyze the consumer decision process.
CO4. To assess the impact of consumer's motivation, personality on the buying behaviour.
CO5. To impart the basic knowledge of consumer protection rights.

Course Contents:

Unit I: Introduction to Consumer Behaviour [08 Hours]

Definition, Nature, Scope, Consumer Behaviour's Applications in Marketing, Consumer research process –Defining Research Objectives, Collecting & Evaluating Secondary Data, Primary Research Design, Collecting Primary Data, Analyzing Data & Report Preparation.

Unit II: Factors affecting Consumer Behaviour [08 Hours]

Factors influencing Consumer Behaviour– External Influences – Culture, Sub Culture, Social Class, Reference Groups, Family, Internal Influences– Needs & Motivations, Perception, Personality, Lifestyle, Values, Learning, Memory, Beliefs & Attitudes.

Unit III: Consumer Decision Making Process [08 Hours]

Types of consumer decisions, Consumer Decision Making Process - Problem Recognition - Information Search - Alternative Evaluation –Purchase Selection – Post purchase Evaluation, Buying pattern in the new digital era.

Unit IV: Consumer Motivation & Personality [08 Hours]

Consumer Motivation– Needs, Goals, Motive arousal, Maslow's Hierarchy of Needs, Freud's Theory of Motivation, Consumer Personality – Self-concept theory, Psychoanalytic Theory, Neo-Freudian Theory, Trait Theory.

Unit V: Marketing Communications, Decision Making Models, Consumer Rights [08 Hours]

Marketing Communication Process, Types of Communication systems – Interpersonal, Impersonal, Persuasive Communication, Consumer Decision Making Models – Black Box Model - Economic model - Howard & Sheth model, Consumer Protection Act 1986, rights of consumers.

Textbooks:

1. Consumer Behaviour – Satish K. Batra, S. H. H. Kazmi, Excel Books
2. Consumer Behaviour in Indian Context – K. K. Srivastava, Sujata Khandai, McGraw Hill Education (India)

Reference Books:

1. Hawkins, Best and Coney, Consumer Behaviour,Tata McGraw Hill, New Delhi
2. John A Howard, Consumer Behaviour in Marketing Strategy, Prentice Hall New Delhi
3. Schiffman L G and Kanuk L L Consumer Behaviour, Prentice Hall New Delhi
4. Anita Ghatak, Consumer Behaviour in India, D K Agencies (P) Ltd New Delhi
5. Sarkar A Problems of Consumer Behaviour in India, Discovery Publishing House New Delhi

Third Year (Semester-VI)
Digital VLSI Design Lab

BTEEV606	Digital VLSI Design lab	LC10	0L- 0T - 2P	1 Credits

Teaching Scheme	Examination Scheme
Practical: 2 hrs./week	Continuous Assessment: 30 Marks End Semester Exam: 20 Marks

Practical based on the syllabus of the subject of Digital VLSI Design.
(Minimum 8-10 experiments are to be performed based on contents from syllabus)

1. Design and simulate a **Pseudo NMOS inverter**
2. Implement **Pseudo NMOS logic gates**
3. Design CMOS logic gates
4. Implement complex CMOS logic circuits from given Boolean expressions.
5. Design a CMOS Full Adder and verify functionality.
6. Design a Transmission Gate-based 2:1 multiplexer and verify logic operation.
7. Implement a Transmission Gate XOR gate in HDL and test using waveform simulation.
8. Design a basic precharge–evaluate **dynamic nMOS gate** and observe output behavior.

Third Year (Semester –VI)
Internet of Things & Industry 4.0 Lab

BTEEV607	Internet of Things & Industry 4.0 Lab	LC11	0L- 0T - 2P	1 Credits

Teaching Scheme	Examination Scheme
Practical: 02 hrs./week	Continuous Assessment:30 Marks End Semester Exam: 20 Marks

BTEEV607 Internet of Things & Industry 4.0 Lab

(Minimum 8-10 experiments are to be performed based on contents from syllabus)

Sample List of Practical's:

1. Study of IoT architecture, characteristics, and logical design.
2. Demonstration of REST and WebSocket APIs with sample IoT data.
3. Case study on IoT enabling technologies (WSN, Cloud, Big Data, Embedded Systems).
4. C program to demonstrate variables, operators, branching, and loops.
5. C program to read analog sensor values and display output.
6. Interfacing NodeMCU (ESP8266) with Arduino IDE – LED blinking.
7. Interfacing digital sensor (DHT11) with NodeMCU and displaying data on Serial Monitor.
8. Python program to demonstrate data types, lists, dictionaries, file read/write, and exception handling.
9. Configuring Raspberry Pi 4 with Raspbian OS and running Python scripts.
10. Interfacing digital sensor (PIR) with Raspberry Pi GPIO.
11. Interfacing analog sensor (LDR) with Raspberry Pi using ADC module.
12. Sending sensor data from NodeMCU to Raspberry Pi via UART.
13. Sending sensor data via Wi-Fi to a cloud dashboard (ThingSpeak/Blynk).
14. Bluetooth Low Energy (BLE) communication between NodeMCU and smartphone.
15. Implementing MQTT protocol for publish–subscribe communication using Mosquitto broker.
16. Simulation of smart factory process using Node-RED or CISCO Packet Tracer.
17. Case study on Industrial IoT (IIoT) reference architecture.
18. Mini-project demonstrating IIoT layers: Sensing → Processing → Communication → Analytics.

Third Year (Semester –VI)
OEC-2 Lab

BTEEV608	OEC-2 Lab	LC12	0L- 0T - 2P	1 Credits

Teaching Scheme	Examination Scheme
Practical: 02 hrs./week	Continuous Assessment:30 Marks End Semester Exam: 20 Marks

BTEEV608A Artificial Intelligence & Machine Learning Lab

Practical based on the syllabus of the subject of Artificial Intelligence & Machine Learning
(Minimum 8-10 experiments are to be performed based on contents from syllabus)

BTEEV608B Android Programming Lab

(Minimum 8-10 experiments are to be performed based on contents from syllabus)
Sample List of Practical's:

1. To set up the Android development environment and create a basic Android application for testing.
2. To design user interfaces using various layouts and views, and manage the Activity lifecycle.
3. To implement Fragments and advanced UI components like Adapters, Menus, and Dialogs.
4. To utilize Intents for inter-component communication and implement user Notifications.
5. To manage application data storage using Shared Preferences, internal, and external files.
6. To implement a local database using SQLite for CRUD operations.
7. To access and manage data using Native and Custom Content Providers.
8. To integrate an Android application with cloud services like Firebase and external web services.
9. To develop applications interacting with telephony services (calls, SMS/MMS).
10. To integrate and manage device hardware features such as Bluetooth, Wi-Fi, and Google Maps.

BTEEV608C Cloud Computing Lab

(Minimum 8-10 experiments are to be performed based on contents from syllabus)
Sample List of Practical's:

1. To set up a free-tier account on a major public cloud platform (e.g., AWS, Azure, or Google Cloud) and navigate its management console to understand the dashboard and basic service categories.
2. To provision and connect to a virtual machine (VM) instance, demonstrating the concept of Infrastructure as a Service (IaaS) compute.
3. To create and manage an object storage bucket, uploading and accessing files, and configuring basic access permissions.
4. To deploy a managed relational database instance (Database as a Service - DBaaS), and connect to it from a client application or tool.
5. To configure a Virtual Private Cloud (VPC) or Virtual Network (VNet) with subnets and security groups to control network traffic to deployed resources.

6. To deploy a simple web application using a Platform as a Service (PaaS) offering, observing its auto-scaling and load balancing capabilities.

7. To create users, groups, and roles within the Identity and Access Management (IAM) service, and assign appropriate permissions to cloud resources.

8. To configure automated backups or snapshots for a deployed VM or database to understand basic disaster recovery principles.

9. To set up monitoring and alerts for cloud resources (e.g., CPU utilization of a VM or database connection metrics) using the cloud provider's monitoring tools.

10. To deploy a simple serverless function (Function as a Service - FaaS) that responds to an event trigger (e.g., an HTTP request or a file upload to storage).

BTEEV607D PLC Automation Lab

Practical based on the syllabus of the subject of PLC Automation Lab
(Minimum 8-10 experiments are to be performed based on contents from syllabus)

Third Year (Semester-VI)
Mini Project II

BTEEV609	Mini Project II	PROJ	0L-0T-4P	2 Credits

Teaching Scheme	Examination Scheme
Practical: 04 hrs./week	Continuous Assessment: 60 Marks End Semester Exam: 40 Marks

Guidelines for Mini Project II

The students shall study in group of two members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Electronics Engineering (VLSI Design and Technology), Electronics & Computer Engineering, Artificial Intelligence, Data Science, Electronics Engineering and Computer Science Engineering or inter discipline branch from current literature, by referring to the current technical journal or reference books, under the guidance of the teacher.

In this subject head, it is expected that the student should complete the following tasks:

1. Identify problem statement / idea which is solving one problem preferably local problem may being their University / College / nearby vicinity.
2. Do the literature survey,
3. Design the solutions
4. Implement a solution using the latest technology
5. Write 20-25 pages report (use of latex is more suitable).
6. Present / demonstrate the solution in front of faculty member

Continues Assessment:

The students shall prepare his report and execution of projects for other students of his class in presence of his guide and examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment: The Continues Assessment for this head will consist of the report written in a technical reporting manner and the execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Third Year (Semester-VI)
Internship –III / MOOC

BTEEV610	Internship –III / MOOC	Internship	Audit

BTEEV610 Internship –III / MOOC

Guidelines for Internships
Guidelines for Field Training / Internship / Industrial Training Industrial Training:

1. To apply for a suitable Industrial Training, apply form to respective Organization concerned one semester before the Industrial Training Programmed commences.
2. Student can also apply through online platforms such as Internshala for industrial training.
3. Submit one copy of the offer letter for the Industrial Training to the Head of the department or Faculty coordinator (Industrial Training).
4. To complete the Industrial Training process within the specified time based on the Industrial Training Programme schedule.
5. Assessment within the Industrial Training context aims to evaluate the student's work quality and appropriateness to the field of study with reference to the learning outcomes of the Industrial Training Program.
6. Evaluation of the students' performance should be done in the next upcoming semester.
7. Those students who fails, they can also complete online certification courses which are available at free of cost on various MOOC platforms