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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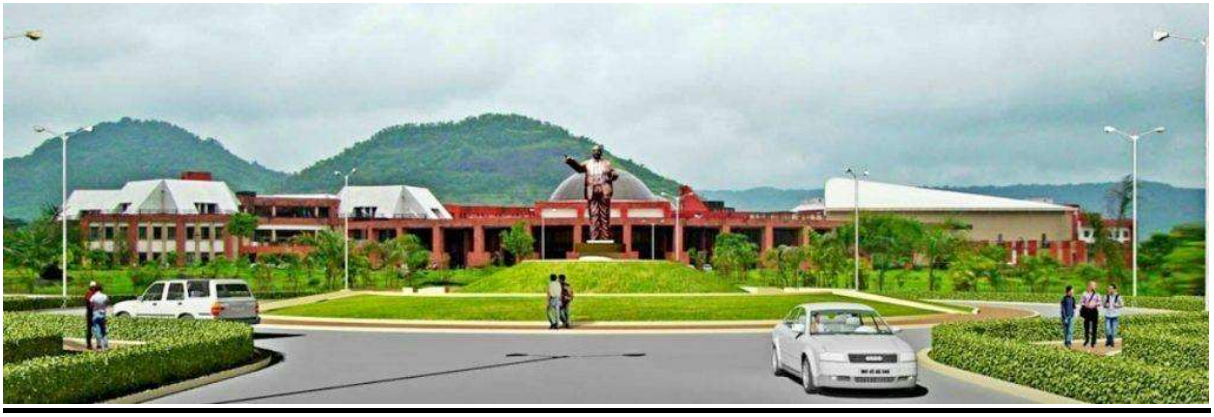
PROPOSED CURRICULUM UNDER GRADUATE PROGRAMME

B. TECH

Electronics and Computer Engineering

Second Year [2022-23]
Third Year [2023-24]
Final Year [2024-25]



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 semester 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 2020-21.

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 Honours

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 & Computer Engineering 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 and Computer Engineering

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	BTHM104	Communication Skills	(2-0-0) 2
2	BTHM109L	Communication Skills Laboratory	(0-0-2) 1
3	BTHM403	Basic Human Rights	(3-0-0) 3
4	BTECHM505	(A) Economics and Management (B) Business Communication	(3-0-0) 3
5	BTECHM605	(A) Development Engineering (B) Employability and Skills Development (C) Consumer Behavior	(3-0-0) 3
6	BTECHM706	(A) Foreign Language Studies (B) Universal Human Values (C) Intellectual Property Rights	(0-0-4) Audit
		TOTAL	**12**

b) Basic Science Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTBS101	Engineering Mathematics – I	(3-1-0) 4
2	BTBS102	Engineering Physics	(3-1-0) 4
3	BTBS107L	Engineering Physics Laboratory	(0-0-2) 1
4	BTBS201	Engineering Mathematics-II	(3-1-0) 4
5	BTBS202	Engineering Chemistry	(3-1-0) 4
6	BTBS207L	Engineering Chemistry Laboratory	(0-0-2) 1
7	BTES301	Engineering Mathematics-III	(3-1-0) 4
8	BTBS404	Probability Theory and Random Processes	(3-0-0) 3
		TOTAL	**25**

c) Engineering Science Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTES103	Engineering Graphics	(2-0-0) 2
2	BTES105	Energy and Environment Engineering	(2-0-0) 2
3	BTES106	Basic Civil and Mechanical Engineering	(2-0-0) Audit
4	BTES108L	Engineering Graphics Laboratory	(0-0-4) 2
5	BTES203	Engineering Mechanics	(2-1-0) 3
6	BTES204	Computer Programming	(2-0-0) 2
7	BTES205	Workshop Practices	(0-0-4) 2
8	BTES206	Basic Electrical and Electronics Engineering	(2-0-0) Audit
9	BTES208L	Engineering Mechanics Laboratory	(0-0-2) 1
10	BTES209L	Basic Computer Programming Laboratory	(0-0-2) 1
11	BTESC304	Computer Architecture & Operating Systems	(3-0-0) 3
12	BTESC305	Digital Electronics and Microprocessor	(3-0-0) 3
		TOTAL	**21**

d) Professional Core Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECPC302	Electronics Devices & Circuits	(3-1-0) 4
2	BTECPC303	Programming, Data Structure and Algorithm Using C	(3-1-0) 4
3	BTECPC401	Python Programming	(3-1-0) 4
4	BTECPC402	Database Management System	(3-1-0) 4
5	BTECPC501	Computer Networks and Cloud Computing	(3-0-2) 4
6	BTECPC502	Digital Signal & Image Processing	(3-0-0) 3
7	BTECPC601	Internet of Things	(3-0-2) 4
8	BTECPC602	Artificial Intelligence and Machine Learning	(3-0-2) 4
9	BTECPC701	Industry 4.0 and Automation	(3-0-0) 3
10	BTECPC702	Deep Learning	(3-0-2) 4
11	BTECPC703	DevOps	(3-0-2) 4
12	BTECPL306	Electronics Devices & Circuits Lab and Programming, Data Structure and Algorithm Using C Lab	(0-0-4) 2
13	BTECPL406	Python Programming Lab and Database Management System Lab	(0-0-4) 2
14	BTECPL506	Computer Networks and Cloud Computing Lab and Competitive Programming Lab	(0-0-4) 2
15	BTECPL606	Internet of Things Lab and Artificial Intelligence & Machine Learning Lab	(0-0-4) 2
16	BTECPL707	DevOps Lab and Deep Learning Lab	(0-0-4) 2
		TOTAL	**51**

e) Professional Elective Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECPE405	Professional Elective Courses –I 1. Microcontroller and Advanced Processor 2. Data Analysis 3. Electromagnetic Engineering and Wave Propagation 4.Linux OS	(3-1-0) 4
2	BTECPE503	Professional Elective Course (PEC) -II 1. Sensors & Robotics Technology 2. Data Warehouse & Data Mining 3. Wireless & Mobile Computing 4. Software Engineering	(3-1-0) 4
3	BTECPE603	Professional Elective Course (PEC) -III 1. Industrial Automation and Control 2. Big Data Analytics 3.Microwave and Optical Fiber Communication 4. Software Testing	(3-1-0) 4
4	BTECPE704	Professional Elective Course (PEC) -IV 1. Automotive Electronics 2. Consumer Electronics 3.Satellite & Radar Engineering 4.Web Development 5.Data Science	(3-1-0) 4
		TOTAL	**16**

f) Open Elective Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECOE504	Open Elective Course (OEC) - I 1. Microelectronics Devices and Circuits 2. Analog & Digital Communication 3. Programming in JAVA 4. Electrical Machines and Instrumentation	(3-1-0) 4
2	BTECOE604	Open Elective Course (OEC) - II 1. VLSI Design 2.Information Theory & Coding 3.Andriod Programming 4. Electrical Drives and Control	(3-1-0) 4
3	BTECOE705	Open Elective Course (OEC) -III 1. Nano Technology 2. Cyber Security & Blockchain Technology 3. IOS Programming 4. Renewable Energy Sources 5. Smart Grid Introduction and Application	(3-1-0) 4
		TOTAL	**12**

g) Seminar / Mini Project / Internship

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTES210S	Seminar	(0-0-2) 1
2	BTES211P	Field Training / Internship / Industrial Training (minimum of 4 weeks which can be completed partially in first semester and second Semester or in at one time).	Audit
3	BTECP408	Internship -II	Audit
4	BTECP408	Internship –II (Evaluation)	Audit
5	BTECP608	Internship -III	Audit
6	BTECP608	Internship –III (Evaluation)	Audit
7	BTECS307	Seminar-I	(0-0-4) 2
8	BTECS407	Seminar-II	(0-0-4) 2
9	BTECM507	Mini Project-I	(0-0-4) 2
10	BTECM607	Mini Project-II	(0-0-4) 2
11	BTECP708	Project Work	(0-0-4) 2
12	BTECF801	Project Work / Internship	(0-0-24) 12
		TOTAL	**23**

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	6	**21**
4	Professional core courses	**48***	0	51	**51**
5	Professional Elective courses relevant to chosen specialization/branch	**18***	0	16	**16**
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	BTES301	BTECPC 401	BTECPC501	BTECPC601	BTECPC701	BTECF801 (Project / Internship)
2	BTBS102	BTBS202	BTECPC302	BTECPC402	BTECPC502	BTECPC602	BTECPC702	--
3	BTES103	BTES203	BTECPC 303	BTHM403	BTECPE503 **(Elective)**	BTECPE603 **(Elective)**	BTECPC703	--
4	BTHM104	BTES204	BTESC304	BTBS404	BTECOE504 **(Elective)**	BTECOE604 **(Elective)**	BTECPE704 **(Elective)**	--
5	BTES105	BTES205	BTESC305	BTECPE405 **(Elective)**	BTECHM505	BTECHM605 **(Elective)**	BTECOE705 **(Elective)**	--
6	BTES106	BTES206	BTECPL 306	BTECPL406	BTECPL506	BTECPL606	BTECHM706 **(Elective)**	--
7	BTBS107L	BTBS207L	BTECS307	BTECS407	BTECM507	BTECM607	BTECPL707	--
8	BTES108L	BTES208L	BTES211P (Internship –1 Evaluation)	BTECP408 (Internship –2)	BTECP508 (Internship –2 Evaluation)	BTECP608 (Internship –3)	BTECP708	--
9	BTHM109L	BTES209S	--	--	--	--	BTECP709 (Internship –3 Evaluation)	--
10	--	BTES211P (Internship -1)	--	--	--	--	--	--

Programme Educational Objectives (PEO)

Name of Programme: Bachelor of Technology (Electronics & Computer Engineering). A graduate in the discipline of Electronics & Computer Engineering is generally expected to have three kinds of knowledge. First, the graduate should have conceptual knowledge of the core topics of Electronics & Computer Science. Second, she/he should have knowledge of mathematical formalism underlying various programming concepts. Third, graduates in the discipline of Electronics & Computer Engineering should have the knowledge of the state of the technologies and tools so that he/she can apply the principles of Electronics & Computer Engineering to solve real-life problems from diverse application domains. The programme of B.Tech in Electronics & Computer Engineering 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	To equip graduates with a strong foundation in engineering sciences and Electronics & Computer Engineering fundamentals to become effective collaborators, researchers and real-time problem solver with technical competencies.
PEO2	Perceive the limitation and impact of engineering solutions in social, legal, environmental, economic and multidisciplinary contexts.
PEO3	Excel in Industry/technical profession, higher studies, and entrepreneurship exhibiting global competitiveness

Programme Outcomes (PO)

After undergoing the learning process of four years, students of B.Tech. (Electronics & Computer Engineering) 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 the fundamentals of science, mathematics and engineering knowledge to design, development, formulates and investigate complex engineering problems related to application area in Electronics & Computer Engineering.
PSO2	Provide exposure to latest tools and technologies and aware of the impact of professional engineering solution in environmental, societal, professional ethics and able to communicate effectively.
PSO3	To publish research paper and think, innovates in Electronics & Computer domain.

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 engineeringsolutions 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 forengineering practice.

(l) Project management and finance: Demonstrate knowledge and understanding of the engineering andmanagement 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 and Computer Engineering

Semester III (Term 3)										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
BSC	BTES301	Engineering Mathematics-III	3	1	-	20	20	60	100	4
PCC1	BTECPC302	Electronics Devices & Circuits	3	1	-	20	20	60	100	4
PCC2	BTECPC303	Programming, Data Structure and Algorithm using C	3	1	-	20	20	60	100	4
ESC11	BTESC304	Computer Architecture & Operating System	3	-	-	20	20	60	100	3
ESC12	BTESC305	Digital Electronics and Microprocessor	3	-	-	20	20	60	100	3
LC1	BTECPL306	Electronics Devices & Circuits Lab & Programming, Data Structure and Algorithm using C Lab	-	-	4	60	-	40	100	2
Seminar	BTECS307	Seminar-I	-	-	4	60	-	40	100	2
Internship	BTES211P	Internship –I (Evaluation)	-	-	-	-	-	-	-	Audit
			15	**3**	**8**	**220**	**100**	**380**	**700**	**22**

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 and Computer Engineering

Semester IV (Term 4)										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				
			L	T	P	CA	MSE	ESE	Total	Credit
PCC3	BTECPC401	Python Programming	3	1	-	20	20	60	100	4
PCC4	BTECPC402	Database Management System	3	1	-	20	20	60	100	4
HSSMC3	BTHM403	Basic Human Rights	3	-	-	20	20	60	100	3
BSC8	BTBS404	Probability Theory and Random Processes	3	-	-	20	20	60	100	3
PEC-1	**BTECPE405**	**Professional Elective Courses –I**	3	1	-	20	20	60	100	4
	BTECPE405 A	1.Microcontroller and Advanced Processor								
	BTECPE405 B	2. Data Analysis								
	BTECPE405 C	3.Electromagnetic Engineering and Wave Propagation								
	BTECPE405 D	4.Linux OS								
LC2	BTECPL406	Python Programming Lab and Database Management System Lab	-	-	4	60	-	40	100	2
Seminar	BTECS407	Seminar - II	-	-	4	60	-	40	100	2
Internship	BTECP408	Internship -II	-	-	-	-	-	-	-	Audit
			15	**3**	**8**	**220**	**100**	**380**	**700**	**22**

Note: The Lab of Professional Elective Courses –I (PEC1) (BTECPE405) should be conducted as per syllabus contents.

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 Third Year

B. Tech in Electronics and Computer Engineering

Semester V (Term 5)										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				
			L	T	P	CA	MSE	ESE	Total	Credit
PCC5	BTECPC501	Computer Networks and Cloud Computing	3	1	-	20	20	60	100	4
PCC6	BTECPC502	Digital Signal & Image Processing	3	-	-	20	20	60	100	3
PEC-2	**BTECPE503**	**Professional Elective Course (PEC) -II**	3	1	-	20	20	60	100	4
	BTECPE503 A	1. Sensors and Robotics Technology								
	BTECPE503 B	2. Data Warehouse & Data Mining								
	BTECPE503 C	3. Wireless & Mobile Computing								
	BTECPE503 D	4. Software Engineering								
OEC-1	**BTECOE504**	**Open Elective Course (OEC) - I**	3	1	-	20	20	60	100	4
	BTECOE504A	1. Microelectronics Devices and Circuits								
	BTECOE504B	2. Analog & Digital Communication								
	BTECOE504C	3. Programming in JAVA								
	BTECOE504D	4. Electrical Machines and Instrumentation								
HSSMEC -4	**BTECHM505**	**Humanities and Social Sciences including Management Elective Course - I**	3	-	-	20	20	60	100	3
	BTECHM505A	1. Economics and Management								
	BTECHM505B	2. Business Communication								
LC3	BTECPL506	Computer Networks and Cloud Computing Lab and Competitive Programming Lab	-	-	4	60	-	40	100	2
PROJ	BTECM507	Mini Project I	-	-	4	60	-	40	100	2
Internship	BTECP508	Internship –II (Evaluation)	-	-	-	-	-	-	-	Audit
			15	**3**	**8**	**220**	**100**	**380**	**700**	**22**

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Course Structure for Third Year

B. Tech in Electronics and Computer Engineering

Semester VI (Term 6)									
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				
			L	T	P	CA	MSE	ESE	Total	Credit
PCC7	BTECPC601	Internet of Things	3	-	-	20	20	60	100	3
PCC8	BTECPC602	Artificial Intelligence and Machine Learning	3	1	-	20	20	60	100	4
PEC-3	**BTECPE603**	**Professional Elective Course (PEC) -III**	3	1	-	20	20	60	100	4
	BTECPE603A	1. Industrial Automation and Control (PLC)								
	BTECPE603B	2. Big Data Analytics								
	BTECPE603C	3.Microwave and Optical Fibre Comm								
	BTECPE603D	4. Software Testing								
OEC-2	**BTECOE604**	**Open Elective Course (OEC) - II**	3	1	-	20	20	60	100	4
	BTECOE604A	1. VLSI Design								
	BTECOE604B	2.Information Theory & Coding								
	BTECOE604C	3.Andriod Programming								
	BTECOE604D	4. Electrical Drives and Control								
HSSMEC-5	**BTECHM605**	**Humanities and Social Sciences including Management Elective Course (HSSMEC) - II**	3	-	-	20	20	60	100	3
	BTECHM605A	1. Development Engineering								
	BTECHM605B	2. Employability and Skill Development								
	BTECHM605C	3. Consumer Behaviour								
LC4	BTECPL606	Internet of Things Lab and Artificial Intelligence and Machine Learning Lab	-	-	4	60	-	40	100	2
PROJ	BTECM607	Mini Project II	-	-	4	60	-	40	100	2
Internship	BTECP608	Internship –III	-	-	-	-	-	-	-	Audit
			15	**4**	**8**	**220**	**100**	**380**	**700**	**22**

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Course Structure for Final Year

B. Tech in Electronics and Computer Engineering

Semester VII (Term 7)										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				
			L	T	P	CA	MSE	ESE	Total	Credit
PCC9	BTECPC701	Industry 4.0 and Automation	3	-	-	20	20	60	100	3
PCC10	BTECPC702	Deep Learning	3	1	-	20	20	60	100	4
PCC11	BTECPC703	DevOps (Development & Operations)	3	1	-	20	20	60	100	4
PEC-4	**BTECPE704**	**Professional Elective Course (PEC) -IV**	3	1	-	20	20	60	100	4
	BTECPE704A	1. Automotive Electronics								
	BTECPE704B	2.Consumer Electronics								
	BTECPE704C	3. Satellite & Radar Engineering								
	BTECPE704D	4. Web Development								
	BTECPE704E	5. Data Science								
OEC-3	**BTECOE705**	**Open Elective Course (OEC) - III**	3	1	-	20	20	60	100	4
	BTECOE705A	1. Nano Technology								
	BTECOE705B	2. Cyber Security & Block chain Technology								
	BTECOE705C	3. IOS Programming								
	BTECOE705D	4. Renewable energy Sources								
	BTECOE705E	5. Smart Grid Introduction and Application								
HSSMEC -6	**BTECHM706**	**Humanities and Social Sciences including Management Elective Course (HSSMEC) - II**	-	-	4	-	-	-	-	Audit
	BTECHM706A	1. Foreign Language Studies								
	BTECHM706B	2. Universal Human Values								
	BTECHM706C	3. Intellectual Property Rights								
LC5	BTECPL707	DevOps Lab and Deep Learning Lab	-	-	4	60	-	40	100	2
PROJ	BTECP708	Project Work	-	-	4	60	-	40	100	2
Internship	BTECP709	Internship –III (Evaluation)	-	-	-	-	-	-	-	Audit
			15	**2**	**12**	**220**	**100**	**380**	**700**	**23**

Semester VIII (Term 8)										
Course Category	Couse Code	Course Title	Teaching Scheme			Evaluation Scheme				
			L	T	P	CA	MSE	ESE	Total	Credit
Project/ Internship	BTECF801	Project Work/ Internship	-	-	24	60	-	40	100	12
			-	**-**	**24**	**60**	**-**	**40**	**100**	**12**

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Second Year (Semester –III)

Engineering Mathematics-III

BTES301	Engineering Mathematics-III	BSC	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.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To study the concepts of transformations, used in various field of Eelctronics & Computer
2. To study partial differential equations to apply it in computer and electronics engineering.
3. To use complex variables.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Understand the concept of LT & ILT.
CO2	Solve problems related to Fourier transform to Deep Learning, Signal & Image processing.
CO3	Understand the concepts of linear algebra and apply Linear Programming, Computer Graphics and Cryptography.
CO4	Understand the concepts of PDE and apply it in data analysis.
CO5	Analyze function of complex variables.

Course Contents:

Unit 1: Laplace Transform [09 Hours]

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

Unit 2: Inverse Laplace Transform [09 Hours]

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

Unit 3: Fourier Transform [09 Hours]

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ;Complex form of Fourier integrals ; Fourier sine and cosine transforms; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

Unit 4: Partial Differential Equations and Their Applications [09 Hours]

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ and one dimensional wave equation (i.e. $\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$).

Unit 5: Functions of Complex Variables [09 Hours]

Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs)

Text Books

1. Linear Algebra, Seymour Lipschutz, Schaums outlines, 4th Edition, McGraw-Hill Publication.

Reference Books

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Wellesley-Cambridge Press.
2. K. Hoffman and R. Kunze, Linear Algebra, 2nd Edition, Prentice-Hall of India, 2005.
3. M. Artin, Algebra, Prentice-Hall of India, 2005.

Second Year (Semester –III)

Electronics Devices and Circuits

BTECPC302	Electronics Devices and Circuits	PCC1	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.)

Pre-Requisites: Basic Semiconductor theory.

Course Objectives:

1. Understand working of semiconductor devices such as FET & MOSFET.
2. Gain knowledge on the linear and nonlinear applications of operational amplifiers.
3. Understand difference between amplifier & Oscillator
4. Understand working of various sensors & Actuators.

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

CO1	Discuss operation, biasing and applications of JFET & MOSFET.
CO2	Comply and verify parameters after exciting devices by any stated method.
CO3	To use Transistor as a Oscillator and Negative Feedback Amplifier.
CO4	Select appropriate transducer for the developing electronic Circuit.
CO5	Choose appropriate actuator for the developing electronic Circuit

Course Contents:

Unit 1 Semiconductor devices:
Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters.

Unit 2 Operational Amplifier and applications:
Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations, Inverting and non-inverting amplifier configurations, voltage follower, summing, averaging, scaling amplifier, integrator, differentiator.

Unit 3 Feedback amplifiers & oscillators (transistorized):
Feedback amplifiers: Feedback concept and topologies, Effect of feedback on terminal characteristics of amplifiers, cascade amplifiers
Oscillators: Basic principle of sinusoidal oscillation, R C phase-shift oscillator, wien-bridge oscillator; LC Oscillators: Hartley and Colpitts oscillators, Crystal oscillator

Unit 4 Voltage Regulator Circuits:

Transistor application: Discrete transistor voltage Regulation, series voltage regulator, shunt voltage regulator. IC Voltage Regulators: Three terminal voltage regulator, Variable voltage regulator.

Unit 5 Sensors & Transducers:
Introduction to sensors & transducer, classification, requirements, thermal (Thermistor & Thermocouple), optical (LDR), electrical (current), magnetic field, displacement, strain, vibration, pressure, flow.

Reference Textbook:
1. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuits Theory", 9thEdition, Prentice Hall of India, 2006.
2. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education 2000.
3. Salivahanan and Kanchana Bhaskaran, "Linear Integrated Circuits", Tata McGraw Hill, India 2008.
4. Sensors & Transducers, Patranabis
5. Measurement Systems (Application & Design), E.D.Doebelin
6. Transducers & Instrumentation, Rangan Mani Sharma

Second Year (Semester –III)

Programming, Data Structures and Algorithm Using C

BTECPC303	Programming, Data Structures and Algorithm Using C	PCC2	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.)

Pre-Requisites: Programming in C, Structures and Pointers.

Course Objectives:

As we are surrounded by huge amount of data, organizing or structuring the data by using efficient and optimized algorithm becomes very much important. Data structure is a logical and mathematical model of sorting, organizing and storing the data in a particular way in a system. As most of the data being dynamic, with programming in C, students will be able to particularly understand the memory management with the given data to solve the given problem statement.

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Providing a strong foundation of fundamental basics of Data Structures and Algorithms.
2. Demonstrating awareness and fundamental understanding of various applications of Data Structures and Algorithms.
3. Applying relevant data structure and algorithms for problem solving.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Implement linked list & perform various operations on Linked List
CO2	Implement stack & perform operations on stack.
CO3	Implement various types of queues & perform operations on stack.
CO4	Implement trees & graph and traverse to solve a problem.
CO5	Implement an algorithm & apply different searching and sorting techniques.

Course Contents:

Unit-1 Data Structures **7 Hours**

Introduction: Need of DS, Abstract Data Types, Types of Data Structures: Linear and Non-Linear, Operations on Data Structures: Traversing, Searching, Sorting, Deletion, Insertion.

Linear Data Structure: Linear Lists:

Linked Lists, Types, Representation of Linear Lists in memory, Traversing a Linked List, Searching a Linked List, Memory Allocation: Insertion of Node into a Linked List, Deletion of Node from Linked List, Circular Linked Lists, Doubly Linked Lists.

Unit 2 Stacks **7 Hours**

Introduction to Stacks, Memory Representation of stack using array and Link List, Operations: Push, Pop, StackFull, StackEmpty, Stack Overflow & Underflow.

Stack Applications:

Reversing a List, Expression Evaluation: Infix, Prefix, Postfix, Conversion, Evaluation.

Unit-3 Queues **7 Hours**

Introduction to Queues, Memory Representation of Queue using array, Types of Queues: Linear Queue, Circular Queue, Priority Queue, Queue Operations: Insert and Delete, QueueFull, QueueEmpty, Applications of Queue.

Unit-4 Non Linear Data Structures: Trees & Graphs **8 Hours**

Trees – Definitions-Degree of Tree / Node, Depth / Height of Tree, In-degree, Out-degree, Path, tree representation, properties of trees, Types of Tree: Binary tree, Binary tree representation, Binary Tree Properties, Binary Tree Implementation, Binary Tree Traversals: In-order, Pre-order, Post-order , BST, Applications of trees.

Graphs - Graph Introduction, Graph theory terminology, Directed Graph, Undirected Graph, Representation of graphs, Path Matrix, Traversing a graph: Breadth- First search, Depth-Final search, Adjacency Matrix of Directed and Undirected Graph, Applications.

Unit-5 Algorithms **7 Hours**

Introduction to Algorithms, Asymptotic analysis Big-O, Big-Theta and other notations, Algorithm Analysis-Worst, Average and Best case analysis, Algorithm Complexity: Time & Space Complexity tradeoff.

Types of Algorithms:

Sorting: Bubble Sort, Insertion sort, Quick Sort, Selection sort, Merge-sort.

Searching: Sequential and binary searches. Hashing Schemes.

Text Books

1. "Data Structures Using C", E. Balgurusamy, McGraw Hill Education, New Delihi, 2003, ISBN: 978-1259029547.
2. "Data Structure in C" by Aaron M Tanenbaum, Yedidyah Langsam, Pearson publication.
3. "Data Structures Through C In Depth", Second Revised & Updated Edition, S. K. Srivastava & Deepali Srivastava, BPB Publication.
4. "Data Structures through C" Yashwant Kanetkar, BPB Publications.
5. "Algorithm and Data Structures", M. M. Raghuwanshi, ISBN13: 9788184874259**.**

Reference Books:

1. "Fundamentals of data structure in C" Horowitz, Sahani & Freed, Computer Science Press.
2. "Fundamental of Data Structure" (Schaums Series) Tata-McGraw-Hill.

Second Year (Semester –III)

Computer Architecture and Operating Systems

BTESC304	Computer Architecture and Operating Systems	ESC11	3L- 0T - 0P	3 Credits

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

Pre-Requisites: History of Computers, Computer Generations, Digital Electronics, Number Systems, Number Conversion

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To understand the services provided by and the design of an operating system.
2. Understand the structure, organization memory management
3. To understand the structure, function, and characteristics of computer systems
4. To identify the elements of modern instructions sets and their impact on processor design

Course Outcomes:

On completion of the course, students will be able to:

CO1	Get acquaint with computer architecture and CPU building blocks
CO2	Understand classify and draw schematic diagrams of various computer memories
CO3	Explain operations of control unit and input output of a typical computer
CO4	Define Operating system, thread, process, inter-process communication and Solve numerical related to various CPU Scheduling Algorithm
CO5	Understand concepts of Process Synchronization and Deadlocks and Solve associated Numerical

Course Contents:

Unit No 1: Computer Architecture, Arithmetic and Instruction Sets [8 Hours]

Concept of computer organization and architecture, Fundamental unit, Computer function and interconnection, CPU structure and function. A Brief history of computers, Designing and Performance, MICs, GPGPUs, Intel X86 Architecture.

The Arithmetic and Logic Unit, Integer representation, Integer arithmetic. Floating point representation, Floating point arithmetic. Instruction Sets: Characteristics, Instruction Representation, Number of Addresses, Instruction Set Design, Types of operands, Types of operations, Addressing modes, Instruction format, Assembly language, Instruction execution, Machine state and processor status, Structure of program, Introduction to RISC and CISC architecture.

Unit No 2: Memory Organization and Management [7 Hours]

Memory Organization: Internal Memory: Semiconductor main memory, Error correction, Advanced DRAM organization, Virtual memory systems and cache memory systems. External Memory: Organization and characteristics of magnetic disk, Magnetic tape, Optical memory, RAID, Memory controllers. Memory Management: Basic concept, Logical and Physical

address map, Memory allocation: Continuous Memory Allocation, Fixed and variable partition, Internal and external fragmentation and compaction, Paging: Principle of operation, Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory Hardware and control structures Locality of reference, Page fault, Working Set, Dirty page/Dirty bit Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Unit No 3: Control Unit & Input/ Output Organization: [7 Hours]

Control Unit: Control unit operation: Micro-operations, Control of the processor, Hardwired implementation, Micro-programmed Control Unit, Basic concepts, Micro-instruction sequencing, Micro-instruction execution, Applications of micro-programming. Input/ Output Organization: External devices, I/O module, Programmed I/O, Interrupt driven I/ O, Direct memory access, I/O channels and processors, External interface. Instruction pipe-lining: Concepts. Parallel processing: Multiple processor organization, Symmetric multiprocessor, Cache coherence and the MESI protocol

Unit No 4: Introduction to Operating Systems [7 Hours]

Computer system architecture, Definition, types/classification, objectives, and functions of Operating System (OS). System Components- System Services, Systems Calls, System structure. Virtual Machines, System Design and Implementation. Concept of Process and Threads, Process Scheduling, Operation on process, Cooperating processes. Inter-process Communication, Scheduling criteria, scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Scheduling Algorithms and performance evaluation

Unit No 5: Process Synchronization & Deadlocks [7 Hours]

Process Synchronization: The critical-section problem, Critical regions, Synchronization Hardware, Semaphores, Classical Problems of synchronization, and Monitors Synchronizations in Solaris. Deadlocks: Systems Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined approach to deadlock Handling

Textbooks:

1. William Stalling, Computer Organization and Architecture: Designing for Performance, Prentice Hall Publication, 8th Edition, 2009.
2. Hayes, Computer Architecture and Organization, McGraw-Hill Publication, 3rd Edition, 2012.
3. Zaky, Computer Organization, McGraw-Hill Publication, 5th Edition, 2011
4. Andrew S. Tanenbaum, Modern Operating System, PHI Publication, 4th Edition, 2015.

Reference Books:

1. Hennessy and Patterson, Computer Architecture: A Quantitative Approach, Morgan and Kaufman Publication, 4th Edition, 2007.
2. Morris Mano, Computer System Architecture, Pearson Education India, 3rd Edition, 2007.
3. Mostafa Abd-El-Barr, Hesham El-Rewini, Fundamentals of Computer Organization and Architecture, Wiley Publication, 1st Edition, 2004.

Second Year (Semester –III)

Digital Electronics & Microprocessor

BTESC305	Digital Electronics & Microprocessor	ESC12	3L- 0T - 0P	3 Credits

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

Pre-Requisites: None

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To provide a strong foundation of fundamental basics of Digital Electronics & microprocessor
2. Demonstrate awareness and fundamental understanding of various Combinational and sequential circuits
3. To impart knowledge about microprocessor

Course Outcomes:

On completion of the course, students will be able to

CO1	Became familiar with the digital signal, positive and negative logic, Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and their conversion from others
CO2	Learn the working mechanism and design guidelines of different combinational circuits and their role in digital system design.
CO3	Understand the working mechanism and design guidelines of different sequential circuits and their role in the digital system design
CO4	Assess and solve basic binary math operations using the microprocessor and explain the microprocessor's internal architecture and its operation within the area of manufacturing and performance
CO5	Describe, list and use different types of instruction and interrupts and develop assembly language programs using various programming tools

Unit 1. Introduction **[7 Hours]**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, Number Systems: decimal, binary, signed binary, octal, hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

Unit 2. Combinational Digital Circuits **[7 Hours]**

Standard representation for logic functions, K-map representation, simplification of logic functions using K- map, minimization of logical functions, Don't care conditions, Multiplexer, De-Multiplexer, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, parity checker / generator.

Unit 3. Sequential circuits and systems **[7 Hours]**

1-bit memory, Bistable latch, the clocked SR flip flop, J-K,T and D-types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops,

special counter IC's, asynchronous sequential counters, applications of counters.

Unit 4.Fundamentals of Microprocessors [8 Hours]

Fundamentals of Microprocessor, The 8085 Architecture: Internal Block Diagram, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles, Memory Interfacing, Interrupts in 8085, 8085 Instruction Set and Programming: Addressing modes of 8085, Instruction set of 8085, I/O Interfacing,

(Perform practical of interfacing of 8255, 8254, and 8259 with 8085 microprocessor).

Unit 5. THE 8086 MICROPROCESSOR & Interfacing [7 Hours]

Introduction to 8086, Microprocessor architecture, Addressing modes, Instruction set and assembler directives, Assembly language programming Memory Interfacing, I/O Interfacing, Parallel communication interface, Serial communication interface, D/A and A/D Interface, Timer, Keyboard /display controller, Interrupt controller, DMA controller Direct Memory Access (DMA), C language programs, Assemblers and compilers, Programming and debugging tools.

Text Book:

1. R. P. Jain, Modern Digital Electronics, McGraw Hill Education, 2009.
2. Ramesh Gaonkar, Microprocessor Architecture ,programming and applications with 8085,PENRAM

Reference Books:

1. M. M. Mano, Digital logic and Computer design, Pearson Education India, 2016.
2. Kumar, Fundamentals of Digital Circuits, Prentice Hall India, 2016.
3. Douglas Hall, Microprocessors and Interfacing, McGraw-Hill Publication, Revised 2nd Edition, 2006.

Semester –III

Electronics Devices & Circuits Lab and Programming, Data Structure and Algorithm Using C Lab

BTECPL306	**Electronics Devices & Circuits Lab and Programming, Data Structure and Algorithm Using C Lab**	**LC1**	**0L-0T-4P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 04 hrs./week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks End Semester Examination: 40 Marks

A) Electronics Devices & Circuits Lab

List of Practical/Tutorial

1. Study of Digital multimeter, Function Generator, CRO/DSO, Dual power supply, connecting probes.
2. Study of FET (Reading data sheet, Terminal Identification, packages, testing & Plot FET characteristics)
3. Study of MOSFET (Reading data sheet, Terminal Identification, packages, testing & Plot MOSFET characteristics)
4. To study & perform Op-amp application. (Adder, subtractor, integrator, Differentiator)
5. To study & perform Voltage series feedback amplifier
6. To study & Perform RC phase shift oscillator
7. To study & perform Colpitts, Hartley oscillator
8. Study of sensors & Transducer.
9. Mini project.

B) Data Structure and Algorithm Using C Lab

List of Practical

1. Write code and understand the concept Variable, Data Type and Data Object in C.
2. Write code and understand the concept Constructor and Relationship
3. Write code and understand the concept List in data Structure
4. Write code and understand the concept Queue in data Structure
5. Write code and understand the concept Array in data Structure
6. Write code and understand the concept Graphs, Trees in data Structure
7. Write code and understand the concept Hashing, Hast Tables in data Structure
8. Write code and understand the concept Search Algorithms (Any two)
9. Write code and understand the concept Sorting Algorithms (Any two)
10. Write code and understand the concept Algorithm Technique on Greedy Approach

Semester –III
Seminar-I

BTECS307	**SEMINAR- I**	**Seminar**	**0L-0T-4P**	**2 Credits**

Guidelines for Seminar

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, Computer Science Engineering Artificial Intelligence, Data Science, or inter discipline branch from current literature, by referring the current technical journal or reference books, under the guidance of the teacher. The students shall prepare his report and deliver talk on the topic for other students of his class in the presence of his guide and internal 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 consists of the report written in a technical reporting manner and presentation of the talk on the subject and will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Second Year (Semester –IV)

Python Programming

BTECPC401	Python Programming	PCC3	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.)

Pre-Requisites: Programming in C, OOPS, Data Structure.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Providing a strong foundation of fundamental basics of programming using python.
2. Demonstrating awareness and fundamental understanding of various data types in python.
3. Demonstrating python programming for the File handling and GUI applications.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Develop small programs to demonstrate use of python tokens in IDE.
CO2	Develop python program to demonstrate use of operators, control flow and sequences.
CO3	Develop python function for a given problem.
CO4	Develop python program to demonstrate use of classes and objects.
CO5	Develop python program to demonstrate file handling and make database connectivity.

Course Contents:

Unit-1 Introduction and Python Installation **6 Hours**

Introduction: History of Python, Need of Python, Features of Python, Comparison with C and Java, Python Building Blocks: Keywords, Identifiers, Variables, Comments, Docstring, Indentation, Input-Output.

Python Installation: Python Installation with 3.x version, Working with various IDE: Command Prompt, IDLE, Jupyter Notebook, Google Colab, Pycharm, VS Code, Spyder.

Unit-2 Data Types, Operators and Control Flow **8 Hours**

Python Data Types: Numbers, Strings, Sequences, Declaration and Initialization.

Operators in Python: Arithmetic, Relational, Assignment, Logical, Bitwise, Membership, Identity, Operator Precedence & Associativity.

Control Flow- if, if-elif-else, nested if-else, Loops: for, while loop, Loops using break, continue, pass.

Python Data Structures: List, Tuple, Set, Dictionary, Slicing and Comprehension operations using sequences.

Unit 3. Python Functions, Modules and Packages **8 Hours**

Python built-in functions, Math Function, Python user-defined functions, Arguments: Actual & Formal, Default Argument, Positional Argument, Variable Length Argument, Function returning value/s, Anonymous Functions. Scope of variable: Global and Local.

Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing & Uninstalling Packages via PIP, Using Python Packages.

Unit-4 OOPS and Exception Handling **7 Hours**

Classes and Objects, Self-variable, Methods, Constructor Method, Encapsulation, Inheritance, Polymorphism, Abstraction, Data Hiding, Method Overloading and Overriding.

Exception Handling: Errors & Exceptions, Difference between Error and Exception, Exception Handling using try-except-finally blocks, Raising Exception, Exception Types: Built-in & User-defined Exceptions.

Unit-5 File Handling and Miscellaneous **7 Hours**

File Handling: Opening file in different modes, accessing file content, reading and writing file, closing a file.

Miscellaneous: Database Connectivity using python, GUI Programming, Turtle Graphics, Date and Time, Data Compression, Testing: Why testing is required? Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests, Introduction: Regular Expression (RegEx).

Text Books

1. "Core Python Programming" by Dr. R. Nageswara Rao, Dreamtech Press.
2. "Python Programming: A Modern Approach", Vamsi Kurama, Pearson.
3. "Think Python", Allen Downey, Green Tea Press.
4. "Learning Python", Mark Lutz, Oroelly Publications.
5. "Let Us Python" Yashwant Kanetkar, 4th Edition, BPB Publications.

Reference Books

1. The Complete Reference: Python- Martin C. Brown, McGraw Hill Publication.
2. Python Essential Reference, Developer's Library, David M. Beazley, 4th Edition, Addidion-Wesely Professional, ISBN: 9780672329784

Second Year (Semester –IV)

Database Management Systems

BTECPC402	Database Management Systems	PCC4	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.)

Pre-Requisites: Programming in C, Structures and Pointers.

Course Objectives:

1. To teach the basic database concepts, applications, data models, schemas and instances.
2. To familiarize Entity Relationship model for a database.
3. To demonstrate the use of constraints and relational algebra operations.
4. To emphasize the importance of normalization in databases.
5. To demonstrate the basic concepts of transaction processing and concurrency control.
6. To familiarize the concepts of database storage structures and identify the access techniques.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Use the basic concepts of Database Systems in Database system
CO2	Apply SQL queries to interact with Database
CO3	Apply normalization on database design to eliminate anomalies
CO4	Analyze database transactions and can control them by applying ACID properties.
CO5	Study of NOSQL database and oriented using MongoDB.

Course Contents:

Unit 1: Introduction to Database Management System **[6 Hours]**

Database system architecture, Data Abstraction, Data Independence, Types of databases, Introduction to Relational Database management system, Schema and instances, Data models: Entity-relationship model.

Unit 2: Structured Query Language (SQL): **[8 Hours]**

Data Definition Language (DDL), Data Manipulation Language (DML), Relational integrity constraints, data manipulation operations using WHERE clause, Order By Clause,NULL,LIMIT etc, SQL functions, joins, group by and having clause, Subqueries, views.

Unit 3: Relational database design: **[7 Hours]**

Types of keys, Need of Normalization, Functional dependency and its types, Dependency preservation, Lossy and Lossless design, dependency, Normal forms, 1NF, 2NF, 3NF and BCNF.

Unit 4: Transaction processing: **[8 Hours]**

Concurrency control, ACID property, Serializability of scheduling, Concurrency Control schemes, Locking and timestamp based schedulers, Database recovery.

Unit 5: NOSQL Database: **[7 Hours]**

Difference between RDBMS and NOSQL Database, Need of NOSQL databases, Types of NOSQL databases, CAP Theorem, Introduction to Document oriented databased with MongoDB, MongoDB installation, Basic CRUD operation with MongoDB.

Text Books:

1. Henry Korth, Abraham Silberschatz & S. Sudarshan, Database System Concepts, McGraw-Hill Publication, 6th Edition, 2011.
2. Navathe, Fundamentals of Database System, Addison-Wesley Publication, 6th Edition, 2012.
3. 2. MongoDB: The Definitive Guide, 2nd Edition, Powerful and Scalable Data Storage, By Kristina Chodorow, Publisher: O'Reilly.

Reference Books:

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGrawHill Publication, 3rd Edition, 2003.
2. Media 3. MongoDB Basics - EelDavid Hows,Peter Membrey,coPlugge, Publisher Apress – Ebook (free) https://it-ebooks.info/book/4527/

Second Year (Semester –IV)

Basic Human Rights

BTHM403	Basic Human Rights	HSSMC3	3L- 0T -0P	3 Credits

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

Pre-Requisites: None

Course Objectives:

1. To train the young minds facing the challenges of the pluralistic society and the rising conflicts and tensions in the name of particularistic loyalties to caste, religion, region and culture.
2. To give knowledge of the major "signposts" in the historical development of human rights, the range of contemporary declarations, conventions, and covenants.
3. To enable them to understand the basic concepts of human rights (including also discrimination, equality, etc.), the relationship between individual, group, and national rights.
4. To develop sympathy in their minds for those who are denied rights.
5. To make the students aware of their rights as well as duties to the nation

Course Outcomes:

On completion of the course, students will be able to:

CO1	Students will be able to understand the history of human rights.
CO2	Students will learn to respect others caste, religion, region and culture.
CO3	Students will be aware of their rights as Indian citizen.
CO4	Students will be able to understand the importance of groups and communities in the society.
CO5	Students will be able to realize the philosophical and cultural basis and historical perspectives of human rights.

Course Contents:

UNIT 1: The Basic Concepts: **[08 Hours]**

Individual, group, civil society, state, equality, justice. Human Values, Human rights and Human Duties: - Origin, Contribution of American bill of rights, French revolution. Declaration of independence, Rights of citizen, Rights of working and exploited people.

UNIT 2 Fundamental rights and economic program: **[07 Hours]**

Society, religion, culture, and their inter relationship. Impact of social structure on human behavior, Social Structure and Social Problems: - Social and communal conflicts and social harmony, rural poverty, unemployment, bonded labor.

UNIT 3: Migrant workers: **[07 Hours]**

Migrant workers and human rights violations, human rights of mentally and physically challenged. State, Individual liberty, Freedom and democracy. NGOs and human rights in India: - Land, Water, Forest issues.

UNIT 4: Human rights in Indian constitution and law **[07 Hours]**

i) The constitution of India: Preamble ii) Fundamental rights. iii) Directive principles of state policy. iv) Fundamental duties. v) Some other provisions.

UNIT 5: Universal declaration: **[07 Hours]**

Universal declaration of human rights and provisions of India. Constitution and law. National human rights commission and state human rights commission

Text / Reference Books

1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005

2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives(Law in India), Oxford India

Second Year (Semester –IV)

Probability Theory and Random Processes

BTBS404	Probability Theory and Random Processes	BSC8	3L- 0T -0P	3 Credits

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

Pre-Requisites: None

Course Objectives:

1. To develop basic of statistics, probability and random variables.
2. The primary objective of this course is to provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probability theory, as well as solve probabilistic problems in engineering and applied science.

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

CO1	Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon
CO2	Understand the basic concepts of one and two dimensional random variables and apply in engineering applications
CO3	Apply the concept random processes in engineering disciplines
CO4	Understand and apply the concept of correlation and spectral densities
CO5	The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems

Course Contents:

UNIT 1: Probability Theory **[07 Hours]**

Definition of probability: classical, empirical and axiomatic approach of probability, Addition theorem of probability, Multiplication theorem of probability, Bayes‘ theorem of inverse probability, Properties of probabilities with proofs, Examples.

UNIT 2: Random Variable and Mathematical Expectation **[07 Hours]**

Random variables, Probability distributions, Probability mass function, Probability density function, Mathematical expectation, Join and marginal probability distributions, Properties of expectation and variance with proofs. Theoretical Probability Distributions : Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial distributions, Properties of binomial, Poisson and normal distributions, Relation between binomial and

normal distributions, Relation between Poisson and normal distributions, Importance of normal distribution, Examples.

UNIT 3: Correlation [07 Hours]

Introduction, Types of correlation, Correlation and causation, Methods of studying correlation, Karl Pearson's correlation coefficient, Spearman‘s rank correlation, Coefficient, Properties of Karl Pearson's correlation coefficient and Spearman‘s rank correlation coefficient, Probable errors.

UNIT 4: Linear Regression Analysis [07 Hours]

Introduction, Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Angle between the regression lines, Coefficients of regression, Theorems on regression coefficient, Properties of regression coefficient.

UNIT 5: Estimation and Hypothesis [07 Hours]

Estimation, Large Sample Estimation of a Population Mean, Small Sample Estimation of a Population Mean, Large Sample Estimation of a Population Proportion, Sample Size Considerations, Testing Hypotheses, The Elements of Hypothesis Testing, Large Sample Tests for a Population Mean, The Observed Significance of a Test, Small Sample Tests for a Population Mean, Large Sample Tests for a Population Proportion.

Text Books

1. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7th Revied and Enlarged Edition, 2016.

Reference Books

1. G. V. Kumbhojkar, Probability and Random Processes, C. Jamnadas and Co., 14th Edition, 2010.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
4. G. Haribaskaran, Probability, Queuing Theory and Reliability Engineering, Laxmi Publications, 2nd Edition, 2009.
5. Murray Spiegel, John Schiller, R. ALU Srinivasan, Probability and Statistics, Schaum's Outlines, 4th Edition, 2013.
6. Kishor S. Trivedi, Probability, Statistics with Reliability, Queuing and Computer Science Applications, Wiley India Pvt. Ltd, 2nd Edition, 2001.
7. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, An Introduction to Probability And Statistics, Wiley Publication, 2nd Edition, 2001.
8. Roxy Peck, Chris Olsen, Jay Devore, Introduction to Statistics and Data Analysis, Third Edition, Thomson Books/Cole.
9. Ronald Walpole; Raymond Myers; Sharon Myers; Keying Ye, Probability & statistics for engineers & scientists, 9th edition, Prentice Hall.

Second Year (Semester –IV)

Microcontroller and Advanced Processor

BTECPE405A	**Microcontroller and Advanced Processor**	**PEC1**	**3L- 1T -0P**	**4 Credits**

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

Pre-Requisites: None

Course Objectives:

After completion of the course, students will have an adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To provide a strong foundation of fundamental basics of Microcontroller & advanced processor
2. Demonstrate awareness and fundamental understanding of various programming tools
3. To impart knowledge about the programming of controllers and processors

Course Outcomes:

On completion of the course, students will be able to

CO1	Explain the internal organization of microprocessors & microcontrollers and the general structures of microcontrollers
CO2	Get acquainted with the programming tools of 8051
CO3	Understand the concepts of interfacing with processors and controllers (ADC, DAC & stepper motor.etc)
CO4	Describe the programmer's model of the ARM processor and Become aware of the Thumb mode of operation of ARM.
CO5	Analyze the functioning of hardware devices and interfacing them into ARM7 Processor.

Unit 1. Fundamentals of Microcontrollers [7 Hours]

Introduction to the general structure of Microcontrollers Harward & Von Neumann architecture, RISC & CISC processors Block diagram and explanation of 8051, Port structure, memory organization, Interrupt structure, timers and its modes, serial communication modes. Overview of Instruction set, Addressing modes.

Unit 2. Programming with 8051 [7 Hours]

Sample programs (assembly): Delay using Timer and interrupt, Programming Timer 0&1, Data transmission and reception using Serial port. Software and Hardware tools for development of microcontroller-based systems such as assemblers, compliers, IDE, Emulators, debuggers, programmers, development board, DSO, Interfacing LED with and without interrupt, Keypads, Seven Segment Display. All Programs in assembly language and C.

Unit 3. Interfacing of 8051 [7 Hours]

8051 timer programming, serial port and its programming, interrupt programming, LCD and keyboard interfacing, ADC and DAC interfacing, interfacing to external memory. Temperature

sensors, Stepper motor, Motion detectors, Relay, Buzzer, Optoisolators. All programs in assembly and C.

Unit 4. Microcontroller Architecture [7 Hours]

Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features and comparison, registers, CPSR, SPSR, ARM and RISC design philosophy, ARM7 data flow model, programmers model, modes of operations, ARM 3 stage Pipeline, ARM 5 stage Pipeline, Introduction to Tiva TM4C123G Series Overview, Programming model, Tivaware Library.

Unit 5. ARM7-based Microcontroller and Advanced Microcontroller [7 Hours]

ARM7 Based Microcontroller LPC2148: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider) , Memory Map, GPIO, Pin Connect Block, timer, Instruction set, programming in assembly language, Introduction to RENESAS Microcontroller (RL78/G13), features and architecture of RENESAS Microcontroller. Advantages of the RZ Family.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books:

1) Andrew Sloss, Dominic Symes, Chris Wright, ARM System Developer‘s Guide Designing and Optimizing System Software‖, ELSEVIER

Reference Books:

1) ARM architecture reference manual : - www.arm.com
2) RENESAS Microcontroller :- www.renesas.com

Semester –IV

Data Analysis

BTECPE405B	Data Analysis	PEC1	3L- 1T -0P	4 Credits

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

Pre-Requisites: Basics of Linear Algebra, Introduction, Probability and Statistics.

Course Objectives:

After completion of the course, students will learn:-

1. To obtain a Comprehensive knowledge of various tools and techniques for Data transformation and visualization
2. To learn the probability and probabilistic models of data science
3. To learn the basic statistics and testing hypothesis for specific problems
4. To learn about the prediction models
5. To give a hands-on experience with real-world data analysis

Course Outcomes:

On completion of this course, the student should be able to

CO1	Apply preprocessing techniques to convert raw data so as to enable further analysis
CO2	Apply exploratory data analysis and create insightful visualizations to identify patterns
CO3	Understand how to derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions
CO4	Understand the statistical foundations of data science and analyze the degree of certainty of predictions using statistical test and models
CO5	Introduce machine learning algorithms for prediction and to derive insights

Course Contents:

Unit 1: Statistical data and Concepts **[07 Hours]**

The statistical Methods, Misuse, Misinterpretation and bias, Sampling and sampling size, Data preparation and cleaning, Missing data and data errors, Exploratory Data Analysis, Statistical error, Statistical Modeling, Computational Statistics, Inference, Bias, Cofounding, Hypothesis testing, Types of error, Statistical significance, Confidence Interval, Power and robustness, Degrees of freedom, Non parametric analysis.

Unit 2: Descriptive Statistics **[07 Hours]**

Counts and specific values, Measure of central tendency, Measure of spread, Measure of distribution shape, Statistical indices, Moments, Key functions, Measures of complexity and model selection.

Unit 3: Data transformation and standardization **[07 Hours]**

Box-Cox and power transforms, Freeman-Tukey (square root and arcsine) transforms, Log and Exponential transforms, Logit transforms, Normal transform.

Unit 4: Classical Tests and Contingency Tables [7 Hours]

Goodness of fit tests: Anderson-Darling, Chi-square test, Kolmogorov-Smirnov, Ryan-Joiner, Shapiro-Wilk, Jarque-Bera, Lilliefors;

Z- test: test of single mean, standard deviation known, Test of the difference between two means, standard deviation known, test for proportions, P;

T-tests: test of single mean, standard deviation not known, Test of the difference between two means, standard deviation not known, test of regression coefficients;

Unit 5: Analysis of Variance and Covariance [08 Hours]

Variance test: Chi square test of single variable, F-test of two variables, test of homogeneity; Wilcoxon rank-sum/Mann-Whitney U test; Sign test.

Contingency Tables: Chi-square contingency table test, G contingency table test, Fisher's exact test, Measures of association, McNemar's test.

ANOVA: Single factor or one way ANOVA, Two factor or two-way and higher-way ANOVA, MANOVA, ANCOVA; Non Parametric ANOVA: Kruskal Wallis ANOVA, Friedam ANOVA test, Mood's median

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. Dr. Michael J de Smith, Statistical Analysis Handbook, A Comprehensive guide to statistical concepts methods and tools, The Winchelsea Press, Drumlin Security Ltd, Edinburgh 2018 edition. https://www.statsref.com/HTML/index.html
2. Douglas C. Montgomery, George C. Runger, Applied Statistics and Probability for Engineers, Sixth Edition, Wiley, 2013
3. Dr.J.Ravichandran, Probability And Statistics For Engineers, First Edition, Wiley, 2010 Scientists

Reference Books

1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
2. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
3. Foster Provost and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking. ISBN 1449361323. 2013.
4. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly. 2014.

Second Year (Semester –IV)

Electromagnetic Engineering and Wave Propagation

BTECPE405 C	Electromagnetic Engineering and Wave Propagation	PEC1	3L- 1T - 0P	4 Credits

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

Pre-Requisites: None

Basic Magnetic Circuit, Vectors, Electrostatics, EM wave, Theorems, different physical laws and theorems and communication technologies.

Course Objectives:

After completion of the course, students must have

- To learn basic coordinate system, significance of divergence, gradient, curl and itsapplications to EM Waves.
- To explore their knowledge in the area of EM Waves and its analysis.
- To understand the boundary conditions for different materials /surfaces.
- To get the basics of microwave, transmission lines and antenna parameters.
- To understand the applications of electromagnetic engineering.
- To analyze and understand the Uniform plane wave propagation in various media.
- To solve the electric field and magnetic fields for a given wire antenna.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Formulate the wave equation and solve it for uniform plane wave.
CO2	Understand characteristics and wave propagation on high frequency transmission lines.
CO3	Carryout impedance transformation on Transmission Line & Calculate reflection and transmission of waves at media interface.
CO4	Understand principle of radiation and radiation characteristics of an antenna & Analyze the given wire antenna and its radiation characteristics.
CO5	Identify the various applications of electromagnetic wave & suitable antenna for a given communication system.

Course Contents:

Unit No 1: Introduction: **[8 Hours]**

Basics of Vectors, Vector calculus, Basic laws of Electromagnetic, Maxwell's Equations, Boundary conditions at Media Interface.

Uniform Plane Wave

Maxwell Equations in phasor form, Wave Equation, Uniform Plane wave in Homogeneous, free space, dielectric, conducting medium. Polarization: Linear, circular & Elliptical polarization, unpolarized wave. Reflection of plane waves, Normal incidence, oblique incidence, Reflection and refraction at dielectric interface, Total internal reflection, Reflection from a conducting boundary. Electromagnetic Power, Power flow, power losses in conductor and Poynting vector & theorem.

Unit No.2: Wave propagation and Transmission [8 Hours]

Wave propagation

Fundamental equations for free space propagation, Friis Transmission equation, Attenuation over reflecting surface, Effect of earth‟s curvature. Ground, sky & space wave propagations. Structure of atmosphere. Characteristics of ionized regions. Effects of earth‟s magnetic field. Ionospheric abnormalities. Multi-hop propagation. Characteristics of Wireless Channel: Fading, Multipath delay spread, Coherence Bandwidth, and Coherence Time.

Transmission Lines

Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Unit No.3: Antenna Fundamentals & Radiations [8 Hours]

Introduction, Types of Antenna, Radiation Mechanism, Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area, reciprocity. Radiation Integrals: Vector potentials A, J, F, M, Electric and magnetic fields electric and magnetic current sources, solution of inhomogeneous vector potential wave equation, far field radiation.

Radiation

Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, transmitting & receiving antenna, Monopole and Dipole antenna

Unit No.4: Antenna Arrays and [6 Hours]

Antenna Arrays

Antenna Arrays: Two element array, pattern multiplication N-element linear array, uniform amplitude and spacing, broad side and end-fire array, N-element array: Uniform spacing, nonuniform amplitude, array factor, binomial array. Planar Array, Circular Array, Log Periodic Antenna, Yagi Uda Antenna Array.

Unit No.5: Antennas and Applications [6 Hours]

Structural details, dimensions, radiation pattern, specifications, features and applications of following Antennas: Hertz & Marconi antennas, V- Antenna, Rhombic antenna. TW antennas. Loop antenna, Whip antenna, Biconical, Helical, Horn, Slot, Microstrip, Turnstile, Super turnstile, parabolic reflector & Lens antennas.

TEXT BOOKS:

1. William Hayt ,"Engineering Electromagnetics ,
2. G.S.N.Raju, Electromagnetic Field Theory and Transmission Lines
3. K. D. Prasad, "Antenna & Wave Propagation", Satya Prakashan, New Delhi.
4. C. A. Balanis, "Antenna Theory - Analysis and Design", John Wiley.

REFERENCES:

1. John D Kraus, "Antenna& Wave Propagation", 4th Edition, McGraw Hill, 2010.
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. Krauss, "Electromagnetics", McGraw Hill, New York, 4th edition.
5. W. H. Hayt, "Engineering Electromagnetics", McGraw Hill, New Delhi, 1999.

Semester –IV

LINUX Operating System

BTECPE405D	LINUX Operating System	PEC1	3L - 1T - 0P	4 Credits

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

Pre-Requisites: Operating System

Course Objectives:

After completion of the course, students will learn:-

1. To teach principles of operating system including File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking Commands, Basic Linux commands, Scripts and filters.
2. To familiarize fundamentals of the Bourne again shell (bash), shell programming, pipes, input and output redirection Control structures, arithmetic in shell interrupt processing, functions, debugging shell scripts.
3. To impart fundamentals of file concepts kernel support for file, File structure related system calls (file API's).
4. To facilitate students in understanding Inter process communication.
5. To facilitate students in understanding semaphore and shared memory.
6. To facilitate students in understanding process.

Course Outcomes:

On completion of this course, the student should be able to

CO1	Ability to use various Linux commands that are used to manipulate system operations at admin level and a prerequisite to pursue job as a Network administrator.
CO2	Ability to write Shell Programming using Linux commands.
CO3	Ability to design and write application to manipulate internal kernel level Linux File System.
CO4	Ability to develop IPC-API's that can be used to control various processes for synchronization
CO5	Ability to develop Network Programming that allows applications to make efficient use

UNIT – I: Introduction to Linux And Linux Utilities: [8 Hours]

A brief history of LINUX, architecture of LINUX, features of LINUX, introduction to vi editor. Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip, file handling utilities, security by file permissions, process utilities, disk utilities, networking commands, unlink, du, df, mount, umount, find, unmask, ulimit, ps, w, finger, arp, ftp, telnet, rlogin.Text Processing utilities and backup utilities , tail, head , sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, pg, comm, cmp, diff, tr, awk, cpio

UNIT - II : Introduction to Shells: [7 Hours]

Linux Session, Standard Streams, Redirection, Pipes, Tee Command, Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases, Variables, Predefined Variables, Options, Shell/Environment Customization. Filters: Filters and Pipes,

Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count Characters, Words or Lines, Comparing Files.

UNIT - III : **Basic operations and File structure:** **[7 Hours]**

Grep: Operation, grep Family, Searching for File Content. Sed :Scripts, Operation, Addresses, commands, Applications, grep and sed. UNIX FILE STRUCTURE: Introduction to UNIX file system, inode (Index Node), file descriptors, system calls and device drivers. File Management :File Structures, System Calls for File Management – create, open, close, read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir, readdir, closedir, mkdir, rmdir, umask**.**

UNIT - IV Process And Signals: **[7 Hours]**

Process, process identifiers, process structure: process table, viewing processes, system processes, process scheduling, starting new processes: waiting for a process, zombie processes, orphan process, fork, vfork, exit, wait, waitpid, exec, signals functions, unreliable signals, interrupted system calls, kill, raise, alarm, pause, abort, system, sleep functions, signal sets. File locking: creating lock files, locking regions, use of read and write with locking, competing locks, other lock commands, deadlocks.

UNIT - V Inter Process Communication: **[7 Hours]**

Pipe, process pipes, the pipe call, parent and child processes, and named pipes: fifos, semaphores: semget, semop, semctl, message queues: msgget, msgsnd, msgrcv, msgctl, shared memory: shmget, shmat, shmdt, shmctl, ipc status commands.

Note: Hands-on practice should be cover under Tutorial slots.

TEXT BOOKS: 1. W. Richard. Stevens (2005), Advanced Programming in the UNIX Environment, 3rd edition, Pearson Education, New Delhi, India. 2. Unix and shell Programming Behrouz A. Forouzan, Richard F. Gilberg.Thomson

REFERENCES: 1. Linux System Programming, Robert Love, O'Reilly, SPD. 2. Advanced Programming in the UNIX environment, 2nd Edition, W.R.Stevens, Pearson Education. 3. UNIX Network Programming, W.R. Stevens, PHI. UNIX for Programmers and Users, 3rd Edition, Graham Glass, King Ables, Pearson Education

Semester –IV

Python Programming Lab and Database Management System Lab

BTECPL406	**Python Programming Lab and Database Management System Lab**	**LC2**	**0L-0T-4P**	**2 Credits**

Teaching Scheme	Examination Scheme
Practical: 04 hrs./week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks End Semester Examination: 40 Marks

a) Python Programming Lab

List of Practical/Tutorial

1. To Study Python Installation in Windows operating system.
2. Practice Execution of python statements in REPL(shell) & IDLE.
3. To study operators in python.
4. To write & perform python program using operators.
5. To perform Python program to demonstrate use of conditional statements.
6. To perform Python program to demonstrate use of looping statements.
7. Write Python program to perform various operations on Lists.
8. Write Python program to perform various operations on Tuples.
9. Write Python program to perform various operations on Sets.
10. Write Python program to perform various operations on Dictionaries.
11. Develop user defined Python function & module for given problem.
12. To study OOPS in python.

b) Database Management System Lab

Practicals on

1. DDL Commands
2. DML commands.
3. Data constraints (Primary key, Foreign key, Not Null).
4. SQL data types and functions.
5. SQL joins.
6. Grouping and ordering data, aggregate functions, group by and having clause.
7. Sub-queries and Set operations.
8. DCL commands
9. TCL Commands.
10. MongoDB database CRUP operations.
11. Triggers & Cursors

Semester –IV
Seminar-II

BTECS407	**SEMINAR- II**	**Seminar**	**0L-0T-4P**	**2 Credits**

Guidelines for Seminar

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, Computer Science Engineering Artificial Intelligence, Data Science, or inter discipline branch from current literature, by referring the current technical journal or reference books, under the guidance of the teacher. The students shall prepare his report and deliver talk on the topic for other students of his class in the presence of his guide and internal 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 consists of the report written in a technical reporting manner and presentation of the talk on the subject and will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Semester –IV
Internship - II

BTESP408	**Internship - II**	**Internship**	**Audit**

Guidelines for Internships

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

1. To apply for a suitable Industrial Training, submit an application 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.

Semester –V
Computer Network and Cloud Computing

BTECPC501	Computer Network and Cloud Computing	PCC5	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.)

Pre-Requisites: Computer Fundamentals, Fundamentals of Digital Communication

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Theoretical and practical base in computer networks issues
2. Outline the basic network configurations
3. Understand state-of-the-art in network protocols, architectures, and applications
4. Fundamental concepts of cloud computing
5. Implementation of virtualization and various cloud services

Course Outcomes:

On completion of the course, students will be able to:

CO1	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies
CO2	Specify and identify deficiencies in existing protocols, and then go onto select new and better protocols.
CO3	Have a basic knowledge of installing and configuring networking applications
CO4	Understand the different cloud computing environments
CO5	Apply concepts of virtualization and various cloud services to design, develop and deploying cloud applications.

Course Contents:

Unit No 1: Introduction to Computer Networks [7 Hours]

Uses of computer networks, Types of computer networks, Network technology- from local to global, Examples of networks, Network protocols, Reference models, Standardization, policy, legal, and social issues.

Unit No 2: The Data Link Layer and Network Layer [8 Hours]

Data link layer design issues, Error detection and correction, Elementary data link protocols, The channel allocation problem, Multiple access protocols, Network layer design issues, Routing algorithms in a single network, Traffic management at the network layer, internetworking, software-defined networking, The network layer in the internet.

Unit No 3: Transport and Application Layers [7 Hours]

The transport service, Elements of transport protocols, The internet transport protocols: UDP and TCP, The Domain Name System (DNS), Electronic mail, The world wide web, Streaming audio and video, Content delivery.

Unit No 4: Introduction to Cloud Computing [7 Hours]

Definition and evolution of Cloud Computing, Enabling Technologies, Service and Deployment Models, Popular Cloud Stacks and Use Cases, Benefits, Risks, and Challenges of Cloud Computing, Economic Models and SLAs, Topics in Cloud Security. Historical Perspective of Data Centers, Data center Components.

Unit No 5: Virtualization and Cloud Services [7 Hours]

Communication-as-a-Service (CaaS), Infrastructure-as-a-Service (IaaS), Monitoring-as-a-Service (MaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS). Virtualization (CPU, Memory, I/O) Case Study: Amazon EC2.

Text Books

1. A Tanenbaum, N Feamster, D Wetherall, Computer Networks, Sixth Edition, Pearson Education Limited. ISBN 10: 1-292-37406-3, 2021
2. John W. Rittinghouse, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press , Routledge Publisher, ISBN-10 : **9781138627031, 2020**

Reference Books

1. B. Forouzan, Data Communications and Networking, McGraw Hill Publication, 5th Edition, 2013.
2. Larry Peterson and Bruce Davie, Computer Networks: A Systems Approach, Morgan Kufman
3. Publication, 5th Edition, 2012.Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India, 2010.
4. Anthony T. Velte, Toby J. Velte and Robert E, Cloud Computing – A Practical Approach, TMH, 2010

Semester –V

Digital Signal & Image Processing

BTECPC502	Digital Signal & Image Processing	PCC6	3L-0T-0P	3 Credits

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

Pre-Requisites: None

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To classify signals and systems into different categories.
2. To build basics for understanding of courses such as signal and image processing, Machine Learning and Deep Learning.
3. To let the students learn the fundamental principles on the aspects of interdisciplinary research including acquiring, processing, analyzing, understanding and utilizing high-dimensional visual data from the real world;
4. To equip the students with the knowledge of how to develop artificial intelligent systems which automate tasks that the human visual system can do;
5. To guide the students to understand the relevant state of art technologies and gain experience throughout a variety of case studies.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Understand mathematical description and representation of various signals and systems.
CO2	Understand use of different transforms and analyze the discrete time signals and systems.
CO3	To implement fundamental image processing techniques required for computer vision
CO4	Understand Image formation process
CO5	To perform morphological operations on image.

Course Contents:

Unit 1: Introduction to Signals and Systems [8 Hours]

Signals: Definition of signal and systems, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power, elementary signals used for testing: exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding. Sampling Process.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

Unit 2: Transformations [07 Hours]

Fourier Transform: DTFT, Definition, Frequency domain sampling, DFT, Properties of DFT, Convolution: circular convolution, linear convolution.

Z- Transform: Need for transform, relation between Laplace transform and Z transform, between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Inverse Z transform, Power series method, partial fraction expansion method.

Unit 3: Introduction to Digital Image Processing [07 Hours]

Motivation & Perspective, Applications, Types of images, image file formats, Fundamentals Steps in Image Processing, Components of Image Processing System, Image digitization, Some basic relationships, Distance Measures between pixels, Image basic operation, Special Operations.

Unit 4: Image Enhancement and Transformation [8 Hours]

Image Enhancement: Introduction, Methods, Basic Intensity Transformation: Image Negatives, Log transformation, Power law Transformation, piecewise linear transformation functions, Histogram processing, Histogram Equalization and Matching.

Basics of Spatial Filters, 2D Convolution & 2D Correlation, Smoothening (LPF) (Linear: Box, Gaussian & Non Linear: Median) and Sharpening (HPF): Laplacian operators, Unsharp Masking and Highboost Filtering, Combining Spatial Enhancement Methods.

Image Transforms: Discrete Fourier transform (DFT): Definition and properties, FFT, DCT.

Unit 5: Morphological operations and segmentation [07 Hours]

Introduction, erosion, dilation, opening, closing, Hit or Miss, boundary extraction, hole filling, connected components, the convex hull, thinning, thickening, skeletonization, and pruning.

Segmentation: Fundamentals; Point, Line and Edge Detection; Basics of edge detection: Image gradient and operators, Thresholding: Intensity Thresholding, Global thresholding, Segmentation by region growing, region splitting and merging.

Text Books

1. Dr. S. L. Nalbalwar, A.M. Kulkarni and S.P. Sheth, “Signals and Systems”, 2nd Edition, Synergy Knowledgeware,2017
2. Nagoor Kanni “Signals and Systems”, 2nd edition, McGrawHill.
3. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc.,4th Edition, 2018.

Reference Books

1. Alan V. Oppenheim. Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”,PHI
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
4. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
5. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010
6. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.

Semester-V
Sensors and Robotics Technology

BTECPE503A	Sensors and Robotics Technology	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 (Duration 03 hrs.)

Pre-Requisites: Digital Electronics, Microcontrollers, Microprocessors, Computer Algorithms.

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Concepts of measurement technology.
2. Various sensors used in measuring various physical parameters.
3. Fundamentals of signal conditioning, data acquisition and communication systems used in Robotics system development
4. Mathematics manipulations of spatial coordinate representation and transformation. Able to solve basic robot forward and inverse kinematic problems
5. Design essentials of robots and End Effectors

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

CO1	**Classify** various robot essential transducers and **explain** their working principles with examples.
CO2	**Predict** the expected performance of various sensors
CO3	**Familiar** with the history, concept development and key components of robotics technologies.
CO4	**Implement** basic mathematics manipulations of spatial coordinate representation and transformation.
CO5	**Calculate** Gripping Force required for object manipulation by various robotic end effectors

Course Contents:

Unit No 1: Measurement and Sensors: [8 Hours]

Basics of Measurement, Classification of errors, Error analysis, Static and dynamic characteristics of transducers, Performance measures of sensors, Classification of sensors Sensor calibration techniques

Temperature: RTD, Thermocouple, Thermistor, Infrared, and LM35.
Humidity Sensors: Capacitive, Resistive, Thermal conductivity, and DHT11 Sensors.
Proximity sensors: Inductive, Capacitive, Magnetic, and optical proximity sensors.
Force and Pressure Sensors: Strain Gauge, Piezoelectric
Motion: Rotary and Linear motions, Gyroscope, Accelerometer, Magnetometer, MEMS
Chemical and Bio Sensors: Gas sensors, Nano Sensors
Vision Sensing: Digital Camera

Unit No 2: Data Acquisition and Actuators [7 Hours]

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi-channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

Introduction to Actuators , Classification, **Linear Actuators:** Electrical- Relays, Pneumatic/ Hydraulic- Single and Double Acting Cylinders, **Rotary Actuators:** Electrical- AC and DC Motors, Stepper Motors, Servo Motors, Pneumatic/Hydraulic Motors.

Pneumatic/Hydraulic Control Valves: 3/2 Valves, 5/3 Valves etc.

Unit No 3: Introduction to Robotic [7 Hours]

Definition; History of Robotics, Laws of Robotics, anatomy of robot: Motion subsystem, Recognition subsystem, and Control subsystem. Robot Specifications: Number of Axes, Load Carrying Capacity, Reach, Stroke, Repeatability, Precision, Accuracy, etc. . Classification of robot based on Drive Technologies, Work Envelop Geometry and Motion Control Methods. Safety Measures in robotics. Block Diagram representation of various Industrial Applications of Robots viz. Medical, Mining, Space, Underwater, Defense, Security
Domestic, Entertainment.

Unit No 4: Robot Kinematics and Dynamics [7 Hours]

A brief overview of Robot Kinematics and Dynamics. Kinematics- coordinate transformations, DH parameters, Forward kinematics, Inverse Kinematics, Jacobians, Statics, Trajectory Planning. Robot Control – PWM, joint motion control, feedback control, Computed torque control.

Unit No 5: Robot End-Effectors and Robot Programming [7 Hours]

Different types of grippers- Mechanical, Magnetics, vacuum, Adhesive, Gripper force Analysis & Gripper Design, Perception, Localization and mapping, Probabilistic robotics, Path planning, BFS; DFS; Dijkstra; A-star; D-star; Voronoi; Potential Field; Hybrid approaches, Simultaneous Localization and Mapping, Introduction to Reinforcement Learning.

Note: Hands-on practice should cover under Tutorial slots.

Text Books

1. Sawney A K and Puneet Sawney, ―A Course in Mechanical Measurements and Instrumentation and Control‖, 12th edition, Dhanpat Rai & Co
2. Introduction to Robotics By S.K.Saha , Tata McGraw Hill
3. KS Fu, RC Gonzalez, CSG Lee , Robotics Control ,Sensing ,Vision and Intelligence, Tata McGraw Hill

Reference Books

1. Richard Zurawski, ―Industrial Communication Technology Handbook‖ 2nd edition, CRC Press, 2015
2. Robert J. Schilling , Fundamentals of Robotics- Analysis and Control, Prentics Hall india
3. J Hirchhorn, Kinematics and Dynamics of Machinery, McGraw Hill book co.

Semester-V
Data Warehouse & Data Mining

BTECPE503B	**Data Warehouse & Data Mining**	**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 (Duration 03 hrs.)

Pre-Requisites: Database Management Systems

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To understand the fundamentals of Data Mining
2. To identify the appropriateness and need of mining the data
3. To learn the preprocessing, mining and post processing of the data
4. To understand various methods, techniques and algorithms in data mining

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

CO1	Apply basic, intermediate and advanced techniques to mine the data.
CO2	Analyze the output generated by the process of data mining.
CO3	To solve software testing problems by designing and selecting software test models, criteria, strategies and methods.
CO4	To apply the techniques learned to improve the quality of software development.
CO5	To prepare a software quality plan for a software project.

Course Contents:

Unit No 1: **[8 Hours]**

Principles of Testing Software development life cycle model: Phases of software project, Quality, Quality assurance and quality control, Testing, Verification and validation, Process models to represent various phases, Life cycle models, Software testing life cycle.

Unit No 2: **[7 Hours]**

Data Warehouse, Operational Database Systems and Data Warehouses(OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model, Concept Hierarchies, Data Warehouse Architecture, The Process of Data Warehouse Design, A three-tier data warehousing architecture, Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP.

Unit No 3: Measuring Data Similarity and Dissimilarity [7 Hours]

Measuring Data Similarity and Dissimilarity, Proximity Measures for Nominal Attributes and Binary Attributes, interval scaled; Dissimilarity of Numeric Data: Minskowski Distance, Euclidean distance and Manhattan distance; Proximity Measures for Categorical, Ordinal Attributes, Ratio scaled variables; Dissimilarity for Attributes of Mixed Types, Cosine Similarity.

Unit No 4: Association Rules Mining [7 Hours]

Market basket Analysis, Frequent item set, Closed item set, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rules.

Unit No 5: Classification [7 Hours]

Classification and Regression for Predictive Analysis, Decision Tree Induction, Rule-Based Classification: using IF-THEN Rules for Classification, Rule Induction Using a Sequential Covering Algorithm. Bayesian Belief Networks, Classification Using Frequent Patterns, Associative Classification, Lazy Learners-k-Nearest-Neighbor Classifiers, Case-Based Reasoning, Multiclass Classification, Semi-Supervised Classification, Reinforcement learning, Systematic Learning, Wholistic learning and multi-perspective learning.

Note: Hands-on practice should cover under Tutorial slots.

Text Books

1. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers, ISBN:9780123814791, 9780123814807.
2. Parag Kulkarni, “Reinforcement and Systemic Machine Learning for Decision Making” by Wiley-IEEE Press, ISBN: 978-0-470-91999-6

Reference Books

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More" , Shroff Publishers, 2nd Edition, ISBN: 9780596006068
2. Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups:Finding connections on the social web", Shroff Publishers , ISBN: 10: 1449306462

Sem-V
Wireless and Mobile Computing.

BTECPE503C	Wireless and Mobile Computing	PCE-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 (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

1 To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.

2 To explore both theoretical and practical issues of mobile computing.

3 To provide an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications.

Course Outcomes:

On completion of the course, students will be able to:

CO1	To identify basic concepts and principles in computing, cellular architecture.
CO2	To describe the components and functioning of mobile networking.
CO3	To classify variety of security techniques in mobile network.
CO4	To apply the concepts of WLAN for local as well as remote applications.
CO5	To describe Long Term Evolution (LTE) architecture and its interfaces.

Course Contents:

Unit No 1: Introduction to Mobile Computing [7 Hours]

Introduction to Mobile Computing, Telecommunication Generations, Cellular systems, Electromagnetic Spectrum, Antenna, Signal Propagation, Signal Characteristics, Multiplexing, Spread Spectrum: DSSS & FHSS, Co-channel interference

Unit No 2: GSM Mobile services [7 Hours]

GSM Mobile services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, security (A3, A5 & A8) GPRS system and protocol architecture,. UTRAN, UMTS core network; Improvements on Core Network,

Unit No 3: Mobile Networking [8 Hours]

Medium Access Protocol, Internet Protocol and Transport layer, Mobile IP: IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Reverse Tunneling, Mobile TCP: Traditional TCP, Classical TCP Improvements like Indirect TCP, Snooping TCP & Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission

Unit No 4: Wireless Local Area Networks [7 Hours]

Wireless Local Area Networks: Introduction, Infrastructure and ad-hoc network.
IEEE 802.11: System architecture , Protocol architecture , Physical layer, Medium access control layer, **MAC management,** 802.11a, 802.11b standard,
Wi-Fi security : WEP ,WPA, Wireless LAN Threats , Securing Wireless Networks.
Bluetooth: Introduction, User Scenario, Architecture, protocol stack

Unit No 5: Mobility Management and Long-Term Evolution (LTE) of 3GPP [7 Hours]

Mobility Management : Introduction, IP Mobility, Optimization, IPv6

Macro Mobility : MIPv6, FMIPv6
Micro Mobility: CellularIP, HAWAII, HMIPv6
Long-Term Evolution (LTE) of 3GPP : LTE System Overview, Evolution from UMTS to LTE LTE/SAE Requirements, SAE Architecture
EPS: Evolved Packet System, E-UTRAN, Voice over LTE (VoLTE), Introduction to LTE-Advanced , Introduction & features of 5G.

Note: Hands-on practice should cover under Tutorial slots.

Text Books

1.Jochen Schilller, “Mobile Communication”, Addision wisely, Pearson Education
2. William Stallings “Wireless Communications & Networks”, Second Edition, Pearson Education
3.Christopher Cox, “An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications”, Wiley publications
4.Raj Kamal, “Mobile Computing”, 2/e, Oxford University Press-New

Reference Books

1.Seppo Hamalainen, Henning Sanneck , Cinzia Sartori, “LTE Self-Organizing Networks (SON): Network Management Automation for Operational Efficiency”, Wiley publications
2. Ashutosh Dutta, Henning Schulzrinne “Mobility Protocols and Handover Optimization: Design, Evaluation and Application”, IEEE Press, Wiley Publication
3. Michael Gregg, “Build your own security lab”, Wiley India edition
4. Dipankar Raychaudhuri, Mario Gerla, “Emerging Wireless Technologies and the Future Mobile Internet”, Cambridge
5. Andreas F. Molisch, “Wireless Communications”, Second Edition, Wiley Publication

Semester-V
Software Engineering

BTECPE503D	Software Engineering	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 (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To provide the idea of decomposing the given problem into Analysis, Design, Implementation, Testing and Maintenance phases.
2. To provide an idea of using various process models in the software industry according to given circumstances.
3. To gain the knowledge of how Analysis, Design, Implementation, Testing and Maintenance processes are conducted in a software project.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Decompose the given project in various phases of a lifecycle.
CO2	Choose appropriate process model depending on the user requirements.
CO3	Perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance.
CO4	Know various processes used in all the phases of the product.
CO5	Apply the knowledge, techniques, and skills in the development of a software product.

Course Contents:

Unit No 1: Introduction [8 Hours]

Professional software development, Software engineering ethics, Case studies.

Software processes: Software process models, Process activities, Coping with change, The rational unified process.

Unit No 2: Agile software development [7 Hours]

Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods.

Requirements engineering: Functional and non-functional requirements, The software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Unit No 3: System modeling **[7 Hours]**

Context models, Interaction models, Structural models, Behavioral models, Model-driven engineering.

Architectural design: Architectural design decisions, Architectural views, Architectural patterns, Application architectures.

Unit No 4: Design and implementation **[7 Hours]**

Object-oriented design using UML, Design patterns Implementation issues, Open source development.

Unit No 5: Testing **[7 Hours]**

Software testing, Development testing, Test-driven development, Release testing, User testing. Dependability properties, Availability and reliability, Safety Security.

Note: Hands-on practice should cover under Tutorial slots.

Text Books

1. Ian Sommerville, Software Engineering; 9th Edition, Addison-Wesley Publishing Company, USA.

Reference Books

1. Software Engineering, S. A. Kelkar, Prentice Hall of India, 2007
2. Software Engineering, Pressman, Tata McGraw Hill, 2006
3. Software Engineering, Pankaj Jalote, Narosa Publishers, 2006.

NPTEL Course: 1Software Engineering, Prof. Rajib Mall, Department of Computer Science and Engineering, IIT Kharagpur

Semester-V
Microelectronics Devices and Circuits

BTECOE504A	Microelectronics Devices and Circuits	OEC-1	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.)

Pre-Requisites: None

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To provide a strong foundation of fundamental basics of Microelectronics.
2. Demonstrate awareness and fundamental understanding of various applications of Microelectronics devices and circuits.
3. Apply Microelectronics devices and circuits knowledge for implementing projects.

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

CO1	Identify the energy band structures of different materials such as conductors, insulators, and semiconductors.
CO2	Interpret basic semiconductor concepts such as transport phenomena.
CO3	Identify pn junction diodes and its physical structure
CO4	Formulate diode equation, relate the equation to the device physics, and identify diode circuits and different diodes such as photodiodes and LEDs.
CO5	Identify bipolar junction transistor (BJT) and metal oxide semiconductor field effect transistors (MOSFET)

Course Contents:

Unit No 1: Introduction: **[7 Hours]**

Review of quantum mechanics, Probability and the uncertainty principles, Schrodinger wave equation. Bipolar Junction Transistor; Physical Structure and Modes of operation, Operation in Active Mode, circuit symbols and conventions, BJT as an Amplifier, small circuit model, BJT as a switch and Ebers Moll Model, Simple BJT inverter and Second Order Effects.

Unit No 2: **[7 Hours]**

MOS Transistor Basic,MOS Parasitic & SPICE Model; CMOS Inverter Basics-I, CMOS Inverter Basics(contd), Power Analysis, SPICE Simulation-I. Statistics of carriers in semiconductors, Lifetime and recombination theory, Boltzmann transport equation, Carrier transport in semiconductor including high field effect.

Unit No 3: **[7 Hours]**

Biasing of MOS Amplifier and its behavior as an analog switch, CMOS CS/CG/SF Amplifier Configuration, Internal cap models and high frequency modelling, JFET, structure and operation. Multistage and Differential Amplifier, Small Signal Operation and Differential Amplifier, MOS Differential Amplier, BiCMOS Amplifier with Active Load, Multistage Amplifier with SPICE Simulation

Unit No 4: **[7 Hours]**

s-domain analysis, transfer function, poles and zeros, High Frequency Response of CS and CE Amplifier, Frequency Response of CC and SF Configuration, Frequency Response of the Differential Amplifier, Cascode Connection and its Operation, General Feedback structure and properties of negative feedback, Basic Feedback Topologies, Design of Feedback Amplifier for all configuration, Stability and Amplifier poles, Bode Plots and Frequency Compensation

Unit No 5: Constraint Satisfaction **[8 Hours]**

Ideal Operational Amplifier and its terminals, Inverting and Non- Inverting Configuration, As an integrator and Differentiator, Introduction to Analog Computer, Large Signal Operation of Op Amp and Second order offsets. Butterworth and Chebyshev Filters, First and Second Order Filter Functions, Switched Capacitor based filters, Single-Amplifier Biquadratic Filters, Second Order LCR Resonator. Clock Strategies for Sequential Design

Text Books

1. S.M. Sze, Physics of semiconductor devices, Wiley Eastern.
2. B.G.Streetman, Solid State Electronics Devices, PHI
3. F.Y.Wang,Introduction to solid state electronics, North Holland.

Reference Books

1. J.Y.Chen CMOS Devices and Technology for VLSI, Prentice-Hall.

Semester-V
Analog & Digital Communication

BTECOE504B	Analog & Digital Communication	OEC-1	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.)

Pre-Requisites: None

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Understanding of Types of communication system
2. Modulation & Demodulation Techniques in Analog & Digital Communication system.
3. Information about digital data transmission

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

CO1	Tell difference between analog & Digital communication system.
CO2	Choose specific modulation technique as per system requirement.
CO3	Analyze various analog & digital signal with different techniques.
CO4	Apply various operation on communication signals.
CO5	Differentiate between various digital modulation & Demodulation techniques.

Course Contents:

Unit No 1: Introduction to Communication System: [7 Hours]

Introduction To Communication System. Analog and Digital Messages, Channel Effect, Signal-to Noise ration and capacity, Modulation and Detection, History of Communications. Signal Transmission through a linear system, Signal distortion over a communication channel, Signal Energy and Energy spectra density, Signal power and power density.

Unit No 2: Amplitude modulation And Demodulations [8 Hours]

Single and Double sideband Amplitude modulation, Amplitude modulation, Bandwidth-efficient Amplitude modulation, VSB, Local Carrier synchronization, FDM, PLL

Angle Modulation and demodulation Nonlinear Modulation, Bandwidth of Angle-modulated Waves,, Generating FM waves, Demodulation of FM signals, Nonlinear distortion and interference, Superheterodyne Receivers, FM broadcasting System.

Unit No 3: Sampling and Analog to digital Conversion [7 Hours]

Sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, DPCM, ADPCM, Delta modulation, Adaptive delta modulation, T1 carrier system

Unit No 4: Digital Data Transmission: [7 Hours]

Digital Data Transmission Components of digital communication system, line coding, pulse shaping, Scrambling, Regenerative Repeater, Eye Diagram, Timing Extraction, Detection Error Probability, M-ary communication, Digital Carrier Systems

Unit No 5: Introduction to Digital Modulation-Demodulation Techniques [7 Hours]

Modulation techniques for ASK,FSK, PSK, MSK, BPSK, QPSK, GMSK

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. Analog and Digital Communications – Simon Haykin, John Wiley, 2005.
2. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, 2009, PHI

Reference Books

1. Digital and analog communication system by B.P.Lathi .Zhi Ding 4th edition.
2. Communication Systems by Simon Haykins.
3. Electronic Communications Systems by Wayne Tomasi.
4. Principles of Communication Systems - Herbert Taub, Donald L Schilling, Goutam Saha, 3rd Edition, McGraw-Hill, 2008.
5. Electronic Communications – Dennis Roddy and John Coolean , 4th Edition , PEA, 2004
6. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004
7. Analog and Digital Communication – K. Sam Shanmugam, Willey ,2005

Semester-V
Programming in Java

BTECOE504C	Programming in Java	OEC-1	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.)

Pre-Requisites: Data Structures, Object Oriented Programming concept

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Basic concepts and techniques of object-oriented programming in Java.
2. Programming skills in Java for problem solving

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

CO1	Understand the basic principles of Java programming language
CO2	Apply the concepts of classes and objects to write programs in Java
CO3	Demonstrate the concepts of Interfaces & Inheritance
CO4	Understand multithreading and Exception handling in Java to develop robust programs
CO5	Apply the concepts of Graphics and JDBC for project development

Course Contents:

Unit No 1: Java Fundamentals **[8 Hours]**

Review of Object oriented concepts, Evolution of Java, Comparison of Java with other programming languages, Java features, Java and World Wide Web, Java Run Time Environment. JVM architecture. Overview of Java Language, Simple Java Program, Java Program Structure. Installing and Configuring Java. Java Tokens, Java Statements, Constants, variables, data types. Declaration of variables, Giving values to variables, Scope of variables, arrays, Symbolic constants, Typecasting, Getting values of variables, Standard default values, Operators, Expressions, Type conversion in expressions, Operator precedence and associatively, Mathematical functions, Control statements- Decision making & looping.

Unit No 2: Classes and Methods **[7 Hours]**

Class Fundamentals, Creating Objects, Accessing Class members, Assigning Object reference variables, Methods, Constructors, using objects as parameters, Argument passing, returning objects, Method Overloading, static members, Nesting of Methods , this keyword, Garbage collection, finalize methods, , final variables and methods, final class. Abstract Methods and classes, Strings , One dimensional and two dimensional arrays , wrapper classes, enumerated types, Command line arguments

Unit No 3: Inheritance, Interfaces & Packages [7 Hours]

Inheritance: Inheritance in Java, Creating Multilevel hierarchy, Constructors in derived class, Method overriding, Dynamic method dispatch

Interfaces: Define, implement and extend, Accessing Interface variables, Default interface methods, Using static method in interface. **Packages**: Java API Packages, Using System Packages, Creating accessing and using a package, importing packages, Adding a class to a Package, Hiding classes.

Unit No 4: Multithreading & Exception Handling [7 Hours]

Introduction to multithreading: Introduction, creating thread and extending thread class. **Concept of Exception handling**: Introduction, Types of errors, Exception handling syntax, Multiple catch statements. I/O basics, reading console inputs, Writing Console output. **Applets**: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating a simple applet.

Unit No 5: Graphics Programming and JDBC [7 Hours]

Graphics class, Introduction to AWT packages, Handling events on AWT components, Introduction to Swing package, components and containers.

JDBC: Introduction, Types of JDBC Drivers, Driver interface & DriverManager class, Connection Interface, Statement Interface, PreparedStatement , ResultSet, example programs.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

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

Semester-V
Electrical Machines and Instrumentation

BTECOE504D	Electrical Machines & Instrumentation	OEC-1	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.)

Pre-Requisites: Basics of electricity, Electromotive force, Magnetic fields, Faradays laws, Induced EMF, Importance of instrumentations & sensor in real world.

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To provide knowledge and Analyze the performance of different types of DC machines
2. Demonstrate awareness and fundamental understanding of various applications based on electricity, laws, motors, sensors & instruments.
3. Analyze the performance of different types, characteristics & applications of DC machines.
4. Analyze the performance of different types of Sensors and Transducers
5. To understand the working of electrical machines, instruments & sensors are used in everyday life.

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

CO1	The ability to analyze the working of any electrical machine using mathematical equations & characteristics to check on with & without load.
CO2	The skill to analyze the response and performance of any electrical machine.
CO3	The ability to troubleshoot the operation of an electrical machine, instruments & sensors for a given application.
CO4	The ability to estimate and correct deviations in measurements due to the influence of the instrument and due to the accuracy of the instrument & sensors.

Course Contents:

Unit 1 : DC Machines **(07 Hours)**

DC machines construction, working principle (motor & generator), EMF equation of DC Machine (motor and generator), Types and its characteristics of DC machines (motor and generator), back emf, starters of dc machine, Speed control of DC motor Breaking of DC motor, applications of DC machines (motor and generator).

Unit 2 : Induction Motor and Synchronous Motor (07 Hours)

Induction Motor : Construction, working principle, types, torque equation, torque slip characteristics, power stages, losses and efficiency, starters speed control, breaking, applications.

Synchronous motor : Construction, working principle, starting methods, effect of load, hunting, V-curve, synchronous condenser, applications.

Unit 3 : Special Purpose Machine (07 Hours)

Construction, working and application of steeper motor, variable reluctance motor, servo motor, FHP motor, hysteresis, repulsion, linear IM.

Unit 4 : Sensors and Transducers (07 Hours)

Classification selection of transducers strain gauges, LVDT, Temperature transducers, piezoelectric, photosensitive transducers, Hall Effect transducers, proximity devices Digital transducers need of signal conditioning and types, interfacing techniques of transducers with microprocessor and controller.

Unit 5 : Industrial Measurement and Industrial Applications (07 Hours)

Measurement of vibration, electrical telemetry thickness, humidity, thermal conductivity and gas analysis emission computerized tomography, smoke and fire detection, burglar alarm, object counter level measurement, on /off timers, RTC, sound level meter, tachometer, VAW meter, Recorder X- Y plotters and its applications, optical oscillograph.

Text Books

1. A course in Electrical and Electronic Measurement and Instrumentation" by A. K.Sawhney (Publisher name: Dhanpat Rai &Co.)
2. Electronics Instrumentation by H.S. Kalsi (Publisher McGraw Hill)
3. Electrical Machines by Ashfaqu Husain, Dhanpatrai and publication
4. Instrumentation Devices System edition C. S. Rajan, G. R.sharma
5. Electrical Machines and Instruments by Dr.Syeda Sumera Ali & Prof.Prabhakar Keni.

Reference Books

1. Abhijit Chakrabarti & Sudipta Debnath, “Electrical Machines”, Tata McGraw-hillPublication.
2. William H Hayt, Jack E Kimmerly and Steven M. Durbin, “Engineering CircuitAnalysis”, Tata McGrawHill.
3. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans, “Electrical Machinery”, TataMcGraw-hill Publication 6thEdition.
4. I.J Nagarath & D.P Kothari, “Electrical Machines”, Tata McGraw-hill Publication 4thEdition.
5. T. J. E. Miller, “Brushless permanent-magnet and reluctance motor drives”, OxfordUniversity Press(1989).
6. Ned Mohan, “Electric Machines and Drives”: A first course,Wiley.
7. B. L. Theraja, “Electrical technology” volume 2, S.Chand.

Semester –V
Economics and Management

BTECHM505A	Economics and Management	HSSMEC-4	3L- 0T - 0P	3 Credits

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

Pre-Requisites: None

Course Objectives:
After completion of the course, students will learn:-

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

CO1	Study of Market Equilibrium
CO2	Understand Relevant Information and Decision Making
CO3	Aware Financial Statements
CO4	Study of Depreciation Accounting
CO5	Understand Product Development

Course Contents:

Unit No 1: Introduction: **[7 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 **[8 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 **[7 Hours]**
Analysis of Financial Statements, Time Value of Money, Comparison of Alternatives.

Unit No 4: Depreciation Accounting **[7 Hours]**
Evolution of Management Thoughts, Functions of Management Directing.

Unit No 5: Product Development **[7 Hours]**
Forecasting Revisited, Capacity Planning, Product / Services Strategies and Plant Layout, Production Planning and Control.

Text Books
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.
3. K. K. Dewett & M. H. Navalur, Modern Economic Theory, S. Chand Publications.

Semester –V

Business Communication

BTECHM505B	Business Communication	HSSMEC4	3L- 0T - 0P	3 Credits

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

Pre-Requisites: None

Course Objectives:
After completion of the course, students will learn business Communication

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

CO1	Study of business
CO2	Understand Intercultural Communication
CO3	Aware Barriers to Communication
CO4	Study of Interpersonal Communication
CO5	Understand Negotiation and Conflict Management

Course Contents:

Unit No 1: Introduction: **[7 Hours]**
Introduction, Definitions & Concepts, Communicative Competence.

Unit No 2: Intercultural Communication **[8 Hours]**
Intercultural Communication, Nonverbal Communication, Thought and Speech, Translation as ProblematicDiscourse.

Unit No 3: Barriers to Communication **[7 Hours]**
Barriers to Communication, Listening, Communication Rules, Communication Style.

Unit No 4: Interpersonal Communication **[7 Hours]**
Interpersonal Communication, Relational Communication, Organizational Communication. Collaboration,Communication in Groups and Teams, Persuasive Communication.

Unit No 5: Negotiation and Conflict Management **[7 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.

Text Books
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.

Semester –V

Computer Network and Cloud Computing Lab & Competitive Programming Lab

BTECPL506	**Computer Network and Cloud Computing Lab & Competitive Programming Lab**	**LC3**	**0L-0T-2P**	**1 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 02 hrs./week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks End Semester Examination: 40 Marks

Computer Network and Cloud Computing Lab

List of Practical

1. Study of different types of Network cables and practically implement the cross-wired cable and straight-through cable using a cramping tool.
2. Study of different Network Devices in Detail.
3. Study of network IP.
4. Study of basic network commands and Network configuration commands.
5. To construct Peer to Peer Topology.
6. To Construct Star Topology
7. To give IP Address of different classes in given Network id.
8. To give IP Address of different classes in given Network id and Subnet.
9. To Study different web services.
10. To Study Cloud Formation in details.

Competitive Programming Lab

List of Practical

1. Problems on array
2. Problems on matrix
3. Problems on string
4. Problems on Searching & Sorting
5. Problems on LinkedList
6. Problems on Binary Trees
7. Problems on Binary Search Trees
8. Problems on Greedy
9. Problems on BackTracking
10. Problems on Stacks & Queues
11. Problems on Heap
12. Problems on Graph
13. Problems on Trie
14. Problems on Dynamic Programming
15. Problems on Bit Manipulation

Note:
At least twenty five problems solving on competitive programming platforms such as https://uva.onlinejudge.org, http://hackerrank.com/, http://codechef.com/ etc.

Semester –V
Mini Project -I

BTECM507	**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 Total : 100 Marks

Guidelines for Mini Project

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 & Computer Engineering, Artificial Intelligence, Data Science, Electronics Engineering and Computer Science Engineering or inter discipline branch from current literature, by referring 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 bein their University / College / near by vicinity.
2. Do the literature survey,
3. Design the solutions
4. Implement solution using 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 project 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 consists of the report written in a technical reporting manner and execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Semester –VI

Internet of Things

BTECPC601	Internet of Things	PCC7	3L-0T-0P	3 Credits

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

Prerequisites: Basics of microprocessor, microcontroller, C language

Course Objectives:

1. To get the understanding of the concepts of Internet of Things
2. To enable the students to build IoT applications.
3. To understand the various protocols in IoT and Networking.
4. To develop the essential programming skill required

Course Outcomes:

On completion of the course, students will be able to:

CO1	The use of concepts of IoT and its areas.
CO2	Understand the basics of C and NodeMCU
CO3	Understand the basics of Python & Raspberry Pi
CO4	Interacting with Web Services and IoT protocol
CO5	Apply the IoT in various applications.

Course Contents:

Unit-1: Introduction to IoT **[07 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 **[07 Hours]**

C: Introduction, Data types, variable, operator, branches, loops, functions, Debugging and Optimization of C programs.
NodeMCU: 8266 Wi-Fimodule, 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 Pi 3 hardware, GPIO pins, operating system for R pi3, Basic of Linux commands, configuring R pi3, Interfacing of Digital and Analog sensors.

Unit-4 : **Interacting with Web Services** **[07 Hours]**

Configuring NodeMCU to connecting to server, NodeMCU interfacing with web services, configuring R pi 3 Wi-Fi and Ethernet, publishing and subscribing data from web using R pi3, interfacing R Pi 3 with twitter and whatsapp.

Unit-5: IoT Protocols **[07 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).

Text Books:

1. Get Started With ESP8266 Programming NodeMCU Using Arduino, Up skill Learning.
2. Internet of Things with Raspberry Pi 3, ManeeshRao, pack
3. Internet of Things with ESP8266, Marco Schwartz
4. Internet of Things with Arduino Cookbook, Marco Schwartz

Reference Books:

1. Internet of Things: A Hands-On Approach- Arsheep Bahga,Vijay Madisetti
2. Raspberry Pi Cookbook for Python Programmers by Tim Cox
3. Learning Internet of Things, Peter Waher

Semester-VI
Artificial Intelligence and Machine Learning

BTECPC602	**Artificial Intelligence and Machine Learning**	**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.)

Pre-Requisites: None

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:
1. To provide a strong foundation of fundamental basics of Artificial Intelligence.
2. Demonstrate awareness and fundamental understanding of various applications of AI techniques.
3. Apply Artificial Intelligence techniques for problem solving.

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

CO1	Discuss Meaning, Scope and Stages of Artificial Intelligence
CO2	Develop a good understanding of fundamental principles of machine learning
CO3	Formulation of a Machine Learning problem
CO4	Develop a model using supervised/unsupervised machine learning algorithms for classification/prediction/clustering
CO5	Evaluate performance of various machine learning algorithms on various data sets of a domain.

Course Contents:

Unit No 1: Introduction: **[7 Hours]**

What Is AI? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. Introduction: Philosophy of AI, Definitions, AI Future. Stages of AI. (ANI, AGI ASI with examples).

Intelligent Agents: Agents and Environments Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit No 2: Search Methods **[8 Hours]**

State Space Search

Generate and test, simple search, Depth first search (DFS), Breadth First search (BFS), Comparison, Quality of Solution, Depth Bounded DFS, Depth First Iterative Deepening.

Heuristic Search:

Heuristic Functions, Search Techniques: Best-first search, Hill climbing, Local Maxima, Solution Space Search, Variable Neighbourhood Descent, Beam Search, Tabu Search, Peak to peak method.

Randomized Search:
Population Based Methods: Escaping Local Optima, Iterated Hill Climbing, Simulated Annealing

Unit No 3: Machine Learning introduction [7 Hours]
Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, Linear regression, Decision trees, overfitting, Instance based learning, Feature reduction, Collaborative filtering-based recommendation, Probability and Bayes learning

Unit No 4: Machine Learning - Performance Metrics [7 Hours]
Performance Metrics for Classification Problems- Confusion Matrix, Classification Accuracy, Classification Report- Precision, Recall or Sensitivity, Support, F1 Score, AUC (Area Under ROC curve).
Performance Metrics for Regression Problems- Mean Absolute Error (MAE), Mean Square Error (MSE), R Squared (R2)

Unit No 5: Linear and Logistic Regression [8 Hours]
Introduction to linear regression:
Introduction to Linear Regression, Optimal Coefficients, Cost function, Coefficient of Determination, Analysis of Linear Regression using dummy Data, Linear Regression Intuition.
Multivariable regression and gradient descent:
Generic Gradient Descent, Learning Rate, Complexity Analysis of Normal Equation Linear Regression, How to find More Complex Boundaries, Variations of Gradient Descent.
Logistic regression:
Handling Classification Problems, Logistic Regression, Cost Function, Finding Optimal Values, Solving Derivatives, Multiclass Logistic Regression, Finding Complex Boundaries and Regularization, Using Logistic Regression from Sklearn.

Text Books

1. Deepak Khemani, “A First Course in Artificial Intelligence”, McGraw-Hill Education, 2013.
2. Ethem Alpaydın, Introduction to Machine Learning, PHI, Third Edition, ISBN No. 978-81-203- 5078-6
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Mcgraw-Hill, ISBN No. 0-07-115467-1
4. Tom Mitchell, Machine Learning, Mcgraw-Hill, First Edition, ISBN No. 0-07-115467-1.
5 .Giuseppe Bonaccorso, “Machine Learning Algorithms”, Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622

Reference Books

1. Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition.
2. R.O. Duda, P.E. Hart, D.G. Stork, Pattern Classification, 2/e, Wiley, 2001
3. Shai shalev-Shwartz and Shai Ben-David, Understanding Machine Learning (From Theory to Algorithms), Cambridge University Press, First Edition, ISBN No. 978-1-107-51282-5.
4. A. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.
5. A. Webb, Statistical Pattern Recognition, 3/e, Wiley, 2011.
6. https://python-course.eu/machine-learning/

Semester-VI

Industrial Automation & Control

BTECPE603A	Industrial Automation and Control	PEC-3	3L 1T 0P	4 Credit

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

Pre-Requisites: Knowledge of basic electronics and control theory

Course Objectives:

1. Develop electrical wiring diagrams, PLC, programs for given application..
2. To expose students to the topics of process control, Sensor used in Automation
3. To understand the working of electrical, hydraulic, pneumatic, PLC, drives, and control panel components.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Learn and apply essential concepts behind control system elements and operations in hydraulics and pneumatics automation
CO2	Develop the PLC Program for given Application
CO3	Develop skills in handling the different controllers.
CO4	To understand the working of electrical, hydraulic, pneumatic, mechanical, PLC, drives
CO5	Explain fundamentals of sensorics technology and modular mechatronics along with robot technology

Course Contents:

Unit No 1: Introduction to Industrial Automation and industrial control Device [7 Hours]

Architecture of Industrial Automation Systems, Basic Elements of an Automated System, Advanced Automation Functions, Automation in Production System, Levels of Automations.

Industrial Control Devices:

Switches: construction, working, application of toggle, slide, DIP, rotary, thumbwheel, selector, push button, micro, limit, emergency, process switches, symbols, specifications.

Relays: construction, working, terminologies and applications of Electro-mechanical relay, hermetically sealed relay, reed relay, solid-state relays and timing relay, Types of relays, specifications. Relay Logic diagram

Contactors: construction, working, specifications and applications of contactors. Motor Control Circuit using contactor

Unit No 2: Programmable Logic controller(PLC) [8 Hours]

Evolution of PLCs, Block Diagram of PLC, Classification of PLCs. Description of PLC components: Power Supply, Input and Output Modules , Discrete Input and Output Modules, Analog Input and output Modules, Programming Devices, CPU, I/O module specifications. Typical PLC specifications. Different Addressing modes.

PLC Programming : Memory Organization, Program Files, Data Files, Program Scan Cycle. Types of programming languages used in PLCs: Ladder logic, Functional block diagram, Sequential flow chart, Instruction List, Structured Text. Relay Logic Instructions, Latching, Interlocking, Logic gates programming in PLC. Timer Instructions: On Delay, Off

Delay and Pulse Timers. Counter Instructions: Up counter and Down Counter. Mathematical instructions, Sequence and Shift register instructions. Analog Module programming

Unit No 3: Interfacing of PLC to Drives [7 Hours]

Stepper motor: principle, types, terminologies, half-stepping and micro-stepping techniques, characteristics, specifications, applications.

Servomotors: construction, working, features, advantages, disadvantages, characteristics of AC and DC servomotor, comparison with stepper motor. AC and DC position and speed control. Synchros for position measurement, position control and error detector.

Drives : Need, Types, Selection criteria, Advantages and disadvantages of drives. Working and construction of VFD, Interfacing of VFD, servo drives to PLC

Unit No 4: Control Schemes, Controllers, Sensor's, and Mechatronics [7 Hours]

Control schemes & controllers, On/OFF control, P, PI, PID control, related terminologies, parameter adjustments and implications Electronic P, PI & PID controller

Introduction to Sensorics Technology, Types of sensor used in industrial Automation, Functions of Inductive, Capacitive, Magnetic, Ultrasonic and Optical types of sensors, Basics of Mechatronics

Unit No 5: Pneumatic and Hydraulic Components [7 Hours]

Hydraulic Components

Hydraulics: principle, block diagram, advantages, disadvantages, applications, hydraulic fluid desirable properties, Types of hydraulic oil and its selection. Hydraulic components: hydraulic power pack, hydraulic pumps, actuators, filters, piping, heat exchangers valves and motors. Introduction Hydraulic circuits

Pneumatic Components

Pneumatics: principle, block diagram, advantages, disadvantages, applications. Fluidic elements and its applications Pneumatic components: pneumatic power Supply, types of pneumatic relay, FRL unit, pneumatic actuator (cylinders and air motors), pneumatic valves, Introduction to Pneumatic circuits

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. F. D. Petruzella "Industrial Electronics", Glancor Publications.
2. Industrial Hydraulics and Pneumatics, Andrew Parr
3. Majumdar, "Pneumatic Systems: Principles and Maintenance", TMH Publications.
4. John Webb, "Programmable Logic Controllers", Prentice Hall of India.
5. B. L. Theraja, "Electrical Technology", S. Chand and Company.
6. Richard Cox, "Programmable Controllers", International Thomson Computer Press.

Reference

Reference Books

1. C.T. Kilian, "Modern Control Technology: Components & Systems", Thomson Learning Publications.
2. "Industrial Hydraulic Technology Parker Motion & Control, Training Department.
3. Festo Controls, "Fundamentals of Pneumatic Control Engineering", Banglore.
4. Frank D Petruzella "Programmable logic controller ", McGraw-Hill Education.

Sem-VI

Big Data Analytics

BTECPE603B	Big Data Analytics	PEC-3	3L 1T 0P	4 Credit

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

Pre-Requisites: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hodoop Eco System
6. Apply analytics on Structured, Unstructured Data.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Identify Big Data and its Business Implications.
CO2	List the components of Hadoop and Hadoop Eco-System
CO3	Access and Process Data on Distributed File System
CO4	Develop Big Data Solutions using Hadoop Eco System
CO5	Use Big data Framework, security and governance.

Course Contents:

Unit No 1: Introduction to Big Data and Hadoop [7 Hours]

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analyzing Data with UNIX tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

Unit No 2: HDFS (Hadoop Distributed File System): [7 Hours]

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

Unit No 3: Map Reduce: **[7 Hours]**

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features, Hadoop cluster.

Unit No 4: Hadoop Eco System: **[8 Hours]**

Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions.

Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS.

Big SQL : Introduction

Unit No 5: Big Data Framework and security: **[7 Hours]**

Apache kafka: Feature, concept, architecture, components

Apache Spark: Feature, concept, architecture, components.

Kerberos authentication: Feature, concept, architecture, components

Note: Hands-on practice of to deploy Big Data systems should cover under Tutorial slots.

Text Books

1. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Reference Books

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
3. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
4. Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, 2012.
5. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
6. Glen J. Myat, "Making Sense of Data", John Wiley & Sons, 2007
7. Pete Warden, "Big Data Glossary", O'Reily, 2011.

Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013

Semester-VI

Microwave and Optical Fiber Communication

BTECPE603C	Microwave and Optical Fiber Communication	PEC-3	3L 1T 0P	4 Credit

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

Pre-Requisites: Fundamental knowledge of electromagnetic engineering.

Course Objectives

To lay the foundation for microwave engineering.

1. To understand the applications of microwave engineering
2. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
3. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
4. To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes

Course Outcomes:

After successfully completing the course students will be able to

CO1	Formulate the wave equation in wave guide for analysis.
CO2	Identify the use of microwave components and devices in microwave applications.
CO3	Understand the working principles of all the microwave tubes.
CO4	Understand the principles fiber-optic communication, the components and the bandwidth advantages.
CO5	Understand the properties of the optical fibers and optical components.
CO6	Understand operation of lasers, LEDs, and detectors.

Course Contents:

Unit No 1: Transmission Lines and Waveguides: [7 Hours]

Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands. Applications of Microwave, General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide, Wave guide parameters,

Introduction to coaxial line, Rectangular waveguide cavity resonators, Circular waveguide cavity resonators.

Unit No 2: Microwave Components: [8 Hours]

Multi-port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers. Ferrites components: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator.

S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator. Related problems.

Unit No 3: Microwave Tubes [7 Hours]

Limitations of conventional tubes. Two cavity Klystron: Construction and principle of operation, velocity modulation and bunching process Applegate diagram. Reflex Klystron: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning. Applications. Slow wave devices Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.

Unit No 4: Types of Optical Fibers [7 Hours]

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model. Different types of optical fibers, Modal analysis of a step index fiber, Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

Unit No 5: Optical Sources [7 Hours]

LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010
2. Microwave Devices and circuits- Liao / Pearson Education
3. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.

Reference Books

1. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008
2. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4thSpecial Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.
3. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008 .
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.

Sem-VI

Software Testing

BTECPE603D	Software Testing	PEC-3	3L 1T 0P	4 Credit

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

Pre-Requisites: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To study fundamental concepts in software testing, including software testing objectives, processes, criteria, strategies, and methods.
2. To learn planning of a test project, designing test cases and test data, conducting test operations, managing software problems and defects, and generating a test report.
3. To develop an understanding of the meaning and importance of quality in relation to software systems and the software development process.
4. To study issues and techniques for implementing and managing software quality assurance processes and procedures.

Course Outcomes:

On completion of the course, students will be able to:

CO1	To apply software testing knowledge and its processes to software applications.
CO2	To identify various software testing problems
CO3	To solve software testing problems by designing and selecting software test models, criteria, strategies and methods.
CO4	To apply the techniques learned to improve the quality of software development.
CO5	To prepare a software quality plan for a software project.

Course Contents:

Unit No 1: **[7 Hours]**

Principles of Testing Software development life cycle model: Phases of software project, Quality, Quality assurance and quality control, Testing, Verification and validation, Process models to represent various phases, Life cycle models, Software testing life cycle.

Unit No 2: **[7 Hours]**

White Box Testing (WBT) and Black Box Testing: Static testing, Structural testing, Challenges in WBT. Black box testing: Black box testing process.

Unit No 3: **[7 Hours]**

Integration Testing: Definition, As a type of testing: Top-down integration, Bottom-up integration, Bidirectional integration, System integration, Choosing integration method, As a phase of testing,

Scenario testing: System scenarios, Use case scenarios, Defect bash.

Unit No 4: [8 Hours]

System and Acceptance Testing, Functional Vs non Functional, Functional system testing, Non-functional system testing, Acceptance testing.

Unit No 5: [7 Hours]

Performance testing, Regression testing, Internationalization testing, Adhoc testing. Factors governing performance of testing, Methodology, tools and process for performance testing. Regression Testing: Introduction, Types of Regression testing, Regression testing process. Adhoc testing: Introduction, Buddy testing, Pair testing, exploratory testing, Iterative testing, Agile and extreme testing, XP work flow, Defect seeding.

Testing Object Oriented Software: Introduction, Comparison of object oriented and procedural software, System testing example, Unit testing of classes, Tools for testing object oriented software, Testing web applications.

Text Books

1. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing: Principles and Practices”, Pearson publication, 2nd edition, 2006.

Reference Books

1. Loise Tamres, “Introducing Software Testing”, Pearson publication, 2002.
2. Boris Beizer, “Software Testing Techniques”, 2nd edition, Dreamtech press, 2014

Semester-VI

VLSI Design

BTECOE604A	VLSI Design	OEC-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 (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To understand the Basic NMOS, CMOS & Bi CMOS circuits and their process technology.
2. To understand the Designing of stick diagrams and layouts for OS transistors.
3. To learn the concepts of modelling of Delay techniques and MOS layers.
4. To learn the concepts of Technology Scaling of MOS transistors.
5. To understand the concepts of testing of combinational and sequential circuits and also the scan of design techniques.

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

CO1	Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
CO2	Draw the layout of any logic circuit which helps to understand and estimate parasitic effect of any logic circuit
CO3	Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
CO4	Implement and design of building blocks of data path and array sub systems.
CO5	Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system.

Course Contents:

Unit No 1: Introduction to MOS technology: [7 Hours]

Introduction:
Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS

Basic Electrical Properties:
Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Unit No 2: VLSI Circuit Design Processes: [8 Hours]
VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

Unit No 3: Gate Level Design: [7 Hours]
Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays,

Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

Unit No 4: Data Path Subsystems: [7 Hours]

Data Path Subsystems:

Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems:

SRAM, DRAM, ROM, Serial Access Memories.

Unit No 5: Programmable Logic Devices: [7 Hours]

Programmable Logic Devices:

Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs.

CMOS Testing:

CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, PHI, 2005 Edition.
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.
3. 3. Basic VLSI design by Douglas A, Pucknell, Kamran Eshraghian, Prantice Hall, 1996 3rd edition.

Reference Books

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. CMOS logic circuit Design - John. P. Uyemura, Springer, 2007.
3. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
4. VLSI Design- K. Lal Kishore, V. S. V. Prabhakar, I.K International, 2009.
5. Mead, C.A and Conway, L.A., Introduction to VLSI Systems, Wesley – Wesley.

Sem-VI

Information Theory & Coding

BTECOE604B	Information Theory & Coding	OEC-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 (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Parameters of Information, Markov Statistical Model for Information Sources
2. Shannon's Encoding Algorithm , Communication Channels
3. Error & error control Coding, Cyclic codes, Convolutional codes

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

CO1	Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of information and Order of a source
CO2	Represent the information using Shannon Encoding, Shannon Fano, Prefix and Huffman Encoding Algorithms
CO3	Model the continuous and discrete communication channels using input, output and joint probabilities
CO4	Determine a codeword comprising of the check bits computed using Linear Block codes, cyclic codes & convolutional codes
CO5	Design the encoding and decoding circuits for Linear Block codes, cyclic codes, convolutional codes, BCH and Golay codes.

Course Contents:

Unit No 1: Introduction: Information Theory **[7 Hours]**

Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model for Information Sources, Entropy and Information rate of Mark off Sources. (Section 4.1, 4.2 of Text 1) L1, L2,L3

Unit No 2: Source Coding **[8 Hours]**

Source Coding: Encoding of the Source Output, Shannon's Encoding Algorithm(Sections 4.3, 4.3.1 of Text 1), Shannon Fano Encoding Algorithm (Section 2.15 of Reference Book 4)

Source coding theorem, Prefix Codes, Kraft McMillan Inequality property KMI, Huffinan codes (Section 2.2 of Text 2) L1,L2,L3

Unit No 3: Information Channels [7 Hours]

Communication Channels, Discrete Communication channels Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies. (Section 4.4, 4.5, 4.51,4.5.2 of Text 1)
Mutual Information, Channel Capacity, Channel Capacity of Binary Symmetric Channel, (Section 2.5, 2.6 of Text 2)
Binary Erasure Channel, Muroga's Theorem (Section 2.27, 2.28 of Reference Book4)
L1,L2,L3

Unit No 4: Error Control Coding: [7 Hours]

Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array.

Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction

(Sections 9.1, 9.2,9.3,9.3.1,9.3.2,9.3.3 of Text 1), L1, L2, L3

Unit No 5: Convolution Codes [7 Hours]

Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm) (Section 8.5-Articles 1,2 and 3, 8.6-Article 1of Text 2), Ll,L2,L3

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. Digital andAnalog Communication Systems, K. Sam Shanmugam, John Wtley India Pvt Ltd, 1996.
2. Digital Communication, Simon Haykin, John Wtley India Pvt Ltd, 2008.

Reference Books

1. ITC and Cryptography, Ranjan Bose, TMH, II edition, 2007.

2 Principles ofDigital Communication, J. Das, S.K.Mullick, P. K. Chatterjee, Wiley, 1986-

Technology &Engineering

3. Digital Conummications- Fundamentals andApplications, Bernard Sklar, SecondEdition,

Pearson Education, 2016, ISBN: 9780134724058.

4. Information Theory and Coding, HariBhat, Ganesh Rao, Cengage, 2017.

5. Error Correction Coding, Todd K Moon,Wiley Std. Edition, 2006

Sem-VI

Android Programming

BTECOE604C	Android Programming	OEC-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 (Duration 03 hrs.)

Pre-Requisites: Data Structures, Object Oriented, Java Programming

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Overall life cycle of Android programming
2. Essential Components of an Android Application

Course Outcomes:

On completion of the course, students will be able to:

CO1	Understand Android architecture, activities and their life cycle
CO2	Apply the knowledge to design user interface using Android UI and Component
CO3	Describe Memory and File operations in Android
CO4	Manage system database, remote database operations using web services and Firebase
CO5	Apply knowledge of map, location services, Graphics, android system and background services

Course Contents:

Unit 1: Introduction to Android

A little Background about mobile technologies, Android – An Open Platform for Mobile development, Native Android Application, Android SDK Features, Android Architecture, Application Frameworks, Android Libraries, Android Runtime, Dalvik Virtual Machine. Creating First Android Application. Creating Configurations. Android Project Structure. Testing the app(AVD, Active device), Android Manifest file. Running and Debugging

Unit 2: User Interface, Activities

Introduction, Android Application Life Cycle, Activity, Layouts, Application Priority and process states, Fundamental Android UI Design, Study of different layouts, Introducing Views, Creating new Views, Draw able Resources. Designing fragments: Fragments lifecycle, Fragment management and integration. Advanced UI: Adapters, Complex UI components, Menus and Dialogs, Tabbed Activities, Navigation Drawer, Animations, Create activity layouts programmatically. Android Material Design: What is material?, properties, Material Styling / Animations, Material Patterns

Unit 3: Intents, Broadcast Receivers and Files

Introducing Intents, Intents and Intent filters, What are Pending Intents, Adapters, Internet Resources, Notifications, Introducing Dialogs, Saving Application Data in external and internal memory, Creating and saving preferences, Retrieving shared preferences, Creating a standard preference activity, Saving Activity State, Saving and Loading Files, Including static files as Resources, File management tools

Unit 4: Database and Content Providers

Introducing Android Databases, Introducing SQLite, Cursors and content values, Working with SQLite Database, Creating new content Provider. SQLiteOpenHelper and creating a database. Opening and closing a database, Working with cursors, Inserts, updates, and deletes. Native Content Providers:Content provider types, searching for content, Adding, changing, and removing content, Native Android Content Providers, Accessing Contact Book, Calendar. Custom Content Providers: Custom Content Provider classes, Publishing content providers. Introduction to Firebase, Real time/Cloud, Authentication in firebase.
connecting to MySQL using JSON (Webservices).

Unit 5: Telephony, Hardware and Network Services

Telephony, Reading Phone device details, Reading Sims Details, Incoming and outgoing call monitoring, Tracking Service Change, Introducing SMS and MMS, Sending SMS and MMS, Sending SMS messages manually, Use of Bluetooth, Managing Network Connectivity, Managing Wi-Fi. Google Map - Layout file, Google Map – Android Manifest file, Customizing Google Map, Adding Marker, Changing Map Type.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1.John Horton, “Android Programming for Beginners”, 2nd Edition Packt Publishing
2.Pradeep Kothari “Android Application Development Black Book” , DreamTech

Reference Books

1. Dawn Griffiths, “Headfirst Android Development”, 1st Edition, O′Reilly
2. Lauren Darcey, “Android Wireless Application Development”, Shane Conder, Pearson
3. Wei Meng Lee “Beginning Android 4 Application Development”, Wrox

Sem-VI

Electrical Drives and Control

BTECOE604D	Electrical Drives and Control	OEC II	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.)

Pre-Requisites: Basics of electrical machines – I & II, Power Electronics, Machines Performance & Characteristics & its applications . Electric drives control & major role of sensors in todays Wolds.

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to subject:

1. To learn the fundamentals of electric drive and different electric braking methods.
2. To analyze the operation of three phase converter controlled dc motors and four quadrant operation of dc motors .
3. To understand the concept of speed control of different types of motors.
4. To understand the different application of controlling devices & sensors in industry .

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

CO1	The ability to provide knowledge and Analyze the performance of different types of AC & DC machines.
CO2	To apply the various drive mechanisms and methods for energy conservation.
CO3	To apply power electronic converters to control the speed of DC motors and induction motors.
CO4	To understand the motor and power converter for a specific application.
CO5	To develop closed loop control strategies of drives

Course Contents:

UNIT I -INTRODUCTION (07 Hours)

Introduction to power semiconductor devices, Advantages of Electric Drives, Parts of Electric Drives, Basic Elements of Electric Drives, Types of Electric Drives, Factors influencing the choice of electrical drives, heating and cooling curves, Loading conditions and classes of duty, Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II -DRIVE MOTOR CHARACTERISTICS (07 Hours)

Mechanical characteristics – Fundamental Torque Equation, Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

Starting Methods -
Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT III -CONTROL OF ELECTRIC DRIVES (07 Hours)

Losses in Electric Drives system, Mode of Operation, Speed Control, Drive Classification, Closed Loop Control
D.C.Drives
Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.
A.C.Drives
Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

UNIT IV ELECTRIC DRIVE SENSORS (07 Hours)

Introduction Sensors, Characteristics & Types. Sensors for Electric Motors, Industrial Vehicle Sensors, Industrial Sensors for Robotic Applications , Industrial Motor Sensors , Sensors for Compressor, Sensors for Machinery, Sensors for Packaging, Sensors for HVAC.

UNIT V- APPLICATIONS (07 Hours)

Applications of switching devices/power semiconductor devices, Role of inverter, choppers, cycloconverter in real time applications, Applications of different Electric drives, Control & Sensors in all sector in real world.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. PILLAI.S.K “A first course on Electric drives”, Wiley Eastern Limited, 1998 2.
2. M.D. SINGH, K.B.KHANCHANDANI,”Power electronics,” Tata McGraw-Hill.1998 3.
3. H.Partab,”Art and science and utilization of electrical energy,”Dhanpat Rai and sons, 1994

Reference Books

1. Power Electronics handbook by Muhammad H.Rashid, Elsevier.
2. Thyristor Control of Electric drives – VedamSubramanyam Tata McGraw Hill Publications.
3.Power Electronic Circuits, Devices and applications by M.H.Rashid, PHI

Semester –VI
Development Engineering

BTECHM605A	Development Engineering	HSSMEC-5	3L- 0T - 0P	3 Credits

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

Pre-Requisites: None

Course Objectives:
After completion of the course, students will learn:-

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

CO1	Improve the skills of development engineering
CO2	Get the 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 **[7 Hours]**
Introduction, Various Definitions of Development Engineering.

Unit No 2: World Poverty and Development **[8 Hours]**
World Poverty and Development, Poverty in the India, Sustainable Development, Culture and Global Competence, The Engineer‘s Role.

Unit No 3: Social Justice **[7 Hours]**
Social Justice, Social Justice and Engineering, Religious Perspectives, Secular Perspectives.

Unit No 4: Development Strategies **[7 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 **[7 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.

Text Books

1. Kevin M. Passino, Humanitarian Engineering: Advancing Technology for Sustainable Development

Semester –VI
Employability and Skill Development

BTECHM605B	Employability and Skill Development	HSSMEC5	3L- 0T - 0P	3 Credits

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

Pre-Requisites: None

Course Objectives:
After completion of the course, students will learn:-

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

CO1	Improve the soft skills and communication.
CO2	Empower Arithmetic and Mathematical Reasoning and Analytical Reasoning and Quantitative Ability
CO3	Use of grammar.
CO4	Development in interview skills.
CO5	Develop problem solving techniques.

Course Contents:

Unit No 1: Soft Skills & Communication basics: [7 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 No 2: Arithmetic and Mathematical Reasoning and Analytical Reasoning and Quantitative Ability [8 Hours]
Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, reminder theorem).
Matching, Selection, Arrangement, Verifications (Exercises on each of these types).
Verbal aptitude (Synonym, Antonym, Analogy).

Unit No 3: Grammar and Comprehension [7 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 No 4: Skills for interviews [7 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 [7 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.

Text Books

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, ―Soft Skills- An integrated approach to maximize personality‖, ISBN: 987-81-265-5639-7, First Edition 2016

Reference Books

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

Semester –VI
Consumer Behavior

BTECHM605C	Consumer Behavior	HSSMEC5	3L- 0T - 0P	3 Credits

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

Pre-Requisites: None

Course Objectives:
After completion of the course, students will learn:-

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

CO1	Study of Consumer Behavior
CO2	Get Market Segmentation and Positioning
CO3	Develop Models of Consumer Behavior
CO4	Analyze Psychological Influences on Consumer Decision Making
CO5	Study Diffusion of innovation Diffusion Process

Course Contents:

Unit No 1: Introduction to the Study of Consumer Behavior: [7 Hours]
Defining Consumer Behavior, Scope and Application of Consumer Behavior, Why Study Consumer Behavior, Evolution of Consumer Behavior as a Field Of Study and its relationship with Marketing: Behavioral Dimension, The Interdisciplinary Nature of Consumer Behavior. Market Research and Consumer Behavior, Relevance of Market Research with Consumer Behavior, Approaches to Consumer Behavior Research, Quantitative Research, Qualitative Research.

Unit No 2: Market Segmentation and Positioning [8 Hours]
Market Segmentation, Basis for Segmentation, Alternatives available for Segmentation, Positioning. The Consumer Decision Making Process: Buying Motives, Buying Roles, Consumer Decision Making Process, Levels of Consumer Decision Making, Perspectives to Consumer Decision Making, Consumer Decision Making Process.

Unit No 3: Models of Consumer Behavior [7 Hours]
The Economic model, Learning model, Psychoanalytic model, The sociological model. The Howard Sheth model of Buying Behaviour, The Nicosia model, The Engel - Kollat - Blackwell Model, Engel, Blackwell and Miniard (EBM) model.

Unit No 4: Psychological Influences on Consumer Decision Making [7 Hours]

Consumers Needs & Motivation, Emotions and Mood, Consumer Involvement, Consumer Learning, Personality, Self-concept and Self-image, Consumer Perception, Risk and Imagery. Consumer Attitude: Belief, Affect, Attitude and Intention, Attitude Formation and Attitude Change, Consumer Communication. Sociological Influences on Consumer Decision Making: Consumer groups, Consumer reference groups, Family and Life cycle, Social class and mobility, lifestyle analysis, Culture; Sub-Culture, Cross Culture, Interpersonal Communication and influence, Opinion Leadership.

Unit No 5: Diffusion of innovation Diffusion Process [7 Hours]

Adoption Process, Consumer Innovators, Multiplicative innovation adoption (MIA) model. Organizational Buying: Differences between Industrial Markets and Consumer Markets, Differences between Organizational and Consumer Buying, Buying Decisions in Organizational Buying Process, Types of Decision Making, Organization Buyer's Decision Making Process, and Factors influencing Organizational Buying Behaviour, Decision Makers in Organizational Buying, Webster and Wind model of Organizational buying behaviour, The Sheth model of Industrial buying, The Sheth model of Industrial buying Consumer Behavior Analysis and Marketing Strategy: Consumer Behavior and Product Strategy, Consumer Behavior and Pricing Strategy, Consumer Behavior and Distribution Channel Strategy, Consumer Behavior and Promotion Strategy.

Text Books

1. Consumer Behavior, Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.

Reference Books

1. Consumer Behavior, Concepts and Applications, Loudon, D.L. and Bitta, A.J.D, TatacGrawHill.
2. Consumer Behavior and Marketing Startegy, Peter, J.P. and Olson, J.C., Schiffman, L.G. andKanuk L.L., Prentice Hall, India.

Semester –VI

Internet of Things Lab

BTECPL606	Internet of Things Lab & Artificial Intelligence & Machine Learning Lab	LC4	0L-0T-02P	1 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1hr/week	Continuous Assessment: 30 Marks Continuous Assessment: 30 Marks End Semester Exam: 40 Marks

List of Practical's of IoT Lab

1. Interfacing of Digital and Analog sensor to NodeMcu
2. Interfacing of Digital sensor to 8266 Wi-Fi module
3. Interfacing of analog and digital sensor to raspberry Pi
4. Interfacing of Servo motor to Raspbery Pi
5. Data transfer to cloud using 8266 Wi-Fi module
6. Home automation using Raspberry Pi
7. SECURITY SURVEILLANCE using Raspbery Pi
8. To study Interfacing between 8266 Wi-Fi module and Raspberry Pi
9. To study Interfacing of Raspbey pi to whats app and twitter

Artificial Intelligence & Machine Learning Lab

List of Practical's

1. To Study Anaconda Navigator and various IDEs .
2. Write a Program to Implement Breadth First Search using Python.
3. Write a Program to Implement Depth First Search using Python.

4.Python Libraries for Data Science-

   a. Pandas Library
   b. Numpy Library
   c. Scikit Learn Library
   d. Matplotlib

5.Evaluation Metrics-

   a. Accuracy
   b. Precision
   c. Recall
   d. F1-Score

6.Train and Test Sets by Splitting Learn and Test Data.

7. To implement Linear Regression model in jupyter notebook.
8. To implement Logistic Regression model in jupyter notebook.
9. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
10. Build first machine learning model using Microsoft Lobe.

Semester –VI
Mini Project -II

BTECM607	**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 Total : 100 Marks

Guidelines for Mini Project

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 & Computer Engineering, Artificial Intelligence, Data Science, Electronics Engineering and Computer Science Engineering or inter discipline branch from current literature, by referring 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 bein their University / College / near by vicinity.
2. Do the literature survey,
3. Design the solutions
4. Implement solution using 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 project 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 consists of the report written in a technical reporting manner and execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Semester –VI
Internship – III

BTECP608	Internship – III	Internship	Audit

Guidelines for Internship

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

1. To apply for a suitable Industrial Training, submit an application form to respective Organization concerned one semester before the Industrial Training Programmed commences.
2. Student can also apply through online platforms such as Intern Shala 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 Programme.
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.

Sem-VII

Industry 4.0 & Automation

BTECPC701	Industry 4.0 & Automation	PCC9	3L_0T_0P	3 Credit

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

Pre-Requisites:
1. Basics of Control Systems
2. Foundation of sensors and actuators
3. Basic of PLC Programming
4. Basic of Industrial Automation
5. Fundamentals of Power Devices and Circuits

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:
1. Globalization and emerging issues of Industry 4.0
2. Internet of Things and Robotics as Pillars of Industry 4.0
3. Process control and Automation
4. Understand architecture of SCADA, HMI and DCS and their Importance in Industrial Automation

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

CO1	Define essential elements of Industry 4.0
CO2	Describe architecture of Industrial IoT
CO3	Explain Recent Technological Components of Robots
CO4	Understand and Recognize Industrial needs of Automation
CO5	Identify and interpret the functionality of SCADA, HMI and DCS.

Course Contents:

Unit No 1: Introduction to Industy 4.0 [7 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, A brief overview of pillars of Industry 4.0: Internet of Things, Cloud Computing, Cybersecurity, Big Data and Analytics, and Robotics.

Unit No 2: Internet of Things in Industry 4.0 [7 Hours]

Introduction to Internet of things (IoT) and Industrial Internet of Things (IIoT), IIoT Business Model and Reference Architecture, IIOT Layers: Sensing, Processing, Communication, and Analytics. Software Defined Networks.

Unit No 3: Robotics in Industry 4.0 [7 Hours]

Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly, Human-Robot Collaboration in Industry, Types of Human-Robot Collaboration, Applications with Collaborative Robots (examples of existing or future applications in the field of manufacturing)

Unit No 4: Introduction to Industrial Automation and Digital Twin [7 Hours]

Architecture of Industrial Automation Systems, Control System Evaluation, Analog control, Digital control, Advantages and limitations of Automation, Introduction and Basic concept of digital Twin system**,** Benefits, impact and challenges ,Features and Implementation of Digital Twins , Types of Digital Twins, Digital Twin use cases, Applications for digital twins in production (examples of existing or future applications in the field of manufacturing)**.**

Unit No 5: SCADA, HMI and DCS [8 Hours]

General definition and SCADA components. Need of SCADA system, application & benefits, PLCs Vs RTUs, RTU Block diagram, Types of SCADA System, Future trends, Internet based SCADA display system, Comparison of different SCADA packages. Trending, Historical data storage and Reporting, Alarm management. Programming techniques For: Creation of pages, Sequencing of pages, Creating graphics and Animation and development of application using SCADA System.

HMI : Need, Advantages of using HMI, PLC-HMI interface

Basic Concept of DCS, History and Hierarchy of DCS, Basic Components of DCS as Operator Station, Types of DCS, Comparison of PLC, DCS and SCADA.

Text Books

1.Alp Ustundag, Emre Cevikacan, Industry 4.0 : Managing the Digital Transformation, Springer
2.Curtis Johnson, “Process Control Instrumentation Technology”, 8th Edition, Pearson Education.
3.Madhuchhanda Mitra, Samarjit Sen Gupta, “Programmable Logic controllers and Industrial Automation”, Penram International Publishing India Pvt. Ltd
4. Kevin Chen Digital Twin

Reference Books

1. Kilian, “Modern control technology: components & systems”, Delmar 2nd edition.
2. R.G. Jamkar, “Industrial Automation Using PLC SCADA & DCS” Global Education Limited
3. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Pres
4. Fei Tao, Meng Zhang and A.Y.C Nee “ Digital Twin Driven Smart Manufacturing

Semester –VII

Deep Learning

BTECPC702	Deep learning	PCC10	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.)

Pre-Requisites: Basic Knowledge of Machine learning, Soft Computing, Data Structures, Python.

Course Objectives:
In this course, attendees will:

1. Understand the context of neural networks and deep learning
2. Have a working knowledge of neural networks and deep learning
3. Explore the parameters for neural networks
4. Use CNN and RNN for solving real world problem.

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

CO1	Implement deep learning models in Python using the Keras/PyTorch library and train them with real-world datasets.
CO2	Design convolution networks for image classification.
CO3	Perform regularization, training optimization, and hyperparameter selection on deep models.
CO4	Design Recurrent Neural Networks for text and sequence classification.
CO5	Apply Generative Deep Learning for Generating images

Course Contents:

Unit 1: Introduction to Neural Network [8 Hours]
Working Of Simple Artificial Neural Network, Multilayer Perceptron, Forward Propagation And Back Propagation Learning, Building Blocks of Deep Neural Networks, Optimization Techniques, Gradient Descent and its variants, Derivatives, Batch Optimization, Momentum Optimizer, RMSProp, Adam, Vectorization, Linear Regression and Logistic Regression with Deep Neural Network.

Unit 2: Convolutional Neural Network [7 Hours]
Introduction Convolutional Neural Network, Fully Connected Network vs Convolutional Neural Network , Building Blocks Of CNN: Filters, Convolution, Pooling, Activations Etc. Training Procedure of CNN, Feeding Images And Videos to CNN, Different CNN Architectures, Residual Networks, Skip Connections.

Unit 3: Transfer Learning and Effective training in Deep Net: [7 Hours]
Transfer Learning: Introduction To Transfer Learning, Need For Transfer Learning, Feature Extraction Using Transfer Learning, Fine Tuning.
Effective Training: Bias Variance Tradeoff, Dealing With Overfitting and Underfitting, Data

Augmentation, Early Stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization, Regularization, Hyperparameter Tuning.

Unit 4: Deep learning for text and Sequences [7 Hours]

Introduction To Sequential/Temporal Data, Sequential Models, Introduction to Recurrent Neural Network ,Working of RNN, Representing Sequential Data using RNN, Working With Text Data, Text Generation With LSTM, LSTM And GRU, Transformer Network.

Unit 5: Generative Deep Learning [7 Hours]

Neural Stryle Transfer ,Variational Autoencoder, Generative Adversarial Network , Classical Supervised Tasks With Deep Learning, Image Denoising, Semantic Segmentation, Object Detection Etc.

Text Books

1. Francois Challot, “Deep Learning with Python”, second edition.
2. Francois Challot, “Deep Learning with Pytorch”, second edition

Reference Books

1. 1 Michael Nielsen, Neural Networks and Deep Learning, 2016
2. Deep Learning- Ian Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press
3. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

Semester –VII
DevOps (Development & Operations)

BTECPC703	DevOps (Development & Operations)	PCC 11	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.)

Pre-Requisites: Computer Fundamentals, Fundamentals of Digital Communication

Course Objectives:

After completion of the course, students will have an adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To give a strong foundation of the Development and its Operations Outline the basic network configurations
2. Define and discuss the key concepts and principles of DevOps.
3. List and explain the business benefits of DevOps and continuous delivery.
4. Describe the Service Delivery process.
5. Explain the concepts of test automation, infrastructure automation, and build and deployment automation. Describe how DevOps relates to Lean and Agile methodologies.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Understand DevOps as a practice, methodology and process for fast collaboration, integration and communication between Development and Operations team
CO2	Master Continuous Integration, Continuous Deployment, Continuous Delivery, Configuration Management, and Continuous Monitoring
CO3	Become an expert on technologies such as GIT. Maven, Chef, Puppet & more.
CO4	Summarize the importance of software configuration management in DevOps
CO5	Synthesizing the provisioning using various methodologies.

Course Contents:

Unit No 1: Introduction to DevOps [7 Hours]

DevOps Principles in detail, DevOps Engineer Skills in the market, Knowing DevOps Delivery Pipeline,CI & CD, Market trend of DevOps, DevOps Technical Challenges, Tools we use in DevOps

Unit No 2: DevOps on Cloud [8 Hours]

Essentials of Cloud computing? Cloud and virtualization architecture, Cloud deployment architecture, Cloud providers – An overview, why we need DevOps on Cloud? Introducing to Amazon web services

Unit No 3: GIT – A Version controlling tool [7 Hours]

Knowing about Version control , Git – A CLI ,Essentials of GIT in industry , How to setup GIT Working with various commands in GIT , Recording Changes to the Repository Viewing the Commit History, Undoing Things, Working with Remotes, Branching and Merging in Git, Git workflows ,Git cheat sheet

Unit No 4: CAMS (Culture, Automation, Measurement and Sharing) [7 Hours]

CAMS – Culture, Cultural aspects of DevOps, Continuous Improvement and Problem Solving, encourage, Experimentation and Learning, CAMS – Automation, Delivering high value - DevOps way, Continuous Delivery Automation: CAMS – Measurement, Metrics used for tracking , Performance Predictors, Continuous Monitoring, CAMS – Sharing, Test-driven development, Configuration Management, Infrastructure Automation, Root Cause Analysis, Blamelessness ,Organizational Learning, Test Driven Development, TDD – Categories of Tests, Configuration Management, Source Code Management - Version Control, Infrastructure Automation Tools, Root Cause Analysis.

Unit No 5: Methodology [7 Hours]

Software, History of Software Engineering and Software, Development Methodologies, Traditional Software Development Models, Waterfall Model, Classical Waterfall Model, Traditional IT Organizations, Developers vs IT Operations Conflict, Birth of Agile, Four Values of the Agile Manifesto, Agile and Lean, Jenkins, Docker, Kubernetes, Ansible.

Text Books

1.Continuous Delivery and DevOps: A Quickstart Guide, 2nd Edition: Deliver quality software regularly by Paul Swartout

2.DevOps for Digital Leaders: Reignite Business with a Modern DevOps-Enabled Software Factory by Aruna Ravichandran & Kieran Taylor & Peter Waterhouse

3.The DevOps Handbook - Book by Gene Kim, Jez Humble, Patrick Debois, and Willis Willis

Reference Books

1. The DevOps Adoption Playbook,Sanjeev Sharma Wiley-India
2. Learning Devops,Mikael Krief. Published by Packt Publishing Ltd. Livery Place 35 Livery Street Birmingham B3 2PB, UK. ISBN 978-1-83864-273-0
3. Devops for Dummies, Bernie Coyne,IBM, Wiley
4. Deepak Gaikwad, Viral Thakkar, DevOps Tools from Practitioner’s ViewPoint, Wiley

Sem-VII

Automotive Electronics

BTECPE704A	Automotive Electronics	PEC-4	3L_1T_0P	4 CREDIT

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

Pre-Requisites:
1. Basic Knowledge of Actuators, Sensors, etc.
2. Basic Knowledge of Vehicle engine

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:
1. To understand the concepts of Automotive Electronics and it‟s evolution and trends automotive systems & subsystems overview.
2. To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
3. To understand, design and model various automotive control systems using Model based development technique.
4. To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software.
5. To describe various communication systems, wired and wireless protocols used in vehicle
6. To understand Safety standards, advances in towards autonomous vehicles.
7. To understand vehicle on board and off board diagnostics.

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

CO1	Acquire an overview of automotive components, subsystems, and basics of Electronic Engine Control in todays automotive industry.
CO2	Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design.
CO3	Understand the networking of various modules in automotive systems, communication protocols and diagnostics of the subsystems
CO4	Design and implement the electronics that attribute the reliability, safety, and smartness to the automobiles, providing add-on comforts and get fair idea on future Automotive Electronic Systems.

Course Contents:

UNIT – 1 Automotive Fundamentals Overview: [8 Hours]

Evolution of Automotive Electronics, Automobile Physical Configuration, Survey of Major Automotive Systems, The Engine – Engine Block, Cylinder Head, Four Stroke Cycle, Engine Control, Ignition System - Spark plug, High voltage circuit and distribution, Spark pulse generation, Ignition Timing, Diesel Engine, Drive Train - Transmission, Drive Shaft, Differential, Suspension, Brakes, Steering System , Starter Battery –Operating principle

UNIT – 2 The Basics of Electronic Engine Control: [7 Hours]

Motivation for Electronic Engine Control – Exhaust Emissions, Fuel Economy, Concept of an Electronic Engine control system, Definition of General terms, Definition of Engine performance terms, Engine mapping, Effect of Air/Fuel ratio, spark timing and EGR on performance, Control Strategy, Electronic Fuel control system, Analysis of intake manifold pressure, Electronic Ignition

UNIT – 3 Automotive Sensors and Actuators: [7 Hours]

Airflow rate sensor, Strain Gauge MAP sensor, Engine Crankshaft Angular Position Sensor, Magnetic Reluctance Position Sensor, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Throttle Angle Sensor (TAS), Engine Coolant Temperature (ECT) Sensor, Exhaust Gas Oxygen (O2/EGO) Lambda Sensors, Piezoelectric Knock Sensor, Solenoid, Fuel Injector, EGR Actuator, Ignition System

Unit No 4: Digital Engine Control Systems [7 Hours]

Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control - Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System - Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, SystemDiagnostics

Unit No 5: Vehicle Motion Control: [07 Hours]

Typical Cruise Control System, Digital Cruise Control System, Digital Speed Sensor, Throttle Actuator, Digital Cruise Control configuration, Cruise Control Electronics (Digital only), Antilock Brake System(ABS)

Text / Reference Books

1. William B. Ribbens, ―Understanding Automotive Electronics‖, 6th Edition, Elsevier Publishing. 2. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley& Sons Inc.,2007

Semester –VII
Consumer Electronics

BTECPE704B	Consumer Electronics	PEC-4	3L_1T_0P	4 Credits

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

Pre-Requisites: Computer Fundamentals, Fundamentals of Digital Communication

Course Objectives:

After completion of the course, students will have an adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To acquaint students with the practical knowledge of designing and developing consumer electronic systems and products and introduce the latest trends and technologies.

Course Outcomes:

On completion of the course, students will be able to:

CO1	List technical specification of electronics Audio system (microphone and speaker)
CO2	Trouble shoots consumer electronics products like TV, washing machine and AC.
CO3	Identify and explain working of various color TV transmission blocks.
CO4	Adjust various controls of color TV receiver and troubleshoot it.
CO5	Use various functions of Cam coder and shoot a video and take snapshots and save them in appropriate format.

Course Contents:

Unit No 1: Communication devices **[7 Hours]**

Mobile handsets, Android technology, 2G, 3G Mobiles, i-phone, EPABX

Unit No 2: Mass Communication devices **[8 Hours]**

Color Television, Antenna, HDTV, LCD TV,LED TV, 3D Technology In TV, Interactive TV, DTHTV, Plasma TV, Video Conferencing, FAX Machine, PA System, Dolby Digital Systems, Gesture Technology In TV.

Unit No 3: Household e1cctronics devices **[7 Hours]**

Washing Machine, Microwave Oven, Types Applications, Electronics Weighing Balance, Air Conditioner, Vacuum Cleaner.

Unit No 4: Printing and recording devices [7 Hours]

LASER printer, Inkjet Printers, Photocopiers, Scanner, DVD/CD Player, Blue ray DVD Player.

Unit No 5: Special purpose machines & Security devices [7 Hours]

Electronic Voting Machine, CFL, LED Lamps, Application and Advantages. Solar lamp, Water Purifier, Electronic Calculator, DVD Player, ATM, Biometric attendance Monitoring System, Working, Biometric Sensors, Home Automation System.

Unit No 6: Compliance [7 Hours]

Product safety and liability issues, standards related to electrical safety and standards related to fire hazards, e.g., UL and VDE. EM1/EMC requirements and design techniques for compliance, e.g. ESD, RF interference and immunity, line current harmonics and mains voltage surge.

Text Books

1. Television &Video Engineering-A. M. Dhake, TMH Publication.

2. Monochrome and Color TV - R. R. Gulati, Wiley Eastern publication.

3. Video demystified -Keith Jack, PI publication

4. Audio &Video Systems-R.G.Gupta

5. Audio and Video system - Principles, maintenance and Troubleshooting by R. Gupta

6. Arora C. P., "Refrigeration and Air conditioning", Tata McGraw-Hill, New Delhi, 1994

7. Color TV Theory &Practice -S. P. Bali. TMG Hill Publication.

8. Basic TV &Video Systems-Bernard Grobb.

9. Electronic Communication Systems, Kennedy, TMH.

10. Principles of Communication Engineering- Anokh Singh-TMH.

11. C. M. Wintzer, International Commercial EMC Standards, Interference Control Techno1ologies 1988.

Final Year (Semester VII)

Satellite and Radar Engineering.

BTECPE704C	Satellite and Radar Engineering	PEC-4	3L_1T_0P	4 Credits

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

Pre-Requisites: None

Course Objectives:

1. To provide students with good depth of knowledge in radar and Satellite communication.
2. Knowledge of theory and practice of advanced communication techniques
3. This will equip the students for further studies and research knowledge of modern applications in radar and Satellite communication

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

CO1	Knowledge of theory and practice related to radar and Satellite communication.
CO2	Ability to identify, formulate and solve engineering problems related to radar and Satellite communication.
CO3	The student would be able to analyze the various aspects of establishing a geo-stationary satellite communication link.
CO4	Acquired knowledge about Radar and Radar Equations..

Course Contents:

Unit No 1: Basic Principles **[7 Hours]**
General features, frequency allocation for satellite services, properties of satellite communication systems.
Earth Station: Introduction, earth station subsystem, different types of earth stations.
Satellite Orbits
Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbitalcapacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping.

Unit No 2: Satellite Construction (Space Segment) **[8 Hours]**
Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification.

Unit No 3: Satellite Links **[7 Hours]**
Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain.

Unit No 4: Introduction to Radar system [7 Hours]

Introduction to radar systems, History and applications of radar, Basic radar function, Radar classifications, elements of pulsed radar, The radar equation,

Unit No 5: MTI and Pulse Doppler Radar [7 Hours]

Introduction to Doppler and MTI radar, Doppler frequency shift Simple CW Doppler radar, MTI radar block diagram Delay line canceler Moving-target-detection Pulse Doppler radar

Text Books

1. Timothy Pratt, Charles W. Bostian, Satellite Communications, John Wiley & Sons.

2. Dennis Roddy, Satellite Communications, 3rd Ed., McGraw-Hill International Ed. 2001.
3. Merill Skolnik,—Introduction to RADAR Systems,Tata McGrawHill, Third Edition
4. Dr. A. K. Sen, Dr. A. B. Bhattacharya- Radar Systems and Radio Aids to Navigation Khanna Publishers

Reference Books

1. Robert Gagliardi , "Satellite Communication" , CBS Publication.
2. Ha, "Digital Satellite Communication", McGraw- Hill.
3. Fundamentals of Radar Signal Processing, Mark A. Richards 2005.
4. Adaptive Radar Signal Processing, Simon Haykin 2006

Second Year (Semester –VII)

Web Development

BTECPE704D	Web Development	PEC-4	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.)

Pre-Requisites: None

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:
1.Fundamentals of web essentials and markup languages
2.Use of the Client-side technologies in web development
3.Use of the Server-side technologies in web development
4.Understand the web services and frameworks

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

CO1	Implement and analyze behavior of web pages using HTML and CSS
CO2	Apply the client-side technologies for web development
CO3	Analyze the concepts of Servlet and JSP
CO4	Analyze the Web services and frameworks
CO5	Apply the server side technologies for web development

Course Contents:

Unit No 1: Introduction to Web Essentials [7 Hours]

The internet, basic internet protocols, the world wide web, HTTP Request message, HTTP response message, web clients, web servers. **HTML**: Introduction, history and versions. **HTML Elements**: heading, paragraphs, line break, colors and fonts, links, frames, list, tables, images and forms. Difference between HTML and HTML5. **CSS:** Introduction to style sheet, CSS features, CSS core syntax, Style sheets and HTML, Style rule cascading and inheritance, text properties. Bootstrap

Unit No 2: Client-Side Technologies: JavaScript and DOM [7 Hours]

JavaScript: Introduction to JavaScript, JavaScript in perspective, basic syntax, variables and data types, statements, operators, literals, functions, objects, arrays, built in objects, JavaScript debuggers. DOM: Introduction to Document Object Model, DOM history and levels, intrinsic event handling, modifying element style, the document tree, DOM event handling, jQuery, Overview of Angular JS.

Unit No 3: Java Servlets and XML [7 Hours]

Servlet: Servlet architecture overview, A "Hello World" servlet, Servlet generating dynamic content, Servlet life cycle, parameter data, sessions, cookies, URL rewriting, other Servlet capabilities, data storage, Servlets concurrency, databases (MySQL) and Java Servlets. XML: XML documents and vocabularies, XML declaration, XML Namespaces, DOM based XML processing, transforming XML documents, DTD: Schema, elements, attributes. AJAX: Introduction, Working of AJAX.

Unit No 4: JSP and Web Services [8 Hours]

JSP: Introduction to Java Server Pages, JSP and Servlets, running JSP applications, Basic JSP, JavaBeans classes and JSP, Support for the Model-View-Controller paradigm, JSP related technologies. Web Services: Web Service concepts, writing a Java Web Service, Writing a Java web service client, Describing Web Services: WSDL, Communicating Object data: SOAP. Struts: Overview, architecture, configuration, actions, interceptors, result types, validations, localization, exception handling, annotations.

Unit No 5: Server Side Scripting Languages [7 Hours]

PHP: Introduction to PHP, uses of PHP, general syntactic characteristics, Primitives, operations and expressions, output, control statements, arrays, functions, pattern matching, form handling, files, cookies, session tracking, using MySQL with PHP, WAP and WML. Introduction to ASP.NET: Overview of the .NET Framework, Overview of C#, Introduction to ASP.NET, ASP.NET Controls, Web Services. Overview of Node JS.

Note: Hands-on practice of Web Development should cover under Tutorial slots.

Text Books

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035
2. Robert W Sebesta, "Programming the World Wide Web , 4th Edition, Pearson education, 2008
3. Marty Hall, Larry, "Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.

Reference Books

1. H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006, ISBN 978-0131752429.
2. Chris Bates, "Web Programming Building Internet Applications , 3rd Edition, Wiley India, 2006.
3. Xue Bai et al, "The web Warrior Guide to Web Programming , Thomson, 2003.

for Big Data Analytics", IGI Global.

Final Year (Semester –VII)

Data Science

BTECPE704E	Data Science	PEC-4	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.)

Pre-Requisites:

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Building the fundamentals of data science.
2. Imparting design thinking capability to build big-data
3. Developing design skills of models for big data problems
4. Gaining practical experience in programming tools for data sciences
5. Empowering students with tools and techniques used in data science

Course Outcomes:

On completion of the course, students will be able to:

CO1	Apply data visualization in big-data analytics
CO2	Apply techniques for Data Collection and Data Processing.
CO3	Utilize EDA, inference and regression techniques
CO4	Study methods for model development.
CO5	Apply techniques to understand model evaluation.

Course Contents:

Unit No 1: Introduction **[7 Hours]**

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Unit No 2: Data Collection and Data Pre-Processing **[7 Hours]**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Unit No 3: Exploratory Data Analytics **[7 Hours]**

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Unit No 4: Model Development **[8 Hours]**

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and

Decision Making.

Unit No 5: Model Evaluation **[7 Hours]**

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.

Reference Books

1. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
2. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

Sem-VII

Nanotechnology

BTECOE705A	Nanotechnology	OEC-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 (Duration 03 hrs.)

Pre-Requisites: Materials Science and Engineering.

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To convey the basic concepts of Nano electronics to engineering students with no background in quantum mechanics and statistical mechanics.
2. Main objective of this is to provide the basic platform and deep information of different Nano electronics devices like MOSFET, FINFET, Nano metrology tools used to design the recently developing VLSI applications.
3. This subject gives idea about the role and importance of the Nano electronic devices system in engineering world to develop the research ideas in VLSI.
4. Recent technology proceeds with MOSFET with 64nm technology, the need Nano electronic Devices and Material subject to achieve transistor size which is less than current technology.
5. The content of this course gives platform to the Nano electronics world and innovative ideas to ensure the knowledge of real time applications which helps students to stand them in Indian and multinational industries.

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

CO1	Discuss Meaning, Scope and Stages of Nanotechnology
CO2	Understand various aspects of nano-technology and the processes involved in making nano components and material.
CO3	Leverage advantages of the nano-materials and appropriate use in solving practical problems.
CO4	Understand various aspects of nano-technology and the processes involved in making nano components and material.
CO5	Leverage advantages of the nano-materials and appropriate use in solving practical problems.

Course Contents:

Unit No 1: Overview Nano Technology [7 Hours]

Introduction to nanotechnology, Nano devices, Nano materials, Nano characterization, Definition of Technology node, Basic CMOS Process flow, meso structures.

Unit No 2: MOS Scaling theory [7 Hours]

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.)

Unit No 3: Nano electronics Semiconductor devices [7 Hours]

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Unit No 4: Properties of Nano devices [8 Hours]

Vertical transistors, Fin FET and Surround gate FET. Metal source/drain junctions – Properties of schottky functions on Silicon, Germanium and compound semiconductors - Work function pinning.

Unit No 5 : Characterization techniques for Nano materials [7 Hours]

FTIR, XRD, AFM, SEM, TEM, EDAX Applications and interpretation of results, Emerging nano material, nano tubes, Nano rods and other Nano structures.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003.

Reference Books

1. Nanostructures and Nanomaterials: Synthesis, Properties and Applications" by Cao G
2. Introduction to Nanoscience and Nanotechnology" by Chattopadhyay K K
3. Introduction to Nanoscience and Nanotechnology" by Gabor L Hornyak and H F Tibbals
4. Nanotechnology: Principles and Practices" by Sulabha K Kulkarni

Final Year (Semester –VII)

Cyber Security & Blockchain Technology

BTECOE705B	Cyber Security & Block Chain Technology	OEC-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 (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. To provide a strong foundation of fundamental basics of cryptography.
2. Demonstrate awareness and fundamental understanding of various applications of cyber security techniques.
3. Apply cyber security techniques for problem solving.

Course Outcomes:

On completion of the course, students will be able to:

CO1	Discuss Meaning, Scope of cyber security
CO2	Differentiate various Ciphers
CO3	Apply several Cryptographic Algorithms
CO4	Illustrate data integrity algorithms.
CO5	Differentiate public Vs private Bloackchain

Course Contents:

Unit No 1: **[7 Hours]**

Introduction and Mathematical Foundations: Introduction, Overview on Modern Cryptography, Number Theory, Probability and Information Theory. Classical Cryptosystems: Classical Cryptosystems, Cryptanalysis of Classical Cryptosystems, Shannon‘s Theory.

Unit No 2: **[8 Hours]**

Symmetric Key Ciphers: Symmetric Key Ciphers, Modern Block Ciphers (DES), Modern Block Cipher (AES).Crypt-analysis of Symmetric Key Ciphers: Linear Crypt-analysis, Differential Crypt-analysis, other Crypt-analytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers. Optimization.

Unit No 3: **[7 Hours]**

Stream Ciphers and Pseudo-randomness: Stream Ciphers, Pseudo-random functions. Hash Functions and MACs: Hash functions: The Merkle Damgard Construction, Message Authentication Codes

(MACs). Asymmetric Key Ciphers: Construction and Crypt-analysis: More Number Theoretic Results, The RSA Cryptosystem, Primality Testing, Factoring Algorithms, Other attacks on RSA and Semantic Security of RSA

Unit No 4: **[7 Hours]**

Digital Signatures: Signature schemes: I, Signature schemes: II. Modern Trends in Asymmetric Key Cryptography: Elliptic curve based cryptography: I, Elliptic curve based cryptography: II. Network Security: Secret Sharing Schemes, A Tutorial on Network Protocols, Kerberos, Pretty Good Privacy (PGP), Secure Socket Layer (SSL), Intruders and Viruses, Firewalls

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

What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.Blockchain usecases

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books

1. B. A. Forouzan, "Cryptography & Network Security", McGraw Hill Publication.
2. William Stallings, "Cryptography and Network Security", Pearson Education.
3. Dr. B. B. Meshram, TCP/IP & Network Security, SPD Publication.
4. Wenbo Mao, "Modern Cryptography, Theory & Practice", Pearson Education.
5. Hoffstein, Pipher, Silvermman, "An Introduction to Mathematical Cryptography", Springer.
6. Alang.Konheim, Computer Security and Cryptography, Wiley Publication.
7. A. Joux, "Algorithmic Crypt-analysis", CRC Press.
8. S. G. Telang, "Number Theory", McGraw Hill.
9. Matt Bishop, "Computer Security", Pearson Education.

B.Tech (Semester –VII)

IOS Programming

BTECOE705C	IOS Programming	OEC-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 (Duration 03 hrs.)

Pre-Requisites: None

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. iOS Programming with Swift programming language
2. Effective utilization of XCode IDE for iOS development

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

CO1	To get insight of designing iOS application
CO2	To get acquainted with Swift Programming language
CO3	To be able to develop multi-screen application using XCode
CO4	To understand the need and be able to use Different UI Controllers
CO5	To be able to debug an application using XCode debugger

Course Contents:

Unit No 1: Introduction: **[7 Hours]**

Overview of iOS and X-CODE: Installation, Create and manage project using XCode, Introduction to iPhone Architecture, Introduction to SWIFT, Developer Technology Overview: The Apple Developer Tool, Swift, Cocoa Touch, Model-View-Controller, Interface Builder, Overview of latest iOS features

Unit No 2: Swift Basics: **[7 Hours]**

Object oriented programming with swift, File structure in Swift, Swift Programming Basics: Data types, Constants, Variables, Operators, Decision making and Branching, Arrays, Functions, Enumerations. Introduction to iOS Playground.

Unit No 3: Fundamentals of iOSApp development **[8 Hours]**

Exploring the iOS Framework with XCode, Cocoa Fundamentals, Tracking the iOS Application Life cycle, Understanding Interface Builder, Creating User Interface, Customizing the Interface Appearance using Layout, Views, Outlets and Actions, View Controllers and UI Controllers like Labels, Buttons, Sliders, Different Views, Gestures, etc. Connecting the code with Accelerometer, Location service, 3D touch, Push notifications

Unit No 4: MVC and XCode **[7 Hours]**

Understand the MVC Design pattern, MVC in XCode, Using Application Templates, User Input and Output: Handling Keyboard Input, Implementing Alert, Sounds and Vibrations, Using XCode debugger

Unit No 5: Database and WebServices **[7 Hours]**

Parsing JSON data, Parsing XML data, SqLite databases, Web Service APIs calls. Create Apple developer account, Submit App to Apple Store.

Note: Hands-on practice should be cover under Tutorial slots.

Text Books

1. Matt Neuburg, “iOS 10 Programming Fundamentals with Swift” - O'Reilly Media Pub
2. MikeWesterfield, “Building iPhone and iPad Electronic Projects” - O'Reilly Media Pub.

Reference Books

1. Dan Pilone, Tracey Pilone, “Head First iPhone and iPad Development, 2nd Edition”, O'Reilly Media
2. Daniel Paterson, ChrisApers, “Beginning iPhone and iPad Web Apps” , Apress Pub

Final Year (Semester –VII)

Renewable Energy Sources

BTECOE705D	Renewable Energy Sources	OEC-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 (Duration 03 hrs.)

Pre-Requisites:
Knowledge of thermodynamics, heat transfer, energy engineering, applied thermodynamics and heat cycles.

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to subject:

- To explore principle renewable energy sources.
- To examine technologies involved in their costs, environmental impact, size of the potential renewable resource and their future.
- To understand the concepts of Non-renewable and renewable energy systems
- To outline utilization of renewable energy sources for both domestic and industrial applications
- To expose the sources of energy crisis and the alternates available.

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

CO1	To provide knowledge and analyze the utility of renewable energy sources & non-conventional technologies.
CO2	To carry out basic design of renewable energy systems
CO3	To Understand the need of energy conversion and the various methods of energy storage
CO4	To explain the field applications of solar energy, winds energy as alternate form of energy
CO5	To explain bio gas generation, Geothermal &Tidal energy and its applications

Course Contents:

UNIT I- ENERGY SOURCES (07 Hours)

Energy Scenario: Classification of Energy Sources, Energy resources (Conventional and nonconventional), Energy needs of India, and energy consumption patterns. Worldwide Potentials of these sources. Energy efficiency and energy security. Energy and its environmental impacts, Distributed generation. Energy storage and hybrid system configurations: Energy storage, Battery – types, equivalent circuit, performance characteristics, battery design, charging and charge regulators.

UNIT II -SOLAR PRINCIPLES (07 Hours)

Solar Radiation

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Solar Collection

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar Storage & Applications

Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT III -WIND ENERGY (07 Hours)

Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

UNIT - IV (07 Hours)

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India. OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC.

UNIT -V (07 Hours)

Grid Integration: Stand alone systems, Concept of Micro-Grid and its components, Hybrid systems – hybrid with diesel, with fuel cell, solar-wind, wind –hydro systems, mode controller, load sharing, system sizing. Hybrid system economics, Interface requirements, Stable operation, Transient-safety, Operating limits of voltage, frequency, stability margin, energy storage, and load scheduling. Effect on power quality, harmonic distortion, voltage transients and sags, voltage flickers, dynamic reactive power support. Systems stiffness.

Text Reference Books

1. Renewable Energy Sources & Emerging Trends by D.P.Kothari , K.C.Singal & Rakesh Ranjan
2. Renewable Energy by R.K.Gupta
3. Fundamentals & Application of Renewable Energy by Mehmet Kangolu, Yunus A , Cengel & John M.Cimbal , Mc Hills

Final Year (Semester –VII)

Smart Grid Introduction and Application

BTECOE705E	Smart Grid Introduction and Application	OEC-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 (Duration 03 hrs.)

Pre-Requisites: Basic Electric Circuits, Sensors.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Understand technology used in smart grid
2. Know communication technology used in smart grid
3. Knowledge of network security methods used in smart grid

Course Outcomes:

On completion of the course, students will be able to:

CO1	Discuss necessity of smart grid and information technology application
CO2	Tell role of communication technology in smart grid
CO3	Apply security for smart grid
CO4	Identify smart metering requirement.
CO5	Understand Automation and application in smart grid.

Course Contents:

Unit No 1: Smart Grid and Information Technologies [7 Hours]

Introduction and necessity of smart grid, Technology required, Data Communication, Dedicated & Shared Channels, Communication Channels, Wired Communication and Optical Fiber. Radio Communication, Cellular Mobile Communication, Satellite Communication, Layered Architecture & Protocols, ISO/OSI Model, TCP/IP, Switching Techniques, Circuit Switching, Message Switching & Packet Switching.

Unit No 2: Communication Technologies for Smart Grid [6 Hours]

Communication Technologies, IEEE 802 series, Mobile Communications, Multi-protocol label switching, Power Line Communication, Standards for information exchange , Standards for smart metering , Modbus, DNP3, IEC 61850**.**

Unit No 3: Information Security for Smart Grid [8 Hours]

Introduction, Encryption and Decryption, Symmetric Key Encryption, Public Key Encryption, Authentication, Authentication based on Shared Secret Key, Authentication based on Key Distribution Center, Digital Signatures, Secret Key Signature, Public Key Signature, Message Digest, Cyber Security Standards, IEEE 1686: IEEE standard for substation Intelligent Electronic Devices (IEDs), Cyber Security Capabilities, IEC 62351: Power Systems Management & Associated Information Exchange – Data & Communications Security.

Unit No 4: Smart Metering and Demand Side Integration [8 Hours]

Smart metering , Evolution of electricity metering, Key components of smart metering, Smart meters: An overview of the hardware used, Signal acquisition, Signal conditioning, Analogue to Digital Conversion (ADC), Computation, Input/output, Communications infrastructure and protocols for smart metering, Home-Area Network, Neighborhood Area Network, Data Concentrator, Meter Data Management System, Protocols for Communications, Demand-Side Integration(DSI), Services provided by DSI, Implementations of DSI, Hardware support to DSI implementations, Flexibility delivered by prosumers from the Demand Side, System support from DSI.

Unit No 5: Automation Equipment for Smart Grid [7 hours]

Substation Automation Equipment, Current Transformers, Voltage Transformers, Intelligent Electronic Devices, Bay Controller, Remote Terminal Units, Faults in the Distribution System, Components for Fault Isolation and Restoration , Fault Location, Isolation and Restoration, Voltage Regulation, Applications, System Monitoring, System Operation, System Management, Outage Management System (OMS).

Text Books

1. “Smart Grid Technology & Application” Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Nick Jenkins, Wiley Publications.
2. “Smart Grids, Opportunities, Developments and Trends”, A.B.M.Shawkat Ali, Green Energy Technology, Springer.
3. “Smart Grid, Fundamentals & Applications”, I.S.Jha, Subir Sen, Rajesh Kumar, D.P.Kothari, New Age International Publications, ISBN-10-938860590X, ISBN-13-978-9388605908.
4. “Smart Grid, An Indian Adaptation: Fundamentals, Design, Technology, Applications, Communication and Security”, Wiley Publications.
5. “Smart Grid”, K.S. Manoj, Notion Press Media Pvt Ltd, ISBN: 9781646509997, 9781646509997.

Semester –VII

Devops

BTECPL707	Devops Lab & Deep Learning Lab	LC5	0L-0T-2P	1 Credits

Teaching Scheme	Examination Scheme
Practical: 02 hrs./week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks End Semester Examination: 40 Marks

List of Practical/Tutorial

1. To Perform Installation of Git and work on local and remote Git repositories.
2. To fetch and synchronize the Git repository.
3. To Perform Basic Branching and Merging in Git.
4. To install Jenkin and Build a job in Jenkin.
5. To Create CI CD pipeline in Jenkin.
6. To install Docker and Execute the Basic command in Docker.
7. To build an image from the Docker file.
8. To deploy the Java application to Docker.
9. To perform Continues testing of web applications using selenium
10. Install Puppet agent and puppet master on two separate machines and establish a connection between them.

Note:

1. Open-Source tools and technology used for programs
2. Lab should be in the scope of hands of experience and practice related program must
3. Add case study and Live project experience if any related contents

Software Tools: Opens Source tools must and highly recommended for students to use when completing their assignments and/or practicals for this

Deep Learning Lab

Practical List

1. Loading dataset into keras/pytorch, creating training and testing splits.
2. Creating functions to compute various losses.
3. Feeding data to pretrained neural network and making predictions.
4. Implementing regression using deep neural network.
5. Classifying IMDB movie review dataset using deep neural network-binary classification problem.
6. Classifying Reuters dataset using deep neural network-multiclass classification problem.
7. Classifying MNIST Dataset using CNN.
8. Classifying data using pretrained models/transfer learning.
9. Training various popular neural networks (Resnet, VGGNet,InceptionV3 etc) on custom Dataset.
10. Tempreture forecasting using RNN.
11. Implementation of GAN on any suitable dataset.

Semester –VII
Project

BTECP708	**PROJECT**	**PROJ**	**0L-0T-4P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 024hrs./week	Continuous Assessment : 60 Marks End Semester Examination: 40 Marks

Guidelines for Project

The students shall study in group of max. three members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Electronics & Computer Engineering, Artificial Intelligence, Data Science, Electronics Engineering and Computer Science Engineering or inter discipline branch from current literature, by referring 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 bein their University / College / nearby vicinity.
2. Do the literature survey,
3. Design the solutions
4. Implement solution using 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 project 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 consists of the report written in a technical reporting manner and execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Semester –VIII

Project Work/ Internship

BTECF801	**Project Work/ Internship**	**Project/ Internship**	**0L-0T-24P**	**12 Credits**

Teaching Scheme	**Examination Scheme**
Practical: 24 hrs./week	Continuous Assessment : 60 Marks End Semester Exam: 40 Marks Total : 100 Marks

Guidelines for Project

The students shall study in group of max. three members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Electronics & Computer Engineering, Artificial Intelligence, Data Science, Electronics Engineering and Computer Science Engineering or inter discipline branch from current literature, by referring 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 bein their University / College / nearby vicinity.
2. Do the literature survey,
3. Design the solutions
4. Implement solution using latest technology
5. Write 60-70 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 project 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 consists of the report written in a technical reporting manner and execution of project will be assessed by the internal examiner appointed by the HOD of concern department of the institution.