

**Dr. Babasaheb Ambedkar Technological University (Established a University of
Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)**

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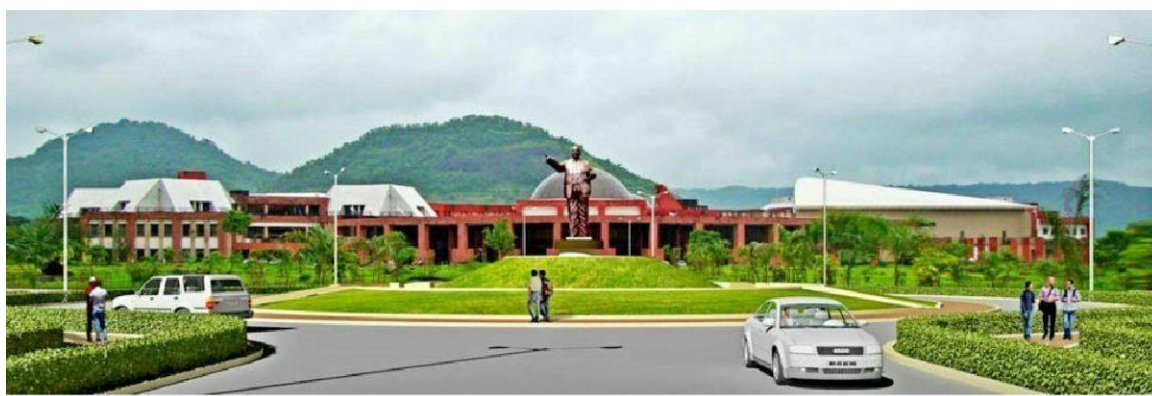
PROPOSED CURRICULUM OF UNDER GRADUATE PROGRAMME B. TECH

Electronics & Communication (Advanced Communication Technology)

Second Year [2024-25]

Third Year [2025-26]

Final Year [2026-27] and onwards



Rules and Regulations

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

REGISTRATION:

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

Course Pre-Requisites:

1. In order to register for some courses, it may be required either to have exposure in, or to have completed satisfactorily, or to have prior earned credits in, some

specified courses.

2. Students who do not register on the day announced for the purpose may be permitted LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.

3. REGISTRATION IN ABSENTIA will be allowed only in exceptional cases with the approval of the Dean (Academic) / Principal.
4. A student will be permitted to register in the next semester only if he fulfills the following conditions:
- Satisfied all the Academic Requirements to continue with the programme of Studies without termination
 - Cleared all Institute, Hostel and Library dues and fines (if any) of the previous semesters;
 - Paid all required advance payments of the Institute and hostel for the current semester;
 - 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 2023-24, 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 $\geq$ 5.50 & < 6.00	Second Class
CGPA $\geq$ 6.00 & < 7.50	First Class
CGPA $\geq$ 7.50	Distinction
[Percentage of Marks =CGPA*10.0]	

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

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

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

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

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

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

5. Description of Grades:

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

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

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

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

6. Evaluation of Performance:

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

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

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

Where

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

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

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

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

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

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

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

Where

„m“ is the total number of subjects from the first semester onwards up to and including the semester S,

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

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

#CGPA will be rounded off to the second place of decimal and recorded as such.

Award of Degree of 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 & Communication (Advanced Communication Technology) with Minor in Computer Engineering).

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

ATTENDANCE REQUIREMENTS:

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

TRANSFER OF CREDITS

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

- a) 20 % of the total credit will be considered for respective calculations.
- b) Credits transferred will be considered for overall credits requirements of the programme.
- c) Credits transfer can be considered only for the course at same level i. e UG, PG etc.
- d) A student must provide all details (original or attested authentic copies) such as course contents, number of contact hours, course instructor /project guide and evaluation system for the course for which he is requesting a credits transfer. He shall also provide the approval or acceptance letter from the other side. These details will be evaluated by the concerned Board of Studies before giving approval. The Board of Studies will then decide the number of equivalent credits the student will get for such course(s) in DBATU. The complete details will then be forwarded to Dean for approval.
- e) A student has to get minimum passing grades/ marks for such courses for which the credits transfers are to be made.
- f) Credits transfers availed by a student shall be properly recorded on academic record(s) of the student.
- g) In exceptional cases, the students may opt for higher credits than the prescribed.

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	BTECA403	Basic Human Rights	(3-0-0) 3
2	BTECA505	1. Economics and Management 2. Business Communication 3. Profession Ethics and Values 4. Project Management	(3-0-0) 3
3	BTECA605	1. Development Engineering 2. Employability and Skills Development 3. Consumer Behavior	(3-0-0) 3
4	BTECA706	1. Foreign Language Studies 2. Universal Human Values and Ethics 3. Intellectual Property Rights	(0-0-4) Audit
TOTAL			9

b) Basic Science Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECA301	Engineering Mathematics – III	(3-1-0) 4
2	BTECA404	Probability Theory and Random Processes	(3-0-0) 3
TOTAL			07

c) Engineering Science Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECA304	Digital Electronics and Microprocessor	(3-1-0) 4
2	BTECA305	Network Theory	(3-0-0) 3
3	BTECA308	Digital Electronics and Microprocessor Lab	(0-0-2) 1
TOTAL			08

d) Professional Core Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECA302	Analog Circuits	(3-1-0) 4
2	BTECA303	Analog Communication and Signals & System	(3-0-0) 3
3	BTECA401	Digital Communication	(3-1-0) 4
4	BTECA402	Control System Engineering	(3-0-0) 3
5	BTECA501	Electromagnetic Field Theory	(3-1-0) 4
6	BTECA502	Information Theory & Coding	(3-0-0) 3
7	BTECA601	Microwave Engineering	(3-0-0) 3
8	BTECA602	Digital Signal Processing	(3-1-0) 4
9	BTECA701	5G Technology	(3-0-0) 3
10	BTECA702	Software Defined Radio	(3-1-0) 4
11	BTECA703	Optical Fiber & Satellite Communication	(3-0-0) 3
12	BTECA306	Analog Circuits	(0-0-2) 1

13	BTECA307	Analog Communication and Signals & System	(0-0-2) 1
14	BTECA406	Digital Communication	(0-0-2)1
15	BTECA407	Control System Engineering	(0-0-2) 1
16	BTECA506	Information Theory & Coding Lab	(0-0-2) 1
17	BTECA606	Digital Signal Processing Lab	(0-0-2)1
18	BTECA607	Microwave Engineering Lab	(0-0-2) 1
19	BTECA707	5G Technology	(0-0-2)1
20	BTECA708	Software Defined Radio	(0-0-2)1
21	BTECA709	Optical Fiber & Satellite Communication	(0-0-2)1
TOTAL			48

e) Professional Elective Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECA405	Professional Elective Courses –I A. Python Programming B. Sensors & Actuators C. Data Structure & Algorithms using C++ D. Electrical Machine & Instrumentation	(3-1-0) 4
2	BTECA408	3. Professional Elective Courses –I Lab A. Python Programming B. Sensors & Actuators C. Data Structure & Algorithms using C++ D. Electrical Machine & Instrumentation	(0-0-2) 1
3	BTECA503	Professional Elective Course (PEC) -II A. Antennas and Propagation B. Microcontroller & Embedded System C. Wireless Communication D. Power Electronics & Drives	(3-1-0) 4
4	BTECA507	2. Professional Elective Course (PEC) –II Lab A. Antennas and Propagation B. Microcontroller & Embedded System C. Wireless Communication D. Power Electronics & Drives	(0-0-2) 1
5	BTECA603	Professional Elective Course (PEC) –III A. Antenna Design B. Computer Networks & Cloud Computing C. Mobile Communication & Networks D. VLSI Design	(3-0-0) 3
5	BTECA704	Professional Elective Course (PEC) -IV A. Advanced Antenna Technology B. Industry 4.0 C. Wireless Sensor Network D. VLSI Testing and Verification	(3-1-0) 4
TOTAL			17

f) Open Elective Course

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECA504	Open Elective Course (OEC) - I A.HDL Programming B.Database Management Systems C. Data Analysis D. Java Programming	(3-0-0) 3
2	BTECA508	3.Open Elective Course (OEC) – I Lab A. HDL Programming B. Database Management Systems C. Data Analysis D. Java Programming	(0-0-2) 1
3	BTECA604	Open Elective Course (OEC) - II A. Internet of Things B. Software Engineering & Testing C. Machine Learning D. Advanced Java	(3-0-0) 3
4	BTECA608	3.Open Elective Course (OEC) – II Lab A. Internet of Things B. Software Engineering & Testing C. Machine Learning D. Advanced Java	(0-0-2) 1
5	BTECA705	Open Elective Course (OEC) -III A. PLC & Automation B. Web Development C. Deep Learning & Computer Vision D. Android Programming	(3-1-0) 4
TOTAL			12

f) Seminar / Mini Project / Internship

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	BTECA309	Seminar-I	(0-0-2) 1
2	BTECA310	Internship –I (Evaluation) / MOOC	Audit
3	BTECA409	Seminar - II	(0-0-4) 2
4	BTECA410	Internship –II / MOOC	Audit
5	BTECA509	Mini Project I	(0-0-4) 2
6	BTECA510	Internship –II (Evaluation) / MOOC	Audit
7	BTECA609	Mini Project II	(0-0-4) 2
8	BTECA610	Internship –III / MOOC	Audit
9	BTECA710	Project Work	(0-0-4) 2
10	BTECA711	Internship –III (Evaluation) / MOOC	Audit
11	BTECA801	Project Work/ Internship	(0-0-24) 12
TOTAL			22

Category – wise total number of credits

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

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

Suggested Plan of Study

Number of Courses	Semester							
	I	II	III	IV	V	VI	VII	VIII
1	BTBS101	BTBS201	BTECA301	BTECA401	BTECA501	BTECA601	BTECA701	BTECA801
2	BTBS102	BTBS202	BTECA302	BTECA402	BTECA502	BTECA602	BTECA702	--
3	BTES103	BTES203	BTECA303	BTECA403	BTECA503 (PEC-II Elective)	BTECA603 (PEC-III Elective)	BTECA703	--
4	BTHM104	BTES204	BTECA304	BTECA404	BTECA504 (OEC -I Elective)	BTECA604 (OEC -II Elective)	BTECA704 (PEC-IV Elective)	--
5	BTES105	BTES205	BTECA305	BTECA405 (PEC-I Elective)	BTECA505 (HSSMEC-IV Elective)	BTECA605 (HSSMEC-V Elective)	BTECA705 (OEC -III Elective)	--
6	BTES106	BTES206	BTECA306	BTECA406	BTECA506	BTECA606	BTECA706 (HSSMEC-VI Elective)	--
7	BTBS107L	BTBS207L	BTECA307	BTECA407	BTECA507	BTECA607	BTECA707	--
8	BTES108L	BTES208L	BTECA308 (Internship –I Evaluation)	BTECA408 (Internship –II)	BTECA508 (Internship –II Evaluation)	BTECA608 (Internship –I Evaluation)	BTECA708	--
9	BTHM109L	BTES209S					BTECA709 (Internship –III Evaluation)	--
10	--	BTES211P (Internship - 1)						--

Programme Educational Objectives (PEO)

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

Objective Identifier	Objectives
PEO1	Graduates will be able to serve in domain specific and interdisciplinary industry to solve society problems
PEO2	Graduates will be successful in pursuing higher studies and research in the field of engineering.
PEO3	Graduates will exhibit professional ethics and teamwork in their profession through lifelong learning.

Programme Outcomes (PO)

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

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

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

Program Specific Outcomes (PSOs)

Outcome Identifier	Outcomes
PSO1	Apply knowledge of mathematics and science to solve advanced engineering problems in the areas of analog and digital communication.
PSO2	Demonstrate professional competencies in the domain of advanced communication technology to meet industry standards.
PSO3	Graduate will be able to work on micro-machining, automation projects.

Graduate Attributes / ABET's Criteria

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

- (a) Engineering knowledge: An ability to apply knowledge of mathematics, science and engineering.
- (b) Problem analysis: An ability to design and conduct experiments as well as to analyze and interpret data.
- (c) Design / development of solutions: An ability to design a system, a component, or process, to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- (d) Individual and team work: An ability to function on multidisciplinary teams.
- (e) Problem Solving: An ability to identify, formulate and solve engineering problems.
- (f) Ethics: An understanding of professional and ethical responsibility.
- (g) Communication: An ability to communicate effectively.
- (h) Environment and sustainability: The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and social context.
- (i) Life-long learning: Recognition of the need for and an ability to engage in life-long learning.
- (j) A knowledge of technology: Acknowledge of contemporary issues, and state of art technology
- (k) Modern tool usage: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- (l) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply in multidisciplinary environments.

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

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

Course Structure for Second Year

Electronics & Communication (Advanced Communication Technology)

Semester III (Term 3)										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
BSC	BTECA301	Engineering Mathematics-III	3	1	-	20	20	60	100	4
PCC1	BTECA302	Analog Circuits	3	1	-	20	20	60	100	4
PCC2	BTECA303	Analog Communication and Signals & System	3		-	20	20	60	100	3
ESC11	BTECA304	Digital Electronics and Microprocessor	3	1	-	20	20	60	100	4
ESC12	BTECA305	Network Theory	3		-	20	20	60	100	3
LC1	BTECA306	Analog Circuits Lab ,	-	-	2	30	-	20	50	1
LC2	BTECA307	Analog Communication Lab	-	-	2	30	-	20	50	1
LC3	BTECA308	Digital Electronics and Microprocessor Lab	-	-	2	30	-	20	50	1
Seminar	BTECA309	Seminar-I	-		4	60	-	40	100	2
Internship	BTECA310	Internship –I (Evaluation)	-	-	-	-	-	-	-	Audit
			15	3	10	250	100	400	750	23

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

Course Structure for Second Year

Electronics & Communication (Advanced Communication Technology)

Semester IV (Term 4)										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC3	BTECA401	Digital Communication	3	1	-	20	20	60	100	4
PCC4	BTECA402	Control System Engineering	3	-	-	20	20	60	100	3
HSSM C3	BTECA403	Basic Human Rights	3	-	-	20	20	60	100	3
BSC8	BTECA404	Probability Theory and Random Processes	3	-	-	20	20	60	100	3
PEC-1	BTECA405	Professional Elective Courses –I	3	1	-	20	20	60	100	4
	BTECA405A	Python Programming								
	BTECA405B	Sensors and Actuators								
	BTECA405C	Data Structure and Algorithm Using C++								
	BTECA405D	Electrical Machine & Instrumentation								
LC4	BTECA406	Digital Communication Lab	-	-	2	30	-	20	50	1
LC5	BTECA407	Control System Engineering	-	-	2	30	-	20	50	1
LC6	BTECA408	PEC-1 Lab	-	-	2	30	-	20	50	1
Seminar	BTECA409	Seminar - II	-	-	4	60	-	40	100	2
Internship	BTECA410	Internship -II	-	-	-	-	-	-	-	Audit
			15	2	10	250		400	750	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

Electronics & Communication (Advanced Communication Technology)

Semester V (Term 5)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC5	BTECA501	Electromagnetic Field Theory	3	1	-	20	20	60	100	4
2	PCC6	BTECA502	Information Theory & Coding	3	-	-	20	20	60	100	3
3	PEC-2	BTECA503	Professional Elective Course (PEC) -II	3	1	-	20	20	60	100	4
		BTECA503A	Antennas and Propagation								
		BTECA503B	Microcontroller & Embedded System								
		BTECA503C	Wireless Communication								
		BTECA503D	Power Electronics & Drives								
4	OEC-1	BTECA504	Open Elective Course (OEC) - I	3	-	-	20	20	60	100	3
		BTECA504A	HDL Programming								
		BTECA504B	Database Management Systems								
		BTECA504C	Data Analysis								
		BTECA504D	Java Programming								
5	HSSMEC-4	BTECA505	Humanities and Social Sciences including Management Elective Course - I	3	-	-	20	20	60	100	3
		BTECA505A	Economics & Management								
		BTECA505B	Business Communication								
		BTECA505C	Professional Ethics and Values								
		BTECA505D	Project Management								
6	LC7	BTECA506	Information Theory & Coding Lab	-	-	2	30	-	20	50	1
7	LC8	BTECA507	PEC-2 Lab	-	-	2	30	-	20	50	1
8	LC9	BTECA508	OEC-1 lab	-	-	2	30	-	20	50	1
9	PROJ	BTECA509	Mini Project I	-	-	4	60	-	40	100	2
10	Internship	BTECA510	Internship –II (Evaluation)/ MOOC	-	-	-	-	-	-	-	Audit
Total for Semester V				15	2	10	250	100	400	750	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 Third Year

Electronics & Communication (Advanced Communication Technology)

Semester VI (Term 6)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC7	BTECA601	Microwave Engineering	3	0	-	20	20	60	100	3
2	PCC8	BTECA602	Digital Signal Processing	3	1	-	20	20	60	100	4
3	PEC-3	BTECA603	Professional Elective Course (PEC) -III	3	-	-	20	20	60	100	3
		BTECA603A	Antenna Design								
		BTECA603B	Computer Networks & Cloud Computing								
		BTECA603C	Mobile Communication & Networks								
		BTECA603D	VLSI Design								
4	OEC-2	BTECA604	Open Elective Course (OEC) - I	3	1	-	20	20	60	100	4
		BTECA604A	Internet of Things								
		BTECA604B	Software Engineering & Testing								
		BTECA604C	Machine Learning								
		BTECA604D	Advanced Java								
5	HSSMEC-5	BTECA605	Humanities and Social Sciences including Management Elective Course (HSSMEC) - II	3	-	-	20	20	60	100	3
		BTECA605A	Development Engineering								
		BTECA605B	Employability and Skill Development								
		BTECA605C	Consumer Behaviour								
6	LC10	BTECA606	Digital Signal Processing Lab,	-	-	2	30	-	20	50	1
7	LC11	BTECA607	Microwave Engineering Lab	-	-	2	30	-	20	50	1
8	LC12	BTECA608	OEC-2 lab	-	-	2	30	-	20	50	1
9	PROJ	BTECA609	Mini Project II	-	-	4	60	-	40	100	2
10	Internship	BTECA610	Internship –III / MOOC	-	-	-	-	-	-	-	Audit
Total for Semester VI				15	2	10	250	100	400	750	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

With effective from academic year 2024-25

Course Structure for Final Year

Electronics & Communication (Advanced Communication Technology)

Semester VII (Term 7)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC9	BTECA701	5G Technology	3	-	-	20	20	60	100	3
2	PCC10	BTECA702	Software Defined Radio	3	-	-	20	20	60	100	3
3	PCC11	BTECA703	Optical Fiber & Satellite Communication	3	-	-	20	20	60	100	3
4	PEC-4	BTECA704	Professional Elective Course (PEC) -IV	3	1	-	20	20	60	100	4
		BTECA704A	Advanced Antenna Technology								
		BTECA704B	Industry 4.0								
		BTECA704C	Wireless Sensor Network								
		BTECA704D	VLSI Testing and Verification								
5	OEC-3	BTECA705	Open Elective Course (OEC) - III	3	1	-	20	20	60	100	4
		BTECA705A	PLC & Automation								
		BTECA705B	Web Development								
		BTECA705C	Deep Learning & Computer Vision								
		BTECA705D	Android Programming								
6	HSSMEC-6	BTECA706	Humanities and Social Sciences including Management Elective Course (HSSMEC) - II	-	-	4	-	-	-	-	Audit
		BTECA706A	Foreign Language Studies								
		BTECA706B	Universal Human Value & Ethics								
		BTECA706C	Intellectual Property Rights								
7	LC13	BTECA707	5G Technology Lab	-	-	2	30	-	20	50	1
8	LC14	BTECA708	Software Defined Radio Lab	-	-	2	30	-	20	50	1
9	LC15	BTECA709	Optical Fiber Communication Lab	-	-	2	30	-	20	50	1
10	PROJ	BTECA710	Project Work	-	-	4	60	-	40	100	2
11	Internship	BTECA711	Internship –III (Evaluation) / MOOC	-	-	-	-	-	-	-	Audit
Total for Semester VII				15	2	14	250	100	400	750	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

With effective from academic year 2024-25

Course Structure for Final Year

Electronics & Communication (Advanced Communication Technology)

Semester VIII (Term 8)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	Project/ Internship	BTECA801	Project Work/ Internship	-	-	24	60	-	40	100	12
Total for Semester VIII				0	0	24	60	-	40	100	12

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

Final Year (Semester – VII)

5G Technology

BTECA701	5G Technology	PCC9	3L- 0T -0P	3 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

1	Learn the basics of 5G and beyond wireless communication.
2	Study 5G network architecture and Heterogeneous Network and Small cells
3	Provide understanding of the key technologies and enablers of 5G and beyond communication systems.
4	Learn 5G technology like massive MIMO, mmWave etc

Course Outcomes:

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

CO1	Distinguish between the major cellular communication standards (1G/2G/3G/4G/5G systems) and architecture of wireless communications networks.
CO2	Apply the 5G techniques e.g., massive MIMO, mmWave etc. for the design of communication systems.
CO3	Analyse various modulation and multiplexing techniques e.g., OFDM, NOMA etc.
CO4	Describe applications of cognitive radio in 5G Wireless Communications.

Course Contents:

Unit No 1:	Introduction	[8Hours]
Introduction to 5G Technology, Features, Requirements, Applications, 5G Services, Introduction to 5G Digital modulations (OFDM, 5G Technology Modulation Techniques) and performance metrics, 5G Internet, Internet of Things and Context-Awareness, Software Defined Networking, Network Function Virtualization (NFV)		
Unit No 2:	5G Architecture	[6 Hours]
5G Network Architecture, Cloud RAN(C-RAN), Definitions of Heterogeneous Networks, Radio Resource and Interference Management for Heterogeneous Networks, Traffic offloading scenarios for heterogeneous networks, mobility management and handover		
Unit No 3:	Mm Wave and NOMA	[8 Hours]
mmWave: Millimeter bands, radio-wave propagation Physical layer design and algorithms, mmWave MIMO challenges, channel modelling, channel estimation and Beam-forming. Types of transceivers, Merits and Demerits, Applications Physical or Radio layer Technologies - Massive MIMO (Sub 6Ghz) -mm wave MIMO (above 6 GHz) Non orthogonal Multiple Access (NOMA), Different Types: power domain NOMA and code domain NOMA, Difference between Orthogonal multiple access and NOMA, Filter Bank multi carrier -Full duplex Radio Techniques, Precoding.		

Unit No 4:	Cognitive Radio for 5G Wireless Networks	[7 Hours]
Introduction, Overview of Cognitive Radio Technology in 5G Wireless, Spectrum Optimisation using Cognitive Radio, Cognitive Radio and Carrier Aggregation, Energy- Efficient Cognitive Radio Technology Cognitive Radios to Mitigate Interference in Macro/femto Heterogeneous Networks, Cognitive Radio enabled Operations, Interference Coordination: Orthogonality in the Time/Frequency domain, Intra-tier Interference mitigation, Compressive sensing		
Unit No 5:	Trends in 5G	[8Hours]
5G NR, Carrier Aggregation in 5G, Open RAN, Use cases of 5G:eMBB, URLLC and mMTC, Advance applications: Robotic surgery, driverless car and Industrial IoT (IIoT), Tactile Internet, 5G-IoT applications, AR/VR in 5G		

Text Books

1.	Principles of Modern Wireless communication systems by Aditya k Jagannathan
2.	Robert W. Heath, Robert C. Daniel, James N. Theodore S. Rappaport, Murdock, "Millimeter Wave Wireless Communication", Prentice Hall, 2014.

Reference Books

1.	R. Vannithamby and S. Talwar, Towards 5G: Applications, Requirements and Candidate Technologies., John Willey & Sons, West Sussex, 2017
2.	Manish, M., Devendra, G., Pattanayak, P., Ha, N., 5G and Beyond Wireless Systems PHY Layer Perspective, Series in Wireless Technology Springer, 2021
3.	T. S. Rappaport, R. W. Heath Jr., R. C. Daniels, and J. M. Murdock, Millimeter Wave Wireless Communication., Pearson Education, 2015.

Final Year (Semester – VII)

Software Defined Radio

BTECA702	Software Defined Radio	PCC10	3L- 0T - 0P	3 Credits
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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:

Course Objectives:

1	The objective of this course is to provide knowledge of fundamental and state-of the art concepts in software defined radio.
2	To understand the various components of software-defined-radios with the understanding of their limitation and application of software-defined-solutions" to overcome such limitations
3	To Understanding the interplay of analog and digital signal processing for power as well as spectrum efficient transmission and reception of signal leads to an optimized, yet, practical radio solution.

Course Outcomes:

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

CO1	Explain the fundamentals of Software Defined Radio (SDR) including its need, characteristics, benefits, and design principles, and analyze RF implementation issues and key challenges in receiver design.
CO2	Analyze RF receiver and transmitter architectures used in SDR systems, and evaluate the effects of noise, distortion, and timing recovery techniques in the RF chain.
CO3	Demonstrate understanding of signal generation and processing in SDR, including direct digital synthesis (DDS), spurious signal analysis, hybrid DDS-PLL systems, and key parameters of data converters.
CO4	Explain the concept and algorithms of smart antennas and compare digital hardware platforms such as DSPs, FPGAs, and ASICs for beam-forming and SDR implementations.
CO5	Apply SDR concepts to real-world radio systems by analyzing power management issues, software architectures, mobile radio environments, and selected SDR case studies.

Course Contents:

Unit No 1:	Fundamentals of SDR:	[6 Hours]
Software Radios, Needs, Characteristics, Benefits, Design Principles of a Software Radio, Radio frequency implementation issues, Principal Challenge of Receiver Design		
Unit No 2:	RF and SDR:	[6 Hours]
RF Receiver Front-End Topologies, Enhanced Flexibility of the RF Chain with Software Radios, Transmitter Architectures and their issues, Noise and Distortion in the RF Chain, Timing Recovery in Digital Receivers Using Multirate Digital Filters		
Unit No 3:	Signals in SDR:	[5 Hours]
Approaches to Direct Digital Synthesis, Analysis of Spurious Signals, Spurious Components due to Periodic Jitter, Band-pass Signal Generation, Hybrid DDS-PLL Systems, Generation of Random Sequences, Parameters of data converters		

Unit No 4:	Smart Antennas:	[7 Hours]
Concept of Smart Antennas, Structures for Beam-forming Systems, Smart Antenna Algorithms, Digital hardware choices, Key Hardware Elements, DSP Processors, Field Programmable Gate Arrays, Trade-Offs in Using DSPs, FPGAs and ASICs.		
Unit No 5:	Case studies in Radio System:	[6Hours]
Power Management Issues, Object-oriented representation of radios and network resources, Mobile Application Environments, Joint Tactical Radio System, Case studies in software radio design		

Text Books

1.	Jeffrey H. Reed, “Software Radio: A Modern Approach to Radio Engineering”, Prentice Hall PTR; May 2002 ISBN: 0130811580
2.	Dillinger, Madani, Alonistioti (Eds.), “Software Defined Radio, Architectures, Systems and Functions”, Wiley 2003
3.	Bard, Kovarik, “Software Defined Radio, The Software Communications Architecture”, Wiley 2007

Reference Books

1.	Johnson, C.R. and W.A. Sethares, “Telecommunication Breakdown: Concepts of Communication Transmitted via Software-Defined Radio, Pearson Prentice Hall, 2004
2.	Bard, John and Kovarik, Vincent, “Software Defined Radio: The Software Communications Architecture”, Wiley Series in Software Radio, 2007

Final Year (Semester – VII)

Optical Fiber & Satellite Communication

BTECA703	Optical Fiber & Satellite Communication	PCC11	3L- T - P	3 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Pre-Requisites: Foundational understanding of electromagnetic theory (Maxwell's equations, wave propagation), basic semiconductor physics (pn-junctions, photonics), and core concepts of digital/analog communication systems.

Course Objectives:

1	After learning OFC course, students will get advantage to pursue higher studies or employment in core engineering/communication engineering companies.
2	To explore the knowledge in the area of LASERs and electro-optics.
3	To provide students with good depth of knowledge in radar and Satellite communication
4	Knowledge of theory and practice of advanced communication techniques
5	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	Learner will apply knowledge of mathematics to solve numerical based on step index and graded index fibers pertaining to MSI and MGI, SMSI.
CO2	Students will understand fiber performance parameters like NA, Group delay, Phase and Group velocity .They will understand optical transmission characteristics theoretically and practically.
CO3	Knowledge of theory and practice related to radar and Satellite communication
CO4	Ability to identify, formulate and solve engineering problems related to radar and Satellite communication.
CO5	The student would be able to analyze the various aspects of establishing a geo-stationary satellite communication link.

Course Contents:

Unit No 1:	Optical communication fundamentals	[6 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.		
Unit No 2:	Optical sources	[6 Hours]
LEDs: structure and its characteristics, Lasers: structure and its characteristics.		
Unit No 3:	Basic Principles	[8 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 orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping.		

Unit No 4:	Satellite Construction (Space Segment)	[8Hours]
Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification.		
Unit No 5:	Satellite Links	[8 Hours]
Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain.		

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

Reference Books

1.	Robert Gagliardi , "Satellite Communication" , CBS Publication.
2.	G. Agrawal, Nonlinear fiber optics, Academic Press, 2nd Ed, 1994.
3	G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1992.

Third Year (Semester – VII)

Advanced Antenna Technology

BTECA704A	Advanced Antenna Technology	PEC-4	3L- 1T -0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 4hrs./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Course Objectives:

1	To understand the applications of electromagnetic engineering.
2	To formulate and solve the Helmholtz wave equation and solve it for Uniform Plane Wave..
3	To analyse and understand the Uniform plane wave propagation in various media.
4	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	Understand fundamental of antennas.
CO2	Explain basics and types of wire antennas.
CO3	Analyse antenna array types and patterns.
CO4	Describe smart antenna concepts and beamforming.
CO5	Identify and compare practical antenna types and uses.

Course Contents:

Unit No 1:	Antenna Fundamentals	[8Hours]
Introduction, Types of Antennas, 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		
Unit No 2:	Wire Antennas	[6 Hours]
Wire Antennas: Analysis of Linear and Loop antennas: Infinitesimal dipole, small dipole, and finite length dipole half wavelength dipole, small circular loop antenna. Complete Analytical treatment of all these elements.		
Unit No 3:	Antenna Arrays	[8 Hours]
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, non-uniform amplitude, array factor, binomial and Dolph Chebyshev array. Planar Array, Circular Array, Log Periodic Antenna, Yagi Uda Antenna Array.		
Unit No 4:	Concepts of Smart Antennas	[7 Hours]
Introduction, Smart Antenna Analogy, Cellular Radio System Evolution, benefits and drawbacks of smart antennas, fixed weight beam forming basics, Antenna beamforming.		

Unit No 5:	Antennas and Applications	[8Hours]
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 & Lens antennas. Antennas with parabolic reflectors.		

Text Books

1.	C. A. Balanis, "Antenna Theory - Analysis and Design", John Wiley
2.	Mathew N O Sadiku, "Elements of Electromagnetics" 3rd edition, Oxford University Press
3.	John D Kraus, Ronald J Marhefka, Ahmad S Khan, Antennas for All Applications, 3 rd Edition, the McGraw Hill Companies

Reference Books

1.	K. D. Prasad, "Antenna & Wave Propagation", Satya Prakashan, New Delhi.
2.	. John D Kraus, "Antenna& Wave Propagation", 4th Edition, McGraw Hill, 2010.
3.	Vijay K Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, An Imprint of Elsevier, 2008.

Final Year (Semester – VII)

Industry 4.0

BTECA704B	Industry 4.0	PEC-4	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 4hrs./week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic knowledge of manufacturing systems / automation / computer fundamentals.

Course Objectives:

1	To explain the evolution and fundamentals of Industry 4.0.
2	To introduce enabling digital and automation technologies used in smart industries.
3	To develop understanding of smart manufacturing and digital production systems.
4	To familiarize students with industrial integration, standards, and cybersecurity.
5	To create awareness about applications, challenges, and future trends of Industry 4.0

Course Outcomes:

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

CO1	Explain the evolution, vision, and core principles of Industry 4.0.
CO2	Describe enabling technologies used in Industry 4.0.
CO3	Analyze smart manufacturing systems and digital production models.
CO4	Apply Industry 4.0 concepts to industrial case studies.
CO5	Evaluate challenges, standards, and future trends of Industry 4.0.

Course Contents:

Unit No 1:	Introduction and Foundations of Industry 4.0	[6 Hours]
Evolution of industrial revolutions (Industry 1.0 to Industry 4.0), Limitations of traditional manufacturing systems, Definition, vision, and objectives of Industry 4.0. Design principles: interoperability, real-time capability, decentralization, and information transparency. Smart factory concept and digital transformation. Economic and societal impact of Industry 4.0.		
Unit No 2:	Enabling Technologies of Industry 4.0	[6 Hours]
Cyber-Physical Systems (CPS): concept and architecture, Internet of Things (IoT) and Industrial IoT (IIoT). Smart sensors, actuators, and embedded systems, Cloud computing and edge computing in industrial applications, Big data sources and industrial data analytics overview, Introduction to Artificial Intelligence and Machine Learning for industry.		
Unit No 3:	Smart Manufacturing Systems	[6 Hours]
Smart manufacturing and digital production planning, Industrial automation and control in Industry 4.0. Robotics and collaborative robots (Cobots), Additive manufacturing (3D printing) and mass customization, Predictive maintenance and asset management concepts.		
Unit No 4:	Industrial Communication and System Integration	[6 Hours]
Industrial communication networks and requirements. Communication protocols: Modbus, PROFINET, EtherCAT, OPC-UA. Vertical and horizontal integration in manufacturing, Manufacturing Execution Systems (MES), Enterprise Resource Planning (ERP) integration, Smart		

supply chain and logistics integration, Introduction to cybersecurity issues in smart industries.		
Unit No 5:	Standards, Applications, and Future Trends	[6Hours]
Industry 4.0 reference architectures: RAMI 4.0 and IIRA. Implementation challenges: technical, economic, and organizational. Applications in automotive, electronics, healthcare, and energy sectors. Case studies of smart manufacturing systems, Introduction to Industry 5.0 and human-centric manufacturing, Skill requirements, employability, and career opportunities.		

Text Books

1.	Klaus Schwab, <i>The Fourth Industrial Revolution</i> , Crown Business.
2.	Alasdair Gilchrist, <i>Industry 4.0: The Industrial Internet of Things</i> , Apress.
3.	Ovidiu Vermesan and Joern P. Woyke, <i>Internet of Things Applications</i> , River Publishers.
4.	Lasi et al., <i>Industry 4.0</i> , Business & Information Systems Engineering.

Reference Books

1.	V. Maheshwari, <i>Industry 4.0 and Advanced Manufacturing</i> , McGraw-Hill.
2.	Shiyong Wang et al., <i>Cloud-Based Cyber-Physical Systems in Manufacturing</i> , Springer.
3.	Frank Lamb, <i>Industrial Automation: Hands On</i> , McGraw-Hill.

Final Year (Semester VII)

Wireless Sensor Networks

BTECA704C	WIRELESS SENSOR NETWORKS	PEC-4	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: hrs./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Objectives:

1	To understand the characteristics, basic concepts in Wireless sensor networks.
2	To understand the architecture framework and goals of WSN
3	To understand the Medium Access control and its protocols
4	To understand the routing metrics and network layer protocols

Course Outcomes:

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

CO1	Describe the overview of wireless sensor networks and enabling technologies for wireless sensor networks
CO2	Apply the design principles of WSN architectures and operating systems for simulating environment situations.
CO3	Apply various concepts for assignment of MAC addresses.
CO4	Select the appropriate infrastructure, topology, joint routing and information aggregation for wireless sensor networks
CO5	Analyse the sensor network platform and tools state-centric programming.

Course Contents:

Unit No 1:	OVERVIEW OF WIRELESS SENSOR NETWORKS:	[6 Hours]
Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.		
Unit No 2:	ARCHITECTURES:	[6 Hours]
Network Architecture- Sensor Networks Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments- Introduction to Tinos and NECs- Internet to WSN Communication		
Unit No 3:	NETWORKING SENSORS:	[5 Hours]
MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy Efficient Routing, Geographic Routing		
Unit No 4:	INFRASTRUCTURE ESTABLISHMENT:	[7 Hours]
Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.		

Unit No 5:	SENSOR NETWORK PLATFORMS AND TOOLS:	[6Hours]
Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.		

Text Books

1.	Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2.	Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007
3.	Waltenegus Dargie, Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks - Theory And Practice", John Wiley & Sons Publications, 2011

Reference Books

1.	Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.
2.	Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003

Third Year (Semester – VII)

VLSI Testing and Verification

BTECA704D	VLSI Testing and Verification	PEC-4	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1hr/week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basics of Digital Electronics and Analog circuits .

Course Objectives:

1	In this course students will learn test economics, fault modelling, and logic and fault simulation, ATPG concepts for combinational and sequential circuit
2	Students will also able to write testbench for the complex VLSI design using System Verilog.

Course Outcomes:

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

CO1	Acquire knowledge about fault modelling and collapsing
CO2	Learn about various combinational automatic test pattern generation techniques.
CO3	Learn about various sequential automatic test pattern generation techniques.
CO4	Analyze different memory faults and its testing methods
CO5	Develop the verification plan for the small to complex VLSI designs.

Course Contents:

Unit No 1:	Testing in VLSI design	[8 Hours]
Role of testing in VLSI design, issues in test and verification of complex chips, VLSI test process and equipment, Test economics, Yield analysis and product quality. Verification guidelines: Verification Process, Basic Testbench functionality, directed testing, Methodology basics, Constrained-Random stimulus, Functional coverage, Testbench components, Layered testbench, Building layered testbench, Simulation environment phases, Maximum code reuse, Testbench performance.		
Unit No 2:	Data types	[7Hours]
Built-in data types, Fixed-size arrays, Dynamic arrays, Queues, Associative arrays, Linked lists, Array methods, Choosing a storage type, Creating new types with type definition , Creating user-defined structures, Type conversion, Enumerated types, Constants strings, Expression width.		
Unit No 3:	ATPG for combinational circuit	[7 Hours]
D-Algorithm, Boolean Difference, PODEM, Random, Exhaustive and Weighted Test Pattern Generation, Aliasing and its effect on Fault coverage. ATPG for sequential circuits: ATPG for Single-Clock Synchronous Circuits, Time frame expansion method, Simulation-Based Sequential Circuit ATPG.		
Unit No 4:	Memory testing and BIST	[7 Hours]
Permanent, Intermittent and pattern sensitive faults, March test notion, Memory testing using march tests, PLA testing, Ad-Hoc DFT methods, Scan design, Partial scan design, Random logic for BIST, Memory BIST		

Unit No 5:	Verification:	[7Hours]
Design verification techniques based on simulation, Analytical and formal approaches, Functional verification, Timing verification, Formal verification, Basics of equivalence checking and model checking, Hardware emulation. Hardware verification language: Introduction to System Verilog, Development of stimulus generator, Monitor and complete test bench using System Verilog		

Text Books

1.	Chris Spears, “ System Verilog for Verification”, Springer, 2nd Edition 2Kluwer Academic Publishers
2.	. M. Bushnell and V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits",

Reference Books

1.	M. Abramovici, M. Breuer, and A. Friedman, Digital System Testing and Testable Design, IEEE Press, 1994 2. 3.. 4. 5
2.	Diraj K. Pradhan, “Fault Tolerant Computer System Design”, Prentice Hall.
3	L. T. Wang, C. W. Wu, and X. Wen, VLSI Test Principles and Architectures, Morgan Kaufmann, 2006
4	System-on-a-Chip Verification-Methodology and Techniques, P. Rashinkar, Paterson and L. Singh, Kluwer Academic Publishers, 2001
5	. Janick Bergeron, “Writing test benches functional verification of HDL models” Kluwer Academic Publishers, 2002

Final Year (Semester – VII)

PLC & Automation

BTECA705A	PLC & Automation	OEC-3	3L- 1T - 0P	Credits 4
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Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1hr/week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites:

Course Objectives:

1	Ability to recognize industrial control problems suitable for PLC control
2	An overview of technology of advanced topics such as SCADA, DCS Systems, Digital Controller, CNC Machines.
3	The ability to select the essential elements and practices needed to develop and implement Engineering Automation using PLC approach.
4	Understand concept Of Human Machine Interface

Course Outcomes:

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

CO1	Understand PLC architecture, PLC addressing concepts.
CO2	Develop PLC ladder programs for simple industrial applications.
CO3	Design Automation systems for industrial applications.
CO4	Design basic concept of Human Machine Interface
CO5	Understand SCADA & DCS

Course Contents:

Unit No 1:	Process Control & Automation:	[6 Hours]
Process control principles, Servomechanisms, Control System Evaluation, Analog control, Digital control, Types of Automation; Architecture of Industrial Automation Systems, Advantages and limitations of Automation, Effects of modern developments in automation on global competitiveness.		
Unit No 2:	Transmitters and Signal Conditioning	[6 Hours]
Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for RTD, Thermocouple, DPT etc, Smart and Intelligent transmitters		
Unit No 3:	Controllers and Actuators	[7Hours]
. PID Controller, Cascade PID control, Microprocessor Based control, PAC (Programmable Automation controller), Mechanical switches, Solid state switches, Electrical actuators: Solenoids, Relays and Contactors, AC Motor, VFD, energy conservation schemes through VFD, DC Motor,		

BLDC Motor, Stepper Motor, Servo Motor, Pneumatic and hydraulic actuators.		
Unit No 4:	PLC and Human Machine Interface (HMI)	[7 Hours]
Functions of PLC, Advantages, Architecture, working of PLC, Selection of PLC, Networking of PLCs, Ladder Programming, Interfacing Input and Output devices with PLC, PLC based automated systems. High frequency inputs. PLC programming standard IEC61131, Soft PLC techniques. IT Interfaces required: for ERP, MIS, MES. Supporting Applications interfaces: RFID, Barcode, Vision Systems. HMI: Block Diagram, Types, Advantages, Applications.		
Unit No 5:	SCADA & Distributed control system	[8Hours]
Elements of SCADA, Features of SCADA, MTU- functions of MTU, RTU- Functions of RTU, Applications of SCADA, Communications in SCADA- types & methods used, Mediums used for communication, Introduction to DCS, Architecture of DCS, Input and output modules, communication module, Specifications of DCS. Introduction of CNC Machines: Basics and need of CNC machines, NC, CNC and DNC (Direct NC) systems, Structure of NC systems, Applications of CNC machines in manufacturing		

Text Books

1.	Curtis Johnson, “Process Control Instrumentation Technology”; 8th Edition, Pearson Education.
2.	Madhuchhanda Mitra, Samarjit Sen Gupta, “Programmable Logic controllers and Industrial Automation”; Penram International Publishing India Pvt. Ltd.
3.	Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication

Reference Books

1.	Kilian, “Modern control technology: components & systems, Delmar 2nd edition.
2.	Bela G Liptak, Process software and digital networks, 3rd edition, 2002. Pollack. Herman, W & Robinson., T. “Computer Numerical Control”, Prentice Hall. NJ

Third Year (Semester –VII)

Web Development

BTECA705B	Web Development	OEC-3	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3hrs./week Tutorial: 1hr/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
5	Fundamentals of web essentials and markup languages

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	[6 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	[6 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	[5 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	[7 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	[6Hours]
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.		

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.

Third Year (Semester –VII)

Deep Learning & Computer Vision

BTECA705C	Deep Learning & Computer Vision	OEC-3	3L- 1T - 0P	4 Credits
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Teaching Scheme	Examination Scheme
Lecture: 3hrs./week Tutorial: 1hr/week	Continuous Assessment : 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks (Duration 03 hrs.)

Pre-Requisites: Basic knowledge of linear algebra and calculus, Image processing fundamentals, Programming skills in Python.

Course Objectives:

To acquire a comprehensive understanding of Computer Vision principles and techniques, enabling the development of advanced image processing, recognition systems, and visual perception applications

Course Outcomes:

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

CO1	Demonstrate a solid understanding of fundamental computer vision & image processing concepts.
CO2	Apply various computer vision algorithms and techniques in image processing.
CO3	Apply various computer vision algorithms and techniques to solve real-world engineering problems, such as object recognition, motion analysis, and texture.
CO4	Analyze and interpret results obtained from computer vision algorithms, and critically evaluate their performance and limitations
CO5	Implement and evaluate computer vision algorithms using programming languages and libraries commonly used in the field, such as Python and OpenCV

Course Contents:

Unit No 1:	Introduction to Computer Vision & Image Processing	[6 Hours]
Introduction to computer vision and its applications, Image representation, image processing operations, Image filtering & convolution. Image enhancement: Contrast stretching, Histogram specification, Adaptive Histogram Equalization (AHE), Wavelet-based enhancement. Image Filtering: Smoothing: Linear Filter (Box filter, Gaussian Filter) & Non-linear Filter: Median, Mini. & Max.), Sharpening: Laplacian Filter.		
Unit No 2:	Image Transformation & Restoration	[6 Hours]
Image Transformation: Definition & its properties (scaling, rotation), DFT, DCT, DST, Walsh-Hadamard Transform, Slant Transform, Haar Transform. Image Restoration: Noise model, Types of Noise: Gaussian, Rayleigh, Erlang, Exponential, Uniform, salt & Pepper noise. Restoration Filtering: Mean Filter (Arithmetic, Geometric, Harmonic, Contra Harmonic), Median Filter, Midpoint Filter.		
Unit No 3:	Segmentation, Texture & Motion Analysis	[5 Hours]
Segmentation: Edge Detection (Prewitt, Sobel, Canny), Optimum Edge Detection, Thresholding techniques, Region-based segmentation. Texture Analysis: Introduction to texture in images, Statistical texture analysis methods: Gray Level Co-occurrence Matrix (GLCM), Local Binary Patterns (LBP); Filter-based texture analysis methods: Gabor filters, Laws' texture energy measures; Texture-based segmentation. Motion Analysis: Optical flow estimation, Lucas-Kanade method, Horn-Schunck method, Background		

subtraction, Dense optical flow using Deep Learning (FlowNet), Motion-based segmentation.		
Unit No 4:	Feature Matching Algorithms	[7 Hours]
Feature Extraction: SIFT (Scale-Invariant Feature Transform), SURF (Speeded-Up Robust Features), BRISK (Binary Robust Invariant Scalable Keypoints). Feature Representation: Building a dataset with extracted features, feature vector representation by Bag-of-words, vector quantization. Feature Classification: SVM, KNN, Random forest.		
Unit No 5:	Computer Vision with Deep Learning	[6Hours]
Image classification: CNN, Attention models, Vision transformation. Generative Models: GAN. Object detection: Regions with CNN, Fast R-CNN, Faster R-CNN & Mask R-CNN, SSD, YOLO. Semantic Segmentation using U-Net, Centroid based object tracking		

Text Books

1.	Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press
2.	Computer Vision: Algorithms & Applications, R. Szeleski, Springer. Computer vision: A modern approach: Forsyth and Ponce, Pearson.

Reference Books

1.	David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.
2.	Richard Hartley, Andrew Zisserman, Multiple View Geometry in Computer Vision, 2004.

Third Year (Semester –VII)

Android Programming

BTECA705D	Android Programming	OEC-3	3L- 1T - 0P	4Credits
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Teaching Scheme	Examination Scheme
Lecture: hrs./week Tutorial: 1hr/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	To understand the fundamentals of mobile technologies and the Android platform
2	To design and implement user interfaces in Android using activities, layouts, views, fragments
3	To enable communication between Android components using intents and broadcast receivers, and to manage application data using files and shared preferences.
4	To develop data-driven Android applications using SQLite databases, content providers, and integrate cloud-based services like Firebase and web services.
5	utilizes Android device features such as telephony, messaging, Bluetooth, network services, and Google Maps for building feature-rich mobile applications.

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 No 1:	Introduction to Android	[6 Hours]
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 No 2:	User Interface, Activities	[6 Hours]
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 No 3:	Intents, Broadcast Receivers and Files	[5 Hours]
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 No 4:	Database and Content Providers	[7 Hours]
Introducing Android Databases, Introducing SQLite, Cursors and content values, working with SQLite Database, Creating new content Provider. SQLite Open Helper and create a database. Opening and closing a database, working with cursors, Inserts, updates, and deletes. Native Content Providers: Content provider types, search for content, Adding, changing, and removing content, Native Android Content Providers, Accessing Contact Book, Calendar. Introduction to Firebase, Real time/Cloud, Authentication in firebase.		
Unit No 5:	Telephony, Hardware and Network Services	[6Hours]
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.		

Text Books

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

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

Final Year (Semester – VII) Foreign Language Studies

BTECA706A	Foreign Language Studies	HSSMEC-6	L- T - 4P	AUDIT
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Teaching Scheme	Examination Scheme
Practical: 4hrs./week	Audit

Pre-Requisites:

Course Objectives:

1	To introduce students to the German alphabet, pronunciation, and basic sentence structures.
2	To develop basic listening, speaking, reading, and writing skills in German.
3	To enable students to communicate in simple everyday situations using commonly used expressions.
4	To build elementary grammatical competence for forming simple sentences.
5	To provide introductory knowledge of German culture and social etiquette.

Course Outcomes:

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

CO1	Understand and use simple everyday expressions and phrases in German.
CO2	Introduce themselves and others and exchange basic personal information.
CO3	Students will be able to construct grammatically correct simple sentences.
CO4	Participate in short, simple conversations related to daily life situations.
CO5	Students will be able to read short texts and write simple messages and forms in German.

Course Contents:

Unit No 1:	Introduction to German Language and Phonetics	[6 Hours]
German alphabet and pronunciation rules, Phonetics, stress patterns, vowels, consonants, umlauts, and diphthongs, Greetings, forms of address, and leave-taking expressions, Self-introduction and personal details, Numbers, days, months, time expressions.		
Unit No 2:	Basic Grammar and Sentence Structure	[6 Hours]
Nouns, definite and indefinite articles, and gender identification, Plural forms of nouns, Personal pronouns, Present tense of regular and common irregular verbs, Sentence structure, word order, formation of questions, and negation.		
Unit No 3:	Vocabulary Development and Functional Language Skills	[6 Hours]
Vocabulary related to family, relationships, and professions. Vocabulary for daily activities and routine actions. Food, beverages and household objects. Common adjectives and descriptive words. Sentence framing, simple dialogues, idiomatic expressions, and contextual vocabulary usage.		
Unit No 4:	Reading, Writing Skills, and Applied Grammar	[6 Hours]
Reading comprehension of short texts, notices, advertisements, and simple emails. Writing short sentences, guided paragraphs, and personal messages. Modal verbs and their usage. Prepositions of place and time. Separable verbs, conjunctions, and applied grammar practice.		

Unit No 5:	Cultural Orientation and Practical Communication	[6Hours]
Introduction to German culture, traditions, and festivals, Social etiquette and formal–informal communication, Polite expressions and conversational norms, Situational dialogues and role-play activities, Listening practice and cross-cultural communication exercises.		

Text Books

1.	Netzwerk Neu A1 – Kursbuch and Arbeitsbuch, Klett Verlag.
2.	Studio d A1 – Deutsch als Fremdsprache, Cornelsen Verlag.

Reference Books

1.	Menschen A1 – Kursbuch and Arbeitsbuch, Hueber Verlag.
2.	Schritte International Neu A1, Hueber Verlag.
3.	Hammer's German Grammar and Usage, Hodder Education.

Other Reference Materials

1. Goethe-Institute online learning resources.
2. Deutsche Welle – Nicos Weg A1 online course.
3. Mobile applications: Duolingo, Quizlet, Anki.
4. YouTube channels: Easy German, Deutsch für Euch, Learn German.

Final Year (Semester – VII) Universal Human Values & Ethics

BTECA706B	Universal Human Values & Ethics	HSSMEC-6	0L- 0T - 4P	Audit
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Teaching Scheme	Examination Scheme
Practical: 4hrs./week	Audit

Pre-Requisites:

Course Objectives:

1.	To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2.	To facilitate the development of a Holistic perspective among students towards life and profession.
3.	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

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

CO1	The students start exploring themselves: get comfortable with each other and with the teacher; they start appreciating the need and relevance for the course.
CO2	The students can see that all physical facility they are required for a limited time in a limited quantity.
CO3	The students can note that the natural acceptance (intention) is always for living in harmony, only competence is lacking! The students can see that respect is right evaluation, and only right evaluation leads to fulfillment in relationship.
CO4	The students can differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them.
CO5	The students can present sustainable solutions to the problems in society and nature.

Course Contents:

Unit No 1:	Introduction to Value Education	[8 Hours]
Understanding Value Education : - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity– Current Scenario - Method to Fulfill the Basic Human Aspirations		
Unit No 2:	Harmony in the Human Bein	[7 Hours]
Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self-understanding Harmony in the Self		

- Harmony of the Self with the Body - Programme to Ensure self-regulation and Health		
Unit No 3:	Harmony in the Family and Society	[8 Hours]
Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship - the Foundational Value in Relationship - 'Respect' – as the Right Evaluation - Understanding Harmony in Society - Vision for the Universal Human Order		
Unit No 4:	Harmony in the Nature (Existence)	[7 Hours]
Understanding Harmony in Nature - Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature - Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence		
Unit No 5:	Implications of the Holistic Understanding a-Look at Professional Ethics	[7 Hours]
Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics		

Text Books

1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1.	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
4.	Small is Beautiful - E. F Schumacher.
5.	Economy of Permanence - J C Kumarappa
6.	Bharat Mein Angreji Raj - PanditSunderlal

Final Year (Semester –VII) Intellectual Property Rights

BTECA706C	Intellectual Property Rights	HSSMEC-6	0L- 0T - 4P	AUDIT
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Teaching Scheme	Examination Scheme
Practical: 4hrs./week	AUDIT

Course Objectives:

1	To explore the historical development and significance of patents in fostering innovation.
2	To familiarize students with the legal frameworks governing patents.
3	To Identify and evaluate the criteria for patentability, including novelty, nonobviousness, and industrial applicability.
4	To understand the role of prior art in the patent examination process.
5	To understand the challenges and opportunities associated with filing patents globally.

Course Outcomes:

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

CO1	Grasp the significance of IPR and its historical context.
CO2	Demonstrate proficiency in patent categorization and practical patent procedures.
CO3	Utilize patent databases effectively.
CO4	Stay updated on the latest IPR developments, especially in biological systems and computer software.
CO5	Apply acquired knowledge and problem-solving skills to real-world cases related to patents and IPR.

Course Contents:

Unit No 1:	Overview of Intellectual Property Patents	[8 Hours]
Introduction of IPR, Need for intellectual property right (IPR), IPR in India – Genesis and Development IPR in abroad.		
Unit No 2:	Patents	[7 Hours]
Designs, Trade and Copyright, Classification of patents in India, Categories of Patent, Special Patents, Patent document, Granting of patent, Rights of a patent, Patent Searching, Patent Drafting, filing of a patent, different layers of the international patent system, Utility models.		
Unit No 3:	Patent Rights	[7 Hours]
Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.		
Unit No 4:	New Developments in IPR	[7 Hours]
Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge, Case Studies.		
Unit No 5:	Case studies	[7 Hours]
Case studies related to patents and IPR		

Text Books

1.	Feroz Ali, The Law of Patents, LexisNexis
2.	Ronald D. Slusky, Invention Analysis and Claiming – A Patent Lawyer’s Guide, Second Edition, American Bar Association, 2012.

Reference Books

1.	Feroz Ali, The Touchstone Effect – The Impact of Pre-grant Opposition on Patents, LexisNexis, 2009.
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Final Year (Semester –VII)

5G Technology Lab

BTECA707	5G Technology Lab	LC13	0L-0T-2P	1 Credits
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Teaching Scheme	Examination Scheme
Practical: 02 hrs./week	Continuous Assessment : 30 Marks End Semester Examination: 20 Marks

(Minimum 08 to 10 experiments are to be performed based on contents in syllabus)

List of Experiments:

Study of evolution from 1G to 5G communication systems.

1. Study of evolution from 1G to 5G communication systems.
2. Study of 5G network architecture and components.
3. Analysis of millimeter wave (mm Wave) communication in 5G.
4. Study of Massive MIMO technology in 5G networks.
5. Simulation of beamforming techniques used in 5G.
6. Study of OFDM (Orthogonal Frequency Division Multiplexing) in 5G communication.
7. Analysis of latency and bandwidth in 5G networks.
8. Study of IoT integration with 5G technology.
9. Simulation of handoff and mobility management in 5G.
10. Study of network slicing concept in 5G.

Final Year (Semester – VII) Software Defined Radio Lab

BTECA708	Software Defined Radio Lab	LC14	0L-0T -2P	1 Credits
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Teaching Scheme	Examination Scheme
Lab : 2 hrs./week	Continuous Assessment : 30 Marks End Semester Exam: 20 Marks

(Minimum 08 to 10 experiments are to be performed based on contents in syllabus)

List of Experiment: -

1. Study of SDR Architecture and GNU Radio Environment
2. Design and Simulation of AM/FM Receiver using GNU Radio
3. Analysis of RF Receiver Front-End Topologies
4. Noise and Distortion Measurement in RF Chains
5. Timing Recovery Using Digital Filters
6. Direct Digital Synthesis (DDS) Signal Generation
7. Analysis of Spurious Signals and Jitter Effects in DDS
8. Generation and Analysis of Pseudo-Random Sequences
9. Simulation of Smart Antenna Beamforming Algorithms
10. SDR-Based Spectrum Monitoring using RTL-SDR
11. Comparative Study of DSP, FPGA and ASIC Based SDR Implementations
12. Case Study: Design of a Software Defined Radio Communication System

Final Year (Semester – VII) Optical Fiber Communication Lab

BTECA709	Optical Fiber Communication Lab	LC15	0L-0T-2P	1 Credits
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Teaching Scheme	Examination Scheme
Practical: 02 hrs./week	Continuous Assessment : 30 Marks End Semester Examination: 20 Marks

Minimum 08 to 10 experiments are to be performed based on contents in syllabus)

List of Experiments:

1. Study of Optical Fiber Components – Identify core, cladding, jacket, numerical aperture.
2. Measurement of Numerical Aperture (NA) – Using laser source and fiber setup.
3. Light Propagation Experiments – Observing ray paths and total internal reflection in fibers.
4. Study of Fiber Types – Single-mode vs multi-mode, step-index vs graded-index fibers.
5. LED Characteristics – V-I characteristics, output power vs current, emission spectrum.
6. Laser Diode Characteristics – Threshold current, power vs current, and wavelength measurement.
7. PIN Photodiode Characteristics – Responsivity, output current vs optical input.
8. Noise Measurement in Photodetectors – Shot noise and thermal noise measurements.
9. Optical Receiver Setup – Study of basic receiver operation using LED/laser source and photodiode.
10. TDR Experiment – Measure attenuation and locate faults in fiber.
11. Fiber Splicing and Connectorization – Practice joining fibers and measuring insertion loss.
12. Study of Optical Amplifiers (EDFA/Raman) – Demonstrate signal amplification in lab setup (simulation if real amplifiers unavailable).

Final Year (Semester –VII) Project

BTECA710	Project	PROJ	0L- 0T - 4P	2 Credits
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Teaching Scheme	Examination Scheme
Practical: 04 hrs./week	Continuous Assessment : 60 Marks End Semester Exam: 40 Marks Total : 100 Marks

Guidelines for 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 be in their University / College / nearby vicinity.
2. Do the literature survey
3. Design the solutions
4. Implement solution using latest technology
5. Write 20-45 pages report (use of latex is more suitable).
6. Present / demonstrate the solution in front of faculty members
7. The students shall prepare his report and execution of projects for other students of his class in the presence of his guide and examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment:

The Continues Assessment for this head will 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.

Final Year (Semester –VII) Internship – III (Evaluation) /MOOC

BTECA711	Internship – III / MOOC	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. Students 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.

Those students who fails, they can also complete online certification courses which are available at free of cost on various MOOC platforms.

Final Year (Semester –VIII) Project Work /Internship

BTECA801	Project Work /Internship	Project/Internship	12 Credit
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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 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 be in their University / College / nearby vicinity.
2. Do the literature survey
3. Design the solutions
4. Implement solution using latest technology
5. Write 20-45 pages report (use of latex is more suitable).
6. Present / demonstrate the solution in front of faculty members
7. The students shall prepare his report and execution of projects for other students of his class in the presence of his guide and examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment:

The Continues Assessment for this head will 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.

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.
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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.
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