Dr. Babasaheb Ambedkar Technological University (Established a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
P.O. Lonere, Dist. Raigad, Pin 402 103,
Maharashtra Telephone and Fax. 02140 - 275142 www.dbatu.ac.in
www.dbatu.ac.in

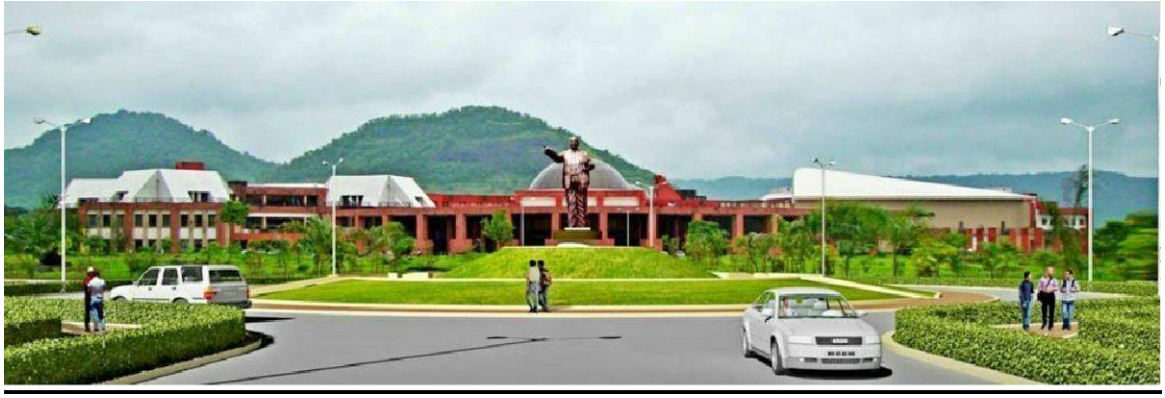
PROPOSED CURRICULUM OF

UNDER GRADUATE PROGRAMME

B. TECH

5G/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:

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

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

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

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

EVALUATION SYSTEM:

1. Absolute grading system based on absolute marks as indicated below will be implemented from academic year 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 ≥ 5.50 & < 6.00	Second Class
CGPA ≥ 6.00 & < 7.50	First Class
CGPA ≥ 7.50	Distinction
[Percentage of Marks =CGPA*10.0]	

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

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

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

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

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

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

5. Description of Grades:

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

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

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

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

6. Evaluation of Performance:

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.

B. Tech. in 5 G / Electronics & Communication (Advanced Communication Technology)

Different Categories of Courses and Credits for Degree Requirements

a) Humanities and Social Science including Management Courses

Sr. No.	Course Code	Course Name	(L-T-P) Credits
1	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 –1 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

5G/ 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

5G/ Electronics & Communication (Advanced Communication Technology)

Semester IV (Term 4)										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				
			L	T	P	CA	MSE	ESE	Total	Credit
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**	**100**	**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

5G/ 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**

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Course Structure for Third Year

5G/ 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

Course Structure for Final Year

5G/ 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**

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Course Structure for Final Year

5G/ 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 Social Science including Management Courses

Second Year (Semester –III)

Engineering Mathematics-III

BTECA301	Engineering Mathematics-III	BSC	3L- 1T -0P	4 Credits

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

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

1	Transforms such as Fourier transform, Laplace transform and applications to Advance Communication systems and Signal processing.
2	To study partial differential equations to apply it in computer and electronics engineering.
3	Complex functions, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing.

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

CO1	Understand the concept & apply the concepts and properties of Laplace transformation.
CO2	Apply the concepts of inverse Laplace Transform with its property to solve Linear Differential Equation with given initial conditions.
CO3	Solve problems related to Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
CO4	Understand the concepts of PDE and applications.
CO5	Analyse conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

UNIT-I: Laplace Transform [09 Hours]

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

UNIT-II: Inverse Laplace Transform [09 Hours]

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

UNIT-III: Fourier Transform [09 Hours]

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

UNIT-IV: Partial Differential Equations and Their Applications [09 Hours]

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange‟s linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation ($\frac{6u}{6t} = c^2 \frac{6^2u}{6x^2}$) , and one dimensional wave equation (i.e. $\frac{6^2y}{6t^2} = c^2 \frac{6^2y}{6x^2}$.

UNIT-V: Unit 5: Functions of Complex Variables [09Hours]

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

TEXT BOOKS:

1. Higher Engineering Mathematics,B. S. Grewal ,Khanna Publishers, New Delhi
2. A Course in Engineering Mathematics (Vol III), Dr. B. B. Singh, Synergy Knowledge ware, Mumba
3. A Text Book of Applied Mathematics (Vol I & II), P. N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune
4. Higher Engineering Mathematics, H. K. Das and Er. RajnishVerma ,S. Chand & CO. Pvt. Ltd., New Delhi

REFERENCES:

1. Higher Engineering Mathematics, B. V. Ramana, Tata McGraw-Hill Publications, New Delhi
2. A Text Book of Engineering Mathematics, Peter O‟ Neil, Thomson Asia Pte Ltd., Singapore
3. Advanced Engineering Mathematics, C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi
4. Integral Transforms and Their Engineering Applications, Dr. B. B. Singh, Synergy. Knowledge ware, Mumbai

Second Year (Semester –III)
Analog Circuits

BTECA302	**Analog Circuits**	**PCC1**	**3L- 1T -0P**	**4 Credits**

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

Pre-Requisites: Basic Semiconductor theory.

Course Objectives:

1	To acquaint the students with construction, theory and characteristics of various electronic devices.
2	To emphasis on design of basic electronic circuits.
3	To impart knowledge of working principles of Op-amp & its applications.
4	To study various op-amp parameters and their significance for Op-Amp
5	To emphasize the features and advantages of integrated circuits.

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

CO1	Discuss operation, biasing and applications of BJT, JFET & MOSFET.
CO2	Understand circuit and test the performance.
CO3	Understand the basic concepts related to Op-amp
CO4	Understand the characteristics Op-Amp and identify the internal structure.
CO5	Analyze and identify linear and nonlinear applications of Op-Amp.

Course Contents:

UNIT – I. Bipolar Junction Transistor: [07 Hours]

BJT: construction, working, characteristics, Transistor as switch, Transistor configurations, Current gain equation, stability factor.

BJT Biasing and basic amplifier configurations: Need for biasing BJT, Transistor biasing methods, Transistor as amplifier, Analysis of Single Stage Amplifier, RC coupled Amplifiers, Effects of bypass and coupling capacitors, Frequency response of CE amplifier.

UNIT-II. Junction Field Effect Transistor and MOSFET [8Hours]

FET-Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison.

MOSFET- Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters.

UNIT – III. Operational amplifier [08 Hours]

Block diagram of Op-Amp, differential amplifier configurations using BJT, constant current source, level shifting, transfer characteristics, frequency response, study of ICuA741, Op-Amp parameters, Inverting and non-inverting amplifiers

UNIT – IV. Linear applications of Op-Amp: [07 Hours]

Theory & Design of scaling, summing, differential amplifier, integrator and differentiator, sinusoidal RC oscillators: RC-phase shift, Wein bridge oscillator using IC 741.

UNIT-V. Non-linear Applications of OP-AMP [07 Hours]

Theory & Design of Op-amp IC 741 based comparator, zero-crossing detector, window detectors, Schmitt trigger, astable multivibrator as square and triangular wave generator, monostable multivibrator

TEXT BOOKS:

1. Boylestad & Nashelsky, Electronics Devices & Circuits, Pearson Education

2.Millman Halkias, –Integrated Electronics-Analog and Digital Circuits and Systems‖, Tata McGraw Hill, 2000.

3. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.

REFERENCE BOOKS:

1. D. A. Neamen, Semiconductor Physics and Devices (IRWIN), TMH Education Group, Chicago) 1997

2. Salivahanan and Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill, India 2008.

3. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition

Second Year (Semester –III)

Analog Communication and Signals & Systems

BTECA303	**Analog Communication and Signals & Systems**	**PCC2**	**3L- 0T -0P**	**3 Credits**

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

Course Objectives:

1	To introduce the concepts of analog communication systems.
2	To equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance
3	To understand the mathematical description of continuous and discrete time signals And systems.
4	To classify signals into different categories.

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

CO1	Understand and identify the fundamental concepts and various components of analog Communication systems.
CO2	Understand the concepts of modulation and demodulation techniques.
CO3	Design circuits to generate modulated and demodulated wave.
CO4	Understand mathematical description and representation of continuous and discrete time signals and systems.
CO5	Develop input output relationship for linear shift invariant system and understand the Convolution operator for continuous and discrete time system.

UNIT-I: Introduction to Communication System [7Hrs]

Block schematic of communication system, Simplex and duplex systems, Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation, sampling theorem and pulse analog modulation, multiplexing: TDM, FDM.

UNIT-II: Amplitude Modulation [7Hrs]

Introduction, Mathematical analysis and expression for AM, Modulation index, Frequency spectrum and bandwidth of AM, Power calculations, Generation of AM using nonlinear property, Low and high level modulation, Balance Modulator. Types of AM: DSB-FC, DSB-SC, SSB-SC, ISB and VSB, their generation methods and comparison

UNIT-III: Angle Modulation [7Hrs]

Introduction, Mathematical analysis of FM and PM, Modulation index for FM and PM, Frequency spectrum and bandwidth of FM, Narrow band and wide band FM, Direct and indirect methods of FM generation, Pre emphasis and de-emphasis, Comparison of AM, FM and PM.

UNIT-4: Introduction to Signal and System **[8Hrs]**

Signals and systems as seen in everyday life, and in various branches of engineering and science. Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift invariance, causality, stability

UNIT-V: Laplace Transform **[8 Hrs]**

Laplace Transform: Laplace Transform, Region of convergence, Inverse Laplace transforms Application of Laplace transform for determination of solution of differential equation and systems realization up to second order, analysis of RC, RL and RLC networks. Frequency response of LTIC system.

TEXT BOOKS:

1.Kennedy, "Electronics Communications Systems", McGraw-Hill New Delhi-1997, 4th Edition.
2. Anokh Singh, "Principles of communication engineering" S.Chand
3. Roddy & Coolen, "Electronic communication" PHI
4. Taub & Schilling "Principles of communication systems" Tata Mc Graw Hill Alan V. *Oppenheim*. Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”, PHI
5. Dr. S. L. Nalbalwar, A.M. Kulkarni and S.P. Sheth, “Signals and Systems”, 2nd Edition,
6. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, Wiley India.

REFERENCE BOOKS:

1. Beasley & Miller, "Modern Electronic Communication", Prentice-Hall India-2006, 8th Edition.
2. Wayne Tomasi, "Electronic Communication Systems", Pearson Education-2005, 5th Edition.
3. Shaila Apte, “Signals and Systems-principles and applications”, Cambridge University press, 2016.
4. Mrinal Mandal and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press, 2007.

Second Year (Semester –III)
Digital Electronics & Microprocessor

BTECA304	**Digital Electronics & Microprocessor**	**ESC11**	**3L- 1T -0P**	**4 Credits**

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

Course Objectives:

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

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

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

CO1	Became familiar with the digital signal, positive and negative logic, Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and their conversion from others
CO2	Learn the working mechanism and design guidelines of different combinational Circuits and their role in digital system design.
CO3	Understand the working mechanism and design guidelines of different sequential circuits and their role in the digital system design
CO4	Understand the working mechanism and design guidelines of different sequential circuits and their role in the digital system design
CO.5	Describe, list and use memory mapping and address decoding technique. Develop assembly language programs for microprocessor and its peripherals.

Unit 1: Introduction **[09 Hours]**

Boolean Algebra, Laws of Boolean Algebra, Number systems and their conversions, BCD code, Octal Code, Hexadecimal code, Excess-3 code, Gray code, 1s & 2s complement, Logic gates, Standard form of logic functions, K-Map up to 4 variables, Don‟t Care Condition and its effect, Simplification of logic expressions using K-Map & its realization.

Unit 2: Combinational Circuits **[08 Hours]**

Combinational logic design using 74XX/54XX MSI chip series concerning to MUX, DEMUX, Decoders, Code Converters, Comparators, Parity Generator/Checker, Encoders, Priority Encoder and BCD to Seven Segment Decoder.

Unit 3: Sequential circuits and systems **[07 Hours]**

1-bit memory cell, Types of flip flops: R-S, J-K, Master slave J-K, D-type, T-type. Clocked SR FF, Use of preset and clear terminals, Shift Registers: SISO, SIPO, PISO, PIPO. Clock: Level & Edge Triggering, Counters: Asynchronous and Synchronous counter, up/down counter. Finite State Machines (FSM) Models – Moore and Mealy.

Unit 4: Fundamentals of Microprocessors **[08 Hours]**
8085: Pin configuration, Architecture, Register Structure, addressing modes, Instruction set of 8085, Timing diagrams (OF, MR, MW, IOR, IOW only), Interrupts (software and hardware interrupts).

Unit 5: Programming & Interfacing **[08 Hours]**
Assembly Language Programming of 8085, Stack, Subroutine. Address space partitioning schemes: Memory mapped I/O and I/O mapped I/ O, Address decoding techniques. Interfacing of 8085 with: 8255, 8253/54, Concept of DMA (Only basic programming examples expected on 8085 and its interfacing). Architecture of 8086.

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

Reference Books:
1. M. M. Mano, Digital logic and Computer design, Pearson Education India, 2016.
2. Kumar, Fundamentals of Digital Circuits, Prentice Hall India, 2016.
3.Douglas Hall, Microprocessors and Interfacing, McGraw-Hill Publication, Revised 2nd Edition, 2006
4. B. Ram : Fundamentals of Microprocessor and Microcontroller, 2nd Edition, Dhanpatrai Publication.

Second Year (Semester –III)

Network Theory

BTECA305	**Network Theory**	**ESC12**	**3L- 0T -0P**	**3Credits**

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.)

Course Objectives:

1	To develop skills for analysis of linear circuits with dependent and independent AC/DC excitations
2	To understand concept of resonance in electric circuits and its applications
3	To analyze transient and steady state response for linear circuits
4	To know fundamentals of two port network, passive filters, Attenuators

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

CO1	Analyze linear circuit with use of different network theorems and analysis methods.
CO2	Compute two port network parameters and draw equivalent network.
CO3	Determine transient and steady state response of linear circuits.
CO4	Understand Concepts of graph theory.
CO5	Understand passive filter and attenuator circuits.

UNIT-I: Circuit Analysis and Network Theorems: **[8Hrs]**

Node and Mesh analysis: Circuit components, assumptions for circuit analysis, Types of Sources and Source transformation, Source transformation, Kirchhoff's laws, Node and Mesh analysis.

Network Theorems: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem and Maximum power transfer theorem

UNIT-II: Resonance: **[7Hrs]**

Series resonance: Series resonance, impedance and phase angle of series resonant circuit, voltage and current in series resonant circuit. Effect of resistance on frequency response curve, bandwidth, selectivity and quality factor. Significance of Quality factor. Parallel resonant: Parallel resonant circuit (Tank circuit), resonant frequency, and variation of Impedance with frequency, reactance curves. Numerical problems based on above..

UNIT-III: Two Port Networks: **[8hrs]**

Open circuit impedance parameters (Z), Short circuit admittance parameters (Y), Transmission parameters (ABCD), Hybrid parameters (H), and reciprocity and symmetry conditions. Interconnection of two port networks: Parallel, Series and Cascade connection of two port networks, T and π representation, Terminated 2 port networks.

UNIT-IV: Transient Response: **[7hrs]**

Review of Laplace Transform Basics: Initial conditions, evaluation and analysis of transient and steady state response of following: RL circuit: RL circuit step voltage response and step current response. RC circuit: RC circuit step current response and step voltage response. RLC circuit: RLC circuit step voltage response and step current

response..

UNIT-V: Network Topolgy (Graph Theory): [7hrs]

Graph of a network, Trees, Co-trees and loops, Incidence matrix, Tie set and Cut set of a network, Analysis of a network using Tie set and Cut set matrix, Network equilibrium equations (without magnetic coupling), Duality.

TEXT BOOKS:

1. "Network Analysis", Valkenburg, PHI Pbs
2. Circuit theory, Kurikose-PHI Pbs
3. Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons

REFERENCE BOOKS:

1. Kelkar, Pandit, "Linear Network Theory", Pratibha Publication.
2. "Network Analysis And Synthesis", Wadhwa, New Age Pbs
3. "Introduction to Network Synthesis", Valkenburg, PHI Pbs.
4. Sudhakar, A. Shyammohan, "Circuits and Network", Third Edition, 2006,Tata McGraw Hill.

Second Year (Semester –III)

Analog Circuits Lab

BTECA306	**Analog Circuits Lab**	**LC1**	**0L- 0T -2P**	**1 Credits**

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

Analog Circuits Lab

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

Sample List of Experiments:

1. Study of Digital multimeter, Function Generator, CRO/DSO, Dual power supply,connecting probes.
2. Study of BJT (Reading data sheet, Terminal Identification, packages, testing & Plot BJT characteristics)
3. To perform CB, CE and CC configuration for BJT.
4. Study of FET (Reading data sheet, Terminal Identification, packages, testing & PlotFET characteristics)
5. Study of MOSFET (Reading data sheet, Terminal Identification, packages, testing &Plot MOSFET characteristics)
6. To verify Op-Amp IC 741 as an inverting and non- inverting amplifier with a specific gain value.
7. To demonstrate integrator and differentiator circuit using Op-Amp IC 741.
8. To perform RC- phase shift oscillator using Op-Amp IC 741.
9. To perform and calculate frequency of oscillations for Wein-Bridge Ocsillator using Op-Amp IC 741.
10. To verify Op-Amp IC 741 as a Schmitt trigger and calculate the hysteresis voltage.
11. To verify operation of astable multivibrator using Op-Amp IC 741.
12. Mini project

Second Year (Semester –III)

Analog Communication and Signals & Systems Lab

BTECA307	**Analog Communication and Signals & Systems Lab**	**LC2**	**0L- 0T -2P**	**1 Credits**

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

Analog Communication and Signals & Systems Lab

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

Sample List of Experiments:

1. Amplitude modulation and demodulation (ii) Spectrum analysis of AM
2. Frequency modulation and demodulation (ii) Spectrum analysis of FM
3. DSB-SC Modulator & Detector
4. SSB-SC Modulator & Detector (Phase Shift Method)
5. Frequency Division Multiplexing & De multiplexing
6. Pulse Amplitude Modulation & Demodulation
7. Pulse Width Modulation & Demodulation
8. Pulse Position Modulation & Demodulation
9. Introduction to MATLAB: To define & use variables, vectors, Matrices & its functions in MATLAB. To study various arithmetic operators and mathematical functions in MATLAB. To create & use m-files
10. Basic plotting of signals: To study various MATLAB commands for creating two and three dimensional plots. • Write a MATLAB program to plot the following continuous time and discrete time Signals. .i. Step Function ii. Impulse Function iii. Exponential Function iv. Ramp Function v. Sine Function
11. Write a MATLAB program to obtain linear convolution of the given sequences.
12. Write a MATLAB program to perform amplitude-scaling, time-scaling and time-shifting on a given signal.
13. To study sampling process

Second Year (Semester –III)
Digital Electronics and Microprocessor Lab

BTECA308	**Digital Electronics and Microprocessor Lab**	**LC3**	**0L- 0T -2P**	**1 Credits**

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

Digital Electronics and Microprocessor Lab

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

Sample List of Experiments:

1) Perform experiment on basic and universal logic gates and verify their truth table.
2) Perform experiment to count the number of clock cycles using counter.
3) Study of code conversion operation binary to Gray and Gray to binary operation.
4) Study and perform experiment to verify the operation of different Flips Flops SR, JK, D and T Type.
5) Study and perform experiment to verify the operation of clocked SR flip flop with Preset and clear.
6) Study of Shift resisters.
7) To design four bit binary comparator.
8) To design parity generator and parity checker.
9) Study of Multiplexer and Demultiplexer using MSI chips.
10) Write a program to perform addition of 10 data bytes using 8085.
11) Write a program to calculate no. of 1s in given 8-bit data using 8085.
12) Write a program for interfacing of LED to 8085 microprocessor.
13) Write a program for interfacing of 8255 to 8085 microprocessor.
14) Write a program to interface 8253/54 with 8085 to generate a square wave.

Second Year (Semester –III)

Seminar-I

BTECA309	**SEMINAR- I**	**Seminar**	**0L-0T-4P**	**2 Credits**

Guidelines for Seminar

The students shall study in group of two members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Electronics Engineering, Computer Science Engineering Artificial Intelligence, Data Science, or inter discipline branch from current literature, by referring the current technical journal or reference books, under the guidance of the teacher. The students shall prepare his report and deliver talk on the topic for other students of his class in the presence of his guide and internal examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment:

The Continues Assessment for this head will consists of the report written in a technical reporting manner and presentation of the talk on the subject and will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Second Year (Semester –III)
Internship – I

BTECA310	**Internship – I**	**Seminar**	**0L-0T-0P**	**Audit**

Guidelines for Internships

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

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

Second Year (Semester –IV)

Digital Communication

BTECA401	Digital Communication	**PCC3**	**3L- 1T -0P**	**4 Credits**

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

Course Objectives:

1	To understand the building blocks of digital communication system.
2	To prepare mathematical background for communication signal analysis.
3	To understand and analyse the signal flow in a digital communication system.
4	To analyse error performance of a digital communication system in presence of
5	To understand concept of spread spectrum communication system

Course Outcomes: At the end of course, students should:

CO1	Understand the block diagram of digital communication system.
CO2	Analyse the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency
CO3	Understand the performance of digital communication system in presence of noise.
CO4	Explore the various passband digital data transmission techniques.
CO5	Analyze Performance of spread spectrum communication system

UNIT-I: Digital Transmission of Analog Signal: [07 Hours]
Introduction to Digital Communication System: Block Diagram and transformations, basic Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error threshold, Delta Modulation,

UNIT-II: Baseband Digital Transmissions: [07 Hours]
Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Intersymbol interference, Equalization

UNIT-III: Baseband Receivers: [07 Hours]
Detection Theory: MAP, LRT, Minimum Error Test, Error Probability, Signal space representation: Geometric representation of signal, Conversion of continuous AWGN channel to vector channel, Likelihood functions, Coherent Detection of binary signals in presence of noise, Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver.

.

UNIT-IV: Passband Digital Transmission [08 Hours]
Pass band transmission model, Signal space diagram, Generation and detection, Error Probability derivation and Power spectra of coherent BPSK, BFSK and QPSK. Geometric representation, Generation and detection of - M-ary PSK, M-ary QAM and their error probability, Generation and detection of -Minimum Shift Keying, Gaussian MSK, Noncoherent BFSK, DPSK and DE PSK ,Introduction to OFDM

UNIT-V: Spread Spectrum Techniques: [07 Hours]

Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Probability of error, Concept of jamming, Frequency hop spread spectrum, Wireless Telephone Systems, Personal Communication System.

TEXT BOOKS:

1. Simon Haykin, "Digital Communication Systems", John Wiley & Sons, Fourth Edition.
2. A.B Carlson, P B Crully, J C Rutledge, "Communication Systems", Fourth Edition, McGraw Hill Publication.
3. Ha Nguyen, Ed Shwedyk, "A First Course in Digital Communication", Cambridge University Press.

REFERENCE BOOKS:

1. B P Lathi, Zhi Ding "Modern Analog and Digital Communication System", Oxford University Press, Fourth Edition.
2. Bernard Sklar, Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications" Second Edition, Pearson Education.
3. Taub, Schilling, "Principles of Communication System", Fourth Edition, McGrawHill.
4. P Ramkrishna Rao, Digital Communication, Mc Graw Hill Publication

Second Year (Semester –IV)

Control System Engineering

BTECA402	**Control System Engineering**	**PCC4**	**3L- 0T -0P**	**3 Credits**

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

Course Objectives:

1	To provide a clear view of Control System.
2	To get accustomed with Frequency and Time domain Analysis methods for industrial applications
3	To get familiarize with state space analysis with its Controllability and Observability of the Systems.

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

CO1	Classify the control systems and calculate transfer function.
CO2	Determine the performance of system in time domain.
CO3	Analyze system using R-H criteria and root locus.
CO4	Able to do system analysis in frequency domain.
CO5	Calculate controllability and observability for the given system.

UNIT-I: Introduction to Control Systems [08Hrs]

Introduction: Concepts of control systems. Examples of control systems, classification of control systems, Block diagram algebra, Representation by Signal flow graph. Reduction using Mason‟s gain formula. Feedback Characteristics, Effects of feedback. Mathematical modelling of systems – Electrical, mechanical translational and rotational systems.

UNIT-II: Time domain analysis [7Hrs]

Standard test signals, Time response of first and second order systems with standard input signals, Time domain specifications, Type of systems, steady state error and error constants. Effects of P, PI, PD and PID Controllers.

UNIT-III: Stability Analysis in S-Domain: [7Hrs]

Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique. Construction of Root-loci, Dominant Poles, Effects of addition of poles and zeros.

UNIT-IV: **Frequency Response Analysis: [08Hrs]**

Relationship between time and frequency response, Polar plots, Bode plots. Gain and phase margin, Nyquist stability criterion, Relative stability using Nyquist criterion.

UNIT-V: State variable analysis: [6Hrs]

State, State variables, State variable representation, State variable form from Transfer function (Diagonal form), transfer function from State variable form, State transition matrix, properties of state transition matrix, Controllability and Observability.

TEXT BOOKS:

1. I. J. Nagrath, M. Gopal, “Control System Engineering”, New Age International Publishers, 05th Ed.
2. B. S. Manke, “Linear Control Systems”, Khanna Publishers, New Delhi, 02nd Ed.
3. A. K. Jairath, “Problems and Solutions of Control Systems”, CBS Publishes, New Delhi, 06th Ed.

REFERENCES BOOKS:

1. K. Ogata, “Modern Control Engineering”, PHI, New Delhi, 06th Ed..
2. Norman S. Nise, “Control System Engineering”, John Wiley and Sons, 07th Ed.

Second Year (Semester –IV)
BASIC HUMAN RIGHTS

BTECA403	**BASIC HUMAN RIGHTS**	**HSSMC3**	**3L- 0T -0P**	**3Credits**

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.)

Course Objectives:

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

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

CO1	Understand the history of human rights
CO2	Learn to respect others caste, religion, region and culture.
CO3	Aware of their rights as Indian citizen.
CO4	Understand the importance of groups and communities in the society.
CO5	Realize the philosophical and cultural basis and historical perspectives of human rights.

Course Contents:

UNIT I. The Basic Concepts: **[08 Hours]**

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

UNIT II. Fundamental rights and economic program: [07 Hours]

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

UNIT III. Migrant workers [07 Hours]

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

UNIT IV. Human rights in Indian constitution and law [07 Hours]

i) The constitution of India: Preamble

ii) ii) Fundamental rights.

iii) iii) Directive principles of statepolicy.

iv) iv) Fundamental duties.

v) v) Some other provisions.

UNIT V. Universal declaration: [07 Hours]

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

Text Books:-

1. M. Laxmikant, Indian Polity: Tata Mc Graw Hill

2. D.Basu, Introduction to the Indian Constitution of India,(26th Edition 2023)

Reference Books:-

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

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

Second Year (Semester –IV)

Probability Theory and Random Processes

BTECA404	**Probability Theory and Random Processes**	**BSC8**	**3L- 0T -0P**	**3Credits**

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.)

Course Objectives:

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

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

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

Course Contents:

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

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

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

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

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

UNIT III: Correlation [07 Hours]

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

UNIT IV: Linear Regression Analysis [07 Hours]

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

UNIT V: Estimation and Hypothesis [07 Hours]

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

Text Books

1. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, 7th Revied and Enlarged Edition, 2016.
2. G. V. Kumbhojkar, Probability and Random Processes, C. Jamnadas and Co., 14th Edition,2010.
3. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, An Introduction to Probability And Statistics, Wiley Publication, 2nd Edition, 2001.

Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
3. G. Haribaskaran, Probability, Queuing Theory and Reliability Engineering, Laxmi Publications,2nd Edition, 2009.
4. Murray Spiegel, John Schiller, R. ALU Srinivasan, Probability and Statistics, Schaum's Outlines, 4th Edition, 2013.
5. Kishor S. Trivedi, Probability, Statistics with Reliability, Queuing and Computer Science Applications, Wiley India Pvt. Ltd, 2nd Edition, 2001.

Second Year (Semester –IV)

Professional Elective-I

Python Programming

BTECA405A	**Python Programming**	**PEC-1**	**3L- 1T -0P**	**4 Credits**

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

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

Course Objectives:

1	Providing a strong foundation of fundamental basics of programming using python
2	Demonstrating awareness and fundamental understanding of various data types in python
3	Demonstrating python programming for the networking and GUI applications
4	Testing of Python programs for given data.

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

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

Course Contents:

UNIT I. Introduction and Python Installation [6 Hours]

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

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

UNIT II. Data Types, Operators and Control Flow [8 Hours]

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

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

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

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

UNIT III. Python Functions, Modules and Packages [8 Hours]

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

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

UNIT IV. OOPS and Exception Handling [7 Hours]

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

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

UNIT V. Networking and Miscellaneous [7 Hours]

Python Network Programming: Python The socket Module, Server Socket Methods, Client Socket Methods, Python Libraries for Telecom Engineers, Sionna Python Framework.

Miscellaneous

Database Connectivity using python, GUI Programming, Turtle Graphics, TKinter

Data Compression: Need, Types.

Testing: Need, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Text Books

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

Reference Books

1. The Complete Reference: Python- Martin C. Brown, McGraw Hill Publication.

2. Python Essential Reference, Developer‟s Library, David M. Beazley, 4th Edition, Addidion-Wesely Professional, ISBN: 9780672329784

COURSE CURRICULUM MAPPING WITH MOOC PLATFORM NPTEL

Sr. No	**Name of Subject as per Curriculum**	**Course Code**	**Semester**	**SWAYAM/ NPTEL Course And Web Link**	**Name of Institute offering course**	**Relevance %**	**Duration of Course**
1.	Python Programming	BTECE403	Fourth	The Joy of Computing using Python	IIT Ropar		12 Weeks

Second Year (Semester –IV)

SENSORS AND ACTUATORS

BTECA405B	**SENSORS AND ACTUATORS**	**PEC-1**	**3L- 1T -0P**	**4 Credits**

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

Prerequisite: Basic electronics, Measurements and Instruments

Course Objectives:

1	Understand basic phenomena that define the behavior of sensors and actuators.
2	Create analytical design and develop solutions using sensors and actuators for Industrial Instrumentation

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

CO1	Understand the behavior of sensors and actuators.
CO2	Understand basic concept of inductive and Capacitive transducers
CO3	Describe development and application of sensors and actuator
CO4	Understand the behavior of Micro sensors and Micro actuators
CO5	Understand Sensor Applications.

UNIT I: TRANSDUCER

Block diagram of Instrumentation System, Working principle of transducers, classification, LVDT, RVDT.

Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers: capacitive microphone, capacitive pressure sensor, Piezo-electric transducer

UNIT II: SENSORS

Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics, Signal transmission - Types of signal, Electronic Signals.

Sensors & it‟s working principle: Proximity, ultrasonic, Pressure, Temperature, Humidity, potentiometer, Hot-wire anemometer, Photo-resistive sensor.

UNIT III: ACTUATORS

Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators,

Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors, AC motors - Single phase & 3 Phase Induction Motor; Stepper motors.

UNIT IV: MICRO SENSORS AND MICRO ACTUATORS

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro

sensors and flow micro sensors.
Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect.

UNIT V: Industrial and Agricultural Applications

Humidity Measurement, Soil moisture and temperature, smoke and fire detection, burglar alarm, object counter level measurement, on /off timers, RTC, liquid level measurement, surveillance system, latest trends in sensors and actuators.

TEXT BOOKS

1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
2. Sergej Fatikow and Ulrich Rembold, "Microsystem Technology Microbotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
3. Jacob Fraden, "Hand Book of Modern Sensors: Physics Designs and Application" Fourth edition, Springer, 2010.

REFERENCE BOOKS

1. Robert H Bishop, "The Mechatronics Hand Book CRC Press, 2002.
2. Thomas. G. Bekwith and Lewis Buck. N, Mechanical Measurements, Oxford and IBHPublishing Co. Pvt. Ltd.,
3. Manfred Kohl, "Shape Memory Actuators", first edition, Springer.

Second Year (Semester –IV)
Data Structures and Algorithm Using C++

BTECA405C	**Data Structures and Algorithm Using C++**	**PEC-1**	**3L- 1T -0P**	**4 Credits**

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

Pre-Requisites: *Basics of C Programming, Structures and Pointers.*

Course Objectives:

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

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

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

Course Contents

Unit-1 An introduction to C++ & OOP Concepts [8Hrs]

C++ Primer

Basic C++ Program, Flow of Execution, Fundamental Data Types, Control Flow, Functions, Pointers, Arrays, Structures, Scope and namespaces.

OOP Concepts

Object Oriented Design principles, Classes, Class Members, Constructors, Destructors, Inheritance and Polymorphism, Standard Template Library (STL), Memory Management using new & delete.

Unit 2 Introduction to Data Structure & Linked List :A C++ implementation [8Hrs]

Basic operations of Data Structures, Need, Types, Introduction to Linked List, types, Memory management of linked list, Singly, Doubly, Circular linked lists, Operations: Inserting, Deleting, Updating, and Counting, Reversing a list. Arrays and Linked List comparison.

Unit-3 Stacks & Queues **[8Hrs]**

Stack

The Stack ADT, Memory Representation of stack using array and Link List, Stack Operations. The STL Stack, A C++ Stack Interface, Stack Applications.

Queue

The Queue ADT, Memory Representation of Queue using array and Link List, Queue Operations. The STL Queue, Types of Queues, A C++ Queue Interface, Queue Applications.

Unit-4 Non Linear Data Structures: Trees & Graphs **[8Hrs]**

Trees

Basic Tree Terminologies, Binary Tree, Binary Tree Traversal: Inorder, Preorder and Postorder, Binary Search Tree (BST), AVL Tree.

Graphs

Introduction, Graph Definitions & Notations, Graph Representation, Operations on Graphs, Graph Traversals: Depth-First Traversal and Breadth-First Traversal.

Unit-5 Algorithms **[8Hrs]**

Introduction to Algorithms, Algorithm Analysis-Worst, Average and Best case analysis, Algorithm Complexity: Time & Space Complexity tradeoff.

Types of Algorithms:

Array Based Sorting: Bubble Sort, Insertion sort, Quick Sort, Selection sort.

Array Based Searching: Sequential and binary searches. Hashing Schemes.

TEXT BOOKS

1. Data Structures using C++, Special Edition-MRCET, Tata McGraw-Hill Publishers 2017.

2.Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.

REFERENCE BOOKS

1.Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student Edition, John Wiley and Sons.

2. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd. Second Edition.

3. Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson

4. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

5. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education.

COURSE CURRICULUM MAPPING WITH MOOC PLATFORM NPTEL

Sr. No	**Name of Subject as per Curriculum**	**Course Code**	**Semester**	**SWAYAM/ NPTEL Course And Web Link**	**Name of Institute offering course**	**Relevance %**	**Duration of Course**
1	Data Structures & Algorithm Using C++			Programming in Modern C++	IIT Kharagpur	40	12 Weeks

Second Year (Semester –IV)
Electrical Machine & Instrumentation

BTECA405D	**Electrical Machine & Instrumentation**	**PEC-1**	**3L- 1T -0P**	**4 Credits**

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

Course Objectives:

1	To determine the parameters of AC, DC machines
2	To identify & solve the problems related AC//DC machines.

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

CO1	To provide knowledge and identify the performance of different types of AC/DC machines
CO2	To demonstrate and fundamental understanding of various applications based on electricity, laws & motors.
CO3	To analyze the performance of different types, characteristics & applications of special purpose machines.
CO4	To troubleshoot the operation of an electrical machine, instruments & sensors for a given application.
CO5	To estimate and correct deviations in measurements due to the accuracy of the instrument as per industrial applications.

UNIT-I:

DC Machines **[8 Hrs]**

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

UNIT-II:

Induction Motor and Synchronous Motor **[7Hrs]**

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

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

UNIT-III:

Special Purpose Machine **[7Hrs]**

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

UNIT-IV:

Sensors and Transducers **[7Hrs]**

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

UNIT-V:

Industrial Measurement and Industrial Applications [7Hrs]

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Abhijit Chakrabarti & Sudipta Debnath, “Electrical Machines”, Tata McGraw-hillPublication.
2. William H Hayt, Jack E Kimmerly and Steven M. Durbin, “Engineering CircuitAnalysis”, Tata McGrawHill.
3. I.J Nagarath & D.P Kothari, “Electrical Machines”, Tata McGraw-hill Publication 4thEdition.
4. B. L. Theraja, “Electrical technology” volume 2, S.Chand.

Second Year (Semester –IV)
Digital Communication Lab

BTECA406	**Digital Communication Lab**	**LC4**	**0L- 0T -2P**	**1 Credits**

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

Digital Communication Lab

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

Sample List of Experiments:

1 To perform experiment on Time Division Multiplexing
2 To perform experiment on Pulse Code Modulation & Demodulation
3 To perform experiment on Differential Pulse Code Modulation & Demodulation
4 To perform experiment on Delta Modulation
5 To perform experiment on ASK, PSK and FSK.
6 To perform experiment on Binary PSK.
7 To perform experiment on Binary FSK.
8 To perform experiment on Quadrature Phase Shift Keying
9 To perform experiment on Digital Companding (A-Law & μ-Law)
10 To perform experiment on DSSS.
11 To perform experiment on FHSS.
12 To perform experiment on synchronization.

Second Year (Semester –IV)
Control System Engineering Lab

BTECA407	**Control System Engineering Lab**	**LC5**	**0L- 0T -2P**	**1 Credits**

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

Control System Engineering Lab

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

Sample List of Experiments:

1 To determine transfer function of RC System and its step response.
2 To determine Transfer function of RLC System step response
3 To study first and second order system response and find its time constant and verify it analytically.
4 To find steady state error of Type 0, 1, 2 systems.
5 To perform experiment on digital controllers (P, PI, PID Controllers).
6 Introduction to Control System Toolbox in MATLAB.
7 To find TF of two RC network using Bode plot
8 To calculate time domain specifications using MATLAB.
9 To perform stability analysis using root locus approach.
10 To perform experiment on Nyquist stability criteria.
11 To perform experiment on state space representation.
12 To perform experiment on controllability and observability.

Second Year (Semester –IV)

PEC 1-Lab (Practical's based on Professional Elective Course-1)

BTECA408	**PEC 1-Lab (Practical's based on Professional Elective Course-1)**	**LC6**	**0L- 0T -2P**	**1 Credits**

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

**** Following are the sample list of experiment based on contents of Professional Elective Course-1(PEC-1)**

PEC-1 Lab

(A).Python Programming Lab

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

Sample List of Experiments:

1. To Study Python Installation in Windows operating system and Practice Execution of python statements in REPL (Shell) & IDLE.
2. To write & perform python program using operators
3. To perform Python program to demonstrate use of conditional statements.
4. To perform Python program to demonstrate use of looping statements.
5. Write Python program to perform various operations on Lists and Tuples.
6. Write Python program to perform various operations on Sets and Dictionaries
7. Develop user defined Python function & module for given problem.
8. Demonstration of Object Oriented concepts
    a. Classes and Objects
    b. Inheritance
    c. Polymorphism
    d. Method Overloading
9. Demonstration of Exception handling in Python.
10. Perform CRUD Operation using database in python.
11. Building your first Python GUI Application using TKinter
    a. Displaying Text and Images With Label Widgets
    b. Displaying Clickable Buttons With Button Widgets
    c. Getting User Input With Entry Widgets
12. Demonstration of simple Server-Client Program using Python

(B)Sensors and Actuators Lab

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

Sample List of Practical's:

1. To study and perform experiment on strain gauge.
2. To study and perform experiment on thermistor.
3. To study and perform experiment on Thermocouple.
4. To study and perform experiment on Characteristics of RTD.
5. To study and perform experiment on Experimental characterization of DC motor.
6. To study and perform experiment on Stepper Motor interfacing.
7. To study and perform experiment on PIR Sensor
8. To study and perform experiment on the Ultrasonic Sensor.
9. To study and perform experiment on IR sensor.
10. To study and perform experiment on temperature and humidity sensors.
11. To study and perform experiment on liquid level measurement.
12. Mini Project

(C). Data Structures and Algorithm Using C++Programming Lab

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

Sample List of Experiments:

1 Demonstrate following concepts with C++ approach
   a. Basic C++ Program
   b. Control Flow

2 Demonstrate following concepts with C++ approach
   a. Swap 2 numbers with and without pointers.
   b.Find smallest and largest element in given array

3 Demonstrate following OOP concepts with C++ approach
   a. Classes, Constructor, Destructor
   b. Memory Management using ***new*** and ***delete***

4 Demonstrate Standard Template Library (STL) .

5 Demonstrate Insertion, Deletion, Updating, Display operations on Linked List.

6 Demonstrate various operations on
   a. Stack in C++ STL
   b. Queue in C++ STL

7 2. Demonstration of Object Oriented concepts
   a. Classes and Objects
   b. Inheritance
   c. Polymorphism
d. Method Overloading

9 Study of various tree definitions

10 Study of various graph definitions and notations.

11 Demonstrate any two Array based Sorting technique.

12 Demonstrate Array based Sequential and Binary Search

(D).Electrical Machine & Instrumentation

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

Sample List of Experiments:

1 To study DC Machine
2 To draw the speed characteristics of DC shunt motor by – Armature Control method and Field control method.
3 To study Running and Reversing of DC motor.
4 To study different starters of Induction motor.
5 To perform experiment on load test on Induction motor.
6 To study the speed – Torque characteristics of Servo motor.
7 To draw V and Inverted V curve of synchronous motor.
8 To study of Strain Gauge.
9 Temperature measurement using thermistor & thermocouple.
10 To Study of Burglar Alarm.
11 Sound level measurement using digital meter.
12 Mini-project

Second Year (Semester –IV)
Seminar-II

BTECA409	**SEMINAR- II**	**Seminar**	**0L-0T-4P**	**2 Credits**

Guidelines for Seminar

The students shall study in group of two members (or individual) on some special topic beyond the scope of the syllabus under the subjects of Electronics Engineering, Computer Science Engineering Artificial Intelligence, Data Science, or inter discipline branch from current literature, by referring the current technical journal or reference books, under the guidance of the teacher. The students shall prepare his report and deliver talk on the topic for other students of his class in the presence of his guide and internal examiner. The student is permitted to use audio-visual aids or any other such teaching aids.

Continues Assessment:

The Continues Assessment for this head will consists of the report written in a technical reporting manner and presentation of the talk on the subject and will be assessed by the internal examiner appointed by the HOD of concern department of the institution.

Second Year (Semester –IV)
Internship – II

BTECA410	**Internship – II**	**Internship**	**0L-0T-0P**	**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 Programme Commences.
2. Student can also apply through online platforms such as Internshala for industrial Training.
3. Submit one copy of the offer letter for the Industrial Training to the Head of the Department or Faculty coordinator (Industrial Training).
4. To complete the Industrial Training process within the specified time based on the Industrial Training Programme schedule.
5. Assessment within the Industrial Training context aims to evaluate the student‟s work quality and appropriateness to the field of study with reference to the learning outcomes of the Industrial Training Program.
6. Evaluation of the students‟ performance should be done in the next upcoming semester.
7. Those students who fails, they can also complete online certification courses which are available at free of cost on various MOOC platform