CURRICULUM FRAMEWORK AND SYLLABUS FOR OUTCOME BASED EDUCATION IN

Bachelor of Science in Electronics and Communication Systems

B.Sc., (ECS)
Degree Program

FOR THE STUDENTS ADMITTED FROM THE ACADEMIC YEAR 2019- 2020 AND ONWARDS

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICAS

HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
(Affiliated to Bharathiar University and Accredited by NAAC)
COIMBATORE-641028
TAMILNADU, INDIA.
Phone: 0422-4440555
Website: www.hindusthan.net/hicas/

HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS

VISION

To provide world class education to the students to face global challenges and to inculcate the latest trends in technological advancement. To cater the needs of the environmental and ethical values in the mind of students to become good citizens and entrepreneurs.

MISSION

The Mission of the college is to pursue a philosophy of perpetual acquisition of knowledge. The important policy is to provide value based education and to bring out the hidden potentials in students that equip them to approach life with optimism.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

Under Graduates of B.Sc., (ECS) program will

PEO1: Demonstrate ability to adapt to a rapidly changing environment by learning and applying new skills and competencies.

PEO2: Be able to engage in independent and life-long learning in the broadest context of technological era.

PROGRAM OUTCOME (PO)

B.Sc (ECS) Students will be able to

PO1: Utilize the basic knowledge in mathematics, science and engineering in Electronics and Communication field.

PO2: Identify, formulate and solve complex problems to achieve demonstrated conclusions using mathematical principles and sciences.

PO3: Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.

PO4: Apply research-based knowledge to design and conduct experiments, analyze, synthesize and interpret the data pertaining to Electronics and Communication problems and arrive at valid conclusions.

PROGRAM SPECIFIC OUTCOME (PSO)

B.Sc (ECS) Students of HICAS can

PSO1: Apply the fundamental concepts of electronics and communication engineering to design a variety of components and systems for applications including signal processing, image processing, communication, networking, embedded systems, VLSI and control system.

PSO2: Select and apply cutting-edge engineering hardware and software tools to solve complex Electronics and Communication Engineering problems.

PSO3:.To design principles and best practices for developing quality products for scientific and business applications.

HINDUSTHAN COLLEGE OF ARTS AND SCIENCE
(AUTONOMOUS)
COIMBATORE – 641028
SCHEME OF EXAMINATION – CBCS PATTERN
B.Sc., ELECTRONICS AND COMMUNICATION SYSTEMS

Course Code	Course Type	Course Title	Lecture Hours / Week	Exam. Dur. Hrs	Max. Marks			Credit Points
					IE	EE	Total	
FIRST SEMESTER								
		Part – I						
19LAT01 19LAH01 19LAM01 19LAF01	MIL	Tamil - I/Hindi - I/Malayalam - I/French – I	6	3	30	70	100	3
		Part – II						
19ENG01	AECC	English – I	6	3	30	70	100	3
		Part – III						
19ELU01	DSC	Principles of Electronics	6	3	30	70	100	5
19ELU02	GE	Allied: Mathematics-I (MAT)	6	3	30	70	100	5
***	DSC	**Practical I:** Principles of Electronics	3	-	-	-	-	-
***	DSC	**Practical II:** Semiconductor Devices	3	-	-	-	-	-
SECOND SEMESTER								
		Part – I						
19LAT02 19LAH02 19LAM02 19LAF02	MIL	Tamil - II/Hindi - II/Malayalam - II/French – II	6	3	30	70	100	3
		Part – II						
19ENG02	AECC	English – II	6	3	30	70	100	3
		Part – III						
19ELU03	DSC	Semiconductor Devices	5	3	30	70	100	5
19ELU04	GE	Allied: Mathematics-II (MAT)	5	3	30	70	100	5
19ELU05	DSC	**Practical I:** Principles of Electronics	3	3	40	60	100	4
19ELU06	DSC	**Practical II:** Semiconductor Devices	3	3	40	60	100	4
		Part – IV						
19GSU01	AEE	Value Education - Human Rights	2	-	100	-	100	2
Students Should Complete Value Added Courses, Communicative English and Soft Skills at the End of the First Year								
THIRD SEMESTER								
		Part – III						
19ELU07	DSC	Principles of Communication System	5	3	30	70	100	4
19ELU08	DSC	Digital Electronics and its Applications	5	3	30	70	100	4
19ELU09	DSC	Electronic Circuits	5	3	30	70	100	4
19ELU10	GE	Programming in C	4	3	30	70	100	4
19ELU11	GE	**Practical III:** C Programming	3	3	40	60	100	2
***	DSC	**Practical IV:** Electronic Circuits	3	-	-	-	-	-
***	DSC	**Practical V :** Analog and Digital IC	3	-	-	-	-	-
		Part – IV						

19GSU02	AEE	Environmental Studies	2		100	-	100	2
FOURTH SEMESTER								
		Part – III						
19ELU12	DSC	Microwave and Fiber Optic Communication	5	3	30	70	100	4
19ELU13	DSC	Integrated Circuits and Instrumentation	5	3	30	70	100	4
19ELU14	SEC	Python Programming	5	3	30	70	100	4
19ELU15	DSC	**Practical IV:** Electronic Circuits	4	3	40	60	100	4
19ELU16	DSC	**Practical V:** Analog and Digital IC	4	3	40	60	100	4
19ELU17A	DSE	**Practical VI:** Communication Systems	5	3	40	60	100	4
19ELU17B		**Practical VI:** Python Programming						
		Part – IV						
19GSU03	AEE	Internet Security	2	-	100	-	100	2
		Part – V						
19GSU04	AECC	Extension Activity	-	-	100	-	100	G
Students Should Complete Value Added Courses, Online Courses (Or) Participation Certificates For Seminars, Workshops From Other Institutions For Each Semester And Womens Studies / Interdisciplinary at the end of Second Year								
Extension Activity – means all those activities under NSS / NCC / Sports / YRC Programme and other Co and extracurricular activities offered under part V of the programme. Every student shall participate compulsorily for a period of not less than two years (4 semesters) in any one of these programmes.								
FIFTH SEMESTER								
		Part – III						
19ELU18	DSC	Cellular Communication System	5	3	30	70	100	4
19ELU19	DSC	VLSI Design Tools	5	3	30	70	100	4
19ELU20A	DSE	8051 Microcontroller	5	3	30	70	100	4
19ELU20B		PIC Microcontroller						
19ELU21	SEC	**Practical VII:** Circuit Simulation	5	3	40	60	100	4
***	DSC	**Practical VIII:** Industrial Electronics	3	-	-	-	-	-
***	DSC	**Practical IX:** Embedded Systems	3	-	-	-	-	-
19ELU22A	DSE	Medical Electronics	4	3	30	70	100	4
19ELU22B		Consumer Electronics						
		Part – V						
19GSU05	AEE	General Awareness	-	-	100	-	100	2
19GSU06	AECC	Law of Ethics	-	-	100	-	100	2
SIXTH SEMESTER								
		Part – III						
19ELU23	DSC	Satellite and Network Communication	5	3	30	70	100	4
19ELU24	DSC	Industrial and Power Electronics	5	3	30	70	100	4
19ELU25A	DSE	Embedded Systems	5	3	30	70	100	4
19ELU25B		IoT and its Applications						
19ELU26	DSC	**Practical VIII:** Industrial Electronics	3	3	40	60	100	4
19ELU27	DSC	**Practical IX:** Embedded Systems	3	3	40	60	100	4
19ELU28A	DSE	Robotics and Automation	5	3	30	70	100	4
19ELU28B		Automotive Electronics						
19ELU29	DSE	Project Work	4	-	40	60	100	4
Students Should Complete Value Added Courses, Online Courses / Entrepreneurship / Startups / Job Oriented Courses and Placement Training at the end of the Third Year								
								140

(For the Students Admitted from the Academic Year 2019 – 2020 and Onwards)

No of courses	Course Type	Total Credit Points
2	Modern Indian Language (MIL)	6
4	Ability Enhancement Compulsory course (AECC)	8
4	Ability Enhancement Elective (AEE)	8
17	Discipline Specific course (DSC)	70
6	Discipline Specific Elective (DSE)	24
2	Skill Enhancement Course (SEC)	8
4	Generic Elective (GE)	16
39	**TOTAL**	**140**

REGULATION

1. **Internal Marks**

Components	Marks
Test I	5
Test II	5
Model Exam	10
Assignment	5
Attendance*	5
TOTAL	30

*Split-up of Attendance Marks

- ♣ 75-79 - 1marks
- ♣ 80-84 - 2marks
- ♣ 85-89 - 3marks
- ♣ 90-94 - 4marks
- ♣ 95-100 - 5 marks

QUESTION PAPER PATTERN FOR I.E TEST I and II

Duration: Two Hours **Maximum: 50Marks**

SECTION - A (6 x 1 = 6 Marks)

Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks

Multiple choice/Fill up the blanks /True or False questions

SECTION - B (4x 5 = 20 marks)

Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks
Either or Type

SECTION - C (3x 8 = 24 marks)

Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks
Either or Type

QUESTION PAPER PATTERN FOR IE Model Examination

Duration: Three Hours **Maximum: 70 Marks**

SECTION - A (10x1=10 Marks)

Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks

Q.No 1 to 10: (Multiple choice/Fill up the blanks /True or False questions).
(Two questions from each unit)

SECTION - B (5x4=20 Marks)
Answer **ALL** Question
ALL Questions Carry **EQUAL** Marks
Q.No 11 to 15: Either or type questions
(One question from each Unit)

SECTION- C (5x8=40 Marks)
Answer **ALL** Questions
ALL Questions carry **EQUAL** Marks
Q.No 16 to 20: Either or type questions (One question from each Unit)

2 a) Components for Practical I.E.

Components	**Marks**
Test –I	20
Test - II	20
Total	------- 40 =====

2 b) Components for Practical E.E.

Components	**Marks**
Completion of Experiments	50
Record	5
Viva	5
Total	------- 60 ======

3. Institutional/ Industrial Training, Mini Project and Major Project Work

Institutional /Industrial Training		Mini Project	Major Project Work	
Components	**Marks**	**Marks**	**Components**	**Marks**
I.E Work Diary Report Viva –voce Examination	25 50 25	50 50	I. E a) Attendance 10Marks b) Review/ Work Diary*[1] 30 Marks	40
Total	100 ====	100 ====	E.E*[2] a) Final Report 40 Marks b) Viva-voce 20Marks	60
			Total	100 ====

*[1] Review is for Individual Project and Work Diary is for Group Projects (group consisting of minimum 3 and maximum 5)
*[2]Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

4. Components for Value Education (Part IV):

S.No.	Components	Marks
a)	Attendance 96% and above - 30 marks 91% to 95% - 25 marks 86% to 90% - 20 marks 76% to 85% - 10 marks	30 marks
b)	Participation in group activity	30 marks
c)	Assignment (2 x 10)	20 marks
d)	Test (1 hr for 20 marks) 2 out of three questions, 10 marks each	20 marks
	Total	100 marks

On completion of the above components students will be remarked as follows:

Range of marks	Equivalent remarks
80 and above	Exemplary
70 – 79	Very good
60 – 69	Good
50 – 59	Fair
40 – 49	Satisfactory
Below 39	Not Satisfactory = Not completed

The passing minimum for this paper is 40%
In case, the candidate fails to secure 40% passing minimum, he / she may have to reappear for the same in the subsequent semesters.

5. **Guidelines for Environmental Studies (Part IV)**

The paper Environmental Studies is to be treated as 100% IE course which is offered in III Semester for II year UG students. The classes will be handled for two hours per week till the end of the Semester. At least one field trip should be arranged.

Total Marks for the subject = 100

Components	Marks
Two Tests (2 x 30)	60
Field visit and report (10 + 10)	20
Two assignments (2 x 10)	20
Total	100

The question paper pattern is as follows:

Test I – 2 hours [3 out of 5 essay type questions] 3 x 10 = 30 Marks
Test II – 2 hours [3 out of 5 essay type questions] 3 x 10 = 30 Marks

Total 60 Marks

The passing minimum for this paper is 40%
In case, the candidate fails to secure 40% passing minimum, he / she may have to reappear for the same in the subsequent semesters.

6. **Guidelines for Skill based subject - Internet Security (Part IV)**

Components	Marks
Two Tests (2 x 40)	80
Two assignments (2 x 10)	20
Total	100

The question paper pattern is as follows:

Test I – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40 Marks
Test II – 2 hours [4 out of 7 essay type questions] 4 x 10 = 40 Marks

Total 80 Marks

The passing minimum for this paper is 40%
In case, the candidate fails to secure 40% passing minimum, he / she may have to reappear for the same in the subsequent semesters.

7. Guidelines for General Awareness (Part IV)

Components	Marks
Two Tests (2 x 50)	100

The question paper pattern is as follows:
Test I – 2 hours [50multiplechoicequestions] 50 x 1 =50Marks
Test II – 2 hours [50 multiple choice questions] 50 x 1 = 50Marks

Total 100 Marks

The passing minimum for this paper is 40%
In case, the candidate fails to secure 40% passing minimum, he / she may have to reappear for the same in the subsequent semesters

8. Guidelines for Law of Ethics (Part V)

Components	Marks
Two Tests (2 x 50)	100

The question paper pattern is as follows:
Test I – 2 hours [5 out of 8 essay type questions] 5 x 10 = 50Marks
Test II – 2 hours [5 out of 8 essay type questions] 5 x 10 = 50Marks

Total 100 Marks

The passing minimum for this paper is 40%
In case, the candidate fails to secure 40% passing minimum, he / she may have to reappear for the same in the subsequent semesters.

9. Guidelines for Extension Activity (Part V)

At least two activities should be conducted within this semester (IV) consisting of two days each. The activities may be Educating Rural Children, Unemployed Graduates, Self Help Group etc.

The marks may be awarded as follows

No of Activities	Marks
2 x 50 (Each Activity for two days)	100

10. QUESTION PAPER PATTERN FOR EE (Part III Theory Papers)

Duration: Three Hours **Maximum: 70Marks**

SECTION - A (10x1=10 Marks)

Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks

Q. No 1 to 10: (Multiple choice/Fill up the blanks /True or False questions).
(Two questions from each unit)

SECTION - B (5x4=20 Marks)

Answer **ALL** Question
ALL Questions Carry **EQUAL** Marks
Q. No 11 to 15: Either or type questions
(One question from each Unit)

SECTION- C (5x8=40 Marks)

Answer **ALL** Questions
ALL Questions carry **EQUAL** Marks
Q. No 16 to 20: Either or type questions
(One question from each Unit)

Programme Code:	BEL	Programme Title: B.SC (ECS)		
Course Code:	19ELU01	Course Title	Batch:	2019-2020 and onwards
		PRINCIPLES OF ELECTRONICS	Semester:	I
Hrs/Week:	5		Credits:	5

Course Objective

To enable the students to learn fundamentals of passive electronic components & basic laws of Electronics.

Course Outcomes (CO)

K1	CO1	Remember the measurable in electronics and electricity.
K2	CO2	Understand the performance of passive electronic components in electronic circuits.
K3	CO3	Analyze the basic laws & theorems of electronics
K4	CO4	Evaluate the behavior of passive components in AC circuits.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	L
CO2	S	S	M	L
CO3	S	S	L	L
CO4	S	S	L	L

S - Strong; M-Medium; L-Low.

19ELU01	PRINCIPLES OF ELECTRONICS	I
Unit No.	**Content**	**Hours**
I	**Electricity** Negative and positive polarities – Electrons and Protons in the atom– Conductors, Insulators and Semiconductors –Structure of atom – The Coulomb unit of electric charge – The volt unit of Potential Difference – Charge in motion is current –The closed circuit – The direction of current — Direct Current (DC) – Alternating Current (AC) –Frequency – Period– Wavelength – Phase angle –RMS value – Average Value – Peak Value– Sources of electricity.	12
II	**Fundamentals of Electronic Components** Resistor: Ohms Law – Color coding – Types: Fixed and Variable –Rheostats and Potentiometers – Power rating – Resistors in serial and parallel. Capacitor: Principles of capacitance – Types: Electrolytic capacitors – Capacitor coding – Capacitor in series and parallel. Inductor: Principles of inductance – Types – Inductor in serial and parallel.	12
III	**Basic Laws of Electronic Circuits** Power dissipation in resistance – Voltage and Current Dividers – Kirchhoff's Voltage Law (KVL) – Kirchhoff's Current Law (KCL) – Method of branch Currents – Node Voltage Analysis – Method of mesh currents– Concept of voltage source and current source – Voltage source in series and current source in parallel.	12
IV	**Network Theorems** Superposition Theorem – Thevenin's Theorem – Thevenizing a circuit with two voltage source – Thevenizing a bridge circuit – Norton's theorem– Thevenin-Norton Conversion – Conversion of Voltage and Current Sources – Millman's Theorem – Maximum Power Transfer Theorem – T or Y and π or Δ Connections – Two port networks.	12
V	**AC Circuits** Alternating Current: Resistance circuit – Capacitance circuit (X_C) –Inductance circuit (X_L) – X_L and X_C in series and parallel – Analysis of resonance circuits – Series resonance – Parallel resonance. RC Filters: RC low pass filter – RC high pass filter – RC band pass filter – RC band stop filter.	12

Text Book:

1. *Bernard Grob and Mitchel E Schultz "Basic Electronics", Tata McGraw Hill, 9th Edition, 2005.(Unit I to V)*

Reference Books:

1. *S.Salivahanan, N.Suresh Kumar &A.Vallavaraj, "Electronic Devices and Circuits", Tata McGraw-Hill, 1998.*
2. *B.L.Theraja, "Basic Electronics-Solid State Devices", S.Chand, 2000.*
3. *B.V.Narayana Rao, "Principles of Electronics", Wiley Eastern Limited, 1992.*
4. *Malvino, Albert Paul, "Electronic Principles", Tata McGraw – Hill, Sixth Edition, 2004.*
5. *V.K. Mehta, Rohit Mehta, "Principles of Electronics", S.Chand and Company Ltd., 2005.*

Course Designed by	Verified by HOD	Checked by	Approved by
Ms.S.SUDHA	Dr.P.GOWRISANKAR		

Head of the Department
Department of Electronics
Hindusthan College of Arts & Science
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CONTROLLER OF EXAMINATIONS HICAS CBE-28

Programme Code:	BEL	Programme Title: B.Sc (ECS)		
Course Code:	19ELU03	Course Title	Batch:	2019-2020 and onwards
		SEMICONDUCTOR DEVICES	Semester:	I
Hrs/Week:	5		Credits:	5

Course Objective

To equip the students to learn the construction, working and characteristics of various semiconductor devices.

Course Outcomes (CO)

K1	CO1	Recall the essential fundamentals of atomic structure and semiconductor devices.
K2	CO2	Understand the principles and functions of semiconductor diodes for switching applications.
K3	CO3	Analyze the switching and amplification applications of transistor.
K4	CO4	Demonstrate the control applications using power electronic semiconductor devices.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	L	L
CO3	S	M	L	L
CO4	S	M	L	L

S - Strong; M-Medium; L-Low.

19ELU03	SEMICONDUCTOR DEVICES	II
Unit No	**Content**	**Hours**
I	**Atomic Structure and Semiconductor Physics** Bohr's atomic model – Energy levels – Energy bands – Energy bands in solids – Classification of solids and energy bands – Semiconductor – Bonds in semiconductors – Energy band description of semiconductors – Effect of temperature on semiconductor – Hole current – Intrinsic semiconductor– Extrinsic semiconductor – n-type and p-type semiconductor – Majority and minority carriers – PN junction – VI Characteristics.	12
II	**Special Diodes** Zener diode – Zener diode as a voltage regulator – Tunneling effect and Tunnel diode – Varactor diode – PIN diode – Schottky Diode – Step recovery diode – Thermistor – Gunn diode –LED – Photo diode.	12
III	**Bipolar Junction Transistors (BJT)** Introduction– Transistor as an Amplifier – CB, CE and CC Configurations– Comparison of transistor configurations – Transistor load line analysis – Operating point – Cut off and Saturation points – Power ratings – Transistor biasing – Types: Self bias, Fixed bias and Potential divider bias – Photo transistor.	12
IV	**Field Effect Transistors** Junction Field Effect Transistor – Operation – Transfer characteristics – Comparison of FET and BJT – MOSFET – Types: Depletion - Enhancement – Drain and transfer characteristics – MOSFET as a resistor– Advantage of N-Channel MOSFET over P-Channel.	12
V	**Thyristors** Overview – Construction and Working: Silicon Controlled Rectifier (SCR)– TRIAC – DIAC – Uni Junction Transistor (UJT): Operation – UJT relaxation oscillator – Silicon Controlled Switch (SCS)- Silicon Unilateral Switch (SUS) – Silicon Bilateral Switch (SBS) – Opto-electronic devices.	12

Text Books:

1. V.K. Mehta, "Principles of Electronics", S.Chand, 1997. (Unit-I, II & III).

2. R.S. Sedha, "A Text Book of Applied Electronics", S.Chand, 3rd Revised Edition, 2008. (Unit-IV & V).

Reference Books:

1. B.L.Theraja "Basic Electronics Solid State", S.Chand, 1998.

2. S. Salivahanan, N. Suresh Kumar & A. Vallavaraj, "Electronics Devices and Circuits", Tata McGraw Hill Publishing Company Limited, New Delhi, 8th edition.

3.S.M.Sze, "Semiconductor Devices: Physics and Technology", Wiley India (P.) Ltd, Second Edition, 2008.

Course Designed by	Verified by HOD	Checked by	Approved by
Dr.V.BALAPRAKASH	Dr.P.GOWRISANKAR		

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CONTROLLER OF EXAMINATIONS HICAS CBE-28

Programme Code:	BEL	Programme Title: B.Sc (ECS)		
Course Code:	19ELU05	Course Title	Batch:	2019-2020 and onwards
		PRACTICAL I: PRINCIPLES OF ELECTRONICS	Semester:	I & II
Hrs/Week:	3		Credits:	5

Course Objective

To equip the students to learn the characteristics of various passive Electronic components.

Course Outcomes (CO)

K1	CO1	Remember the fundamentals of active and passive components.
K2	CO2	Understand the measurements like amplitude, frequency and phase using CRO.
K3	CO3	Analyze the operation and applications of basic laws & theorems in electronics circuits.
K4	CO4	Demonstrate the performance RLC components in AC circuits.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	L	L
CO2	S	S	L	L
CO3	S	M	S	S
CO4	S	M	S	S

S - Strong; M-Medium; L-Low.

Code No.	Course	Semester No.
19ELU05	PRACTICAL I: PRINCIPLES OF ELECTRONICS	I & II

(Any 18 Experiments)

1. Familiarization of components: Active & Passive - identification (colour coding, Wattage), specification and testing using Multimeter.
2. Measurement of Amplitude, Frequency & Phase difference using CRO.
3. Verification of Ohm's Law.
4. Voltage sources in series, parallel and series & parallel.
5. Resistors in series, parallel and series & parallel.
6. Capacitors and Inductors in series, parallel and series & parallel.
7. Verification of Kirchhoff's Law.
8. Verification of Voltage Divider Rule.
9. Verification of Current Divider Rule.
10. Verification of Superposition Theorem.
11. Verification of Thevenin's Theorem.
12. Verification of Norton's Theorem.
13. Verification of Millman's Theorem.
14. Verification of Maximum Power Transfer Theorem.
15. Series Resonance Circuit.
16. Parallel Resonance Circuit.
17. RC Low Pass Filter.
18. RC High Pass Filter
19. RC Band Pass Filter.
20. RC Band Rejection Filter.
21. Transient response of RC Circuit.
22. Transient response of RL Circuit.
23. Frequency response of R, L & C.
24. Wheatstone Bridge.
25. LCR Bridge.

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CONTROLLER OF EXAMINATIONS
HICAS
CBE-28

Programme Code:	BEL	Programme Title: B.Sc (ECS)		
Course Code:	19ELU06	Course Title	Batch:	2019-2020 and onwards
		PRACTICAL II: SEMICONDUCTOR DEVICES	Semester:	I & II
Hrs/Week:	3		Credits:	5

Course Objective

To equip the students to learn the working and characteristics of various active electronic components.

Course Outcomes (CO)

K1	CO1	Understand the properties and principles of various semiconductor devices.
K2	CO2	Study the characteristics of semiconductor diodes and various transistors configurations.
K3	CO3	Evaluate the biasing and basic switching applications of transistor.
K4	CO4	Demonstrate the operation and applications of various power electronics components.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	L	L
CO2	S	S	L	L
CO3	S	M	S	S
CO4	S	M	S	S

S - Strong; M-Medium; L-Low.

Code No.	Course	Semester No.
19ELU06	PRACTICAL II: SEMICONDUCTOR DEVICES	I & II

(Any 18 Experiments)

1. Band Gap Energy of Silicon / Germanium Diode.
2. Temperature Co-efficient of Junction Diode.
3. Characteristics of PN Junction Diode.
4. Characteristics of Zener Diode.
5. Characteristics of Light Emitting Diode.
6. Common Emitter (CE) Characteristics of Transistor.
7. Common Base (CB) Characteristics of Transistor.
8. Common Collector (CC) Characteristics of Transistor.
9. Transistor Biasing Circuits.
10. Transistor as a Switch.
11. Characteristics of JFET.
12. Characteristics of MOSFET
13. Characteristics of SCR.
14. Characteristics of TRIAC.
15. Characteristics of DIAC.
16. Characteristics of UJT.
17. UJT Relaxation Oscillator.
18. Zener Diode as Voltage Regulator.
19. FET as Voltage Variable Resistor (VVR).
20. Measurement of stability factor of Fixed and Self Bias.
21. Characteristics of LDR.
22. Characteristics of Solar Cell.
23. Study of IR Transmitter & Receiver.
24. Study of Seven Segment Display.
25. ON / OFF control of relay using Opto – Couplers.

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CONTROLLER OF EXAMINATIONS
HICAS
CBE-28

Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU07	Course Title	Batch:	2019- 2020 Batch Only
		PRINCIPLES OF COMMUNICATION SYSTEM	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective:

To equip and enable the students to learn the basic principles used in Electronic Communication Systems.

Course Outcomes (CO)

K1	CO1	Understand the principles of wave propagation and communication system.
K2	CO2	Analyze the need of modulation and frequency spectrum of AM & FM.
K3	CO3	Interpret the working of various analog, pulse and digital modulation techniques.
K4	CO4	Apply analog and digital modulation scheme for real time knowledge transfer.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	S
CO3	S	M	S	S
CO4	S	M	M	L

S – Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELU07	PRINCIPLES OF COMMUNICATION SYSTEM	III
Units	**Topics**	**Hours**
I	**Radio wave propagation:** Electromagnetic wave – Ground wave propagation–Sky wave propagation–Space wave propagation – surface waves – atmospheric propagation –critical frequency and MUF – skip distance – Radio horizon – space wave propagation – concept of duct and tropospheric scatter propagation. Line of sight – over the horizon system.	12
II	**Amplitude Modulation:** Introduction – Modulation – Need for modulation – Amplitude modulation theory: Mathematical representation of AM – Frequency spectrum – Power relations in the AM wave. Generation of AM: Balanced modulator – Filter method – Phase shift method – Filter method and Third method –Independent sideband system – Vestigial sideband Transmission.	12
III	**Frequency Modulation:** Introduction – Theory – mathematical representation of FM – Frequency spectrum of FM. Phase modulation – Noise and frequency modulation: Effects of noise on carrier – Pre-emphasis – De-emphasis – Comparison of wideband and Narrowband FM. Generation of Frequency modulation: Direct methods: Reactance Modulator, Varactor Diode Modulator, Stablished reactance modulator–AFC. Indirect Method: Armstrong method.	12
IV	**Pulse and Digital Modulation:** Introduction – Sampling – Sampling theorem – Pulse amplitude modulation– Pulse width modulation – Pulse position modulation – Pulse code modulation – Quantization Noise – Differential PCM – Delta modulation– ASK – FSK – PSK – BPSK –DPSK – QAM – QPSK.	12
V	**Radio Receivers:** Introduction – Tuned Radio Frequency (TRF) receiver – Superheterodyne receiver – AM receivers: RF section and characteristics – Frequency changing and tracking – Intermediate frequencies and IF amplifiers – Detection and Automatic Gain Control (AGC). FM receivers: Block diagram– Amplitude limiting– FM demodulators –Ratio detectors– SSB receiver– ISB receiver.	12

Text Books:

1. *Electronic Communication System – Kennedy-TMH.*
2. *Communication System – Bruce Carson –PHI.*
3. *Principles of Communication System-Taub and schillings-PHI.*

Reference Books:

1. *Electronic and Radio Engineering- Terman M.H.*
2. *Electronic Communication –Roddy and Coolen-PHI.*

Course Designed by	Verified by HOD	Checked by	Approved by
Dr. K. THANGAVEL	Dr. P. Gomiram	M. [illegible]	

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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU08	Course Title	Batch:	2019- 2020 Batch Only
		DIGITAL ELECTRONICS AND ITS APPLICATIONS	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective:

To equip the students to learn with detailed knowledge in number systems, digital IC's, logic gates, comparators, flip flops, DACs and ADCs.

Course Outcomes (CO)

K1	CO1	Understand the basic and principles of Digital Electronics.
K2	CO2	Analyze the various number systems.
K3	CO3	Interpret the working of several logic gates and Boolean theorems.
K4	CO4	Apply the sequential, A/D and D/A principles for real time knowledge transfer.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	M	S	M
CO2	S	S	M	S
CO3	S	M	S	L
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELU08	DIGITAL ELECTRONICS AND ITS APPLICATIONS	III
Units	**Topics**	**Hours**
I	**Number System and Codes** Binary Number System – Binary-to-decimal Conversion – Binary-to-decimal Conversion – Decimal-to-binary Conversion – Octal Numbers – Hexadecimal Numbers – Alphanumeric Codes: ASCII Code – EBCDIC Code– Hollerith Code. Weighted Codes: Reflective and Sequential Codes. The Excess-3 Code – The Gray Code– Parity Method for Error Detection and Correction– Hamming Code.	12
II	**Logic Gates and Boolean Algebra** Basic Logic Gates – Universal Logic Gates – AND-OR-Invert Gates – Positive and Negative Logic – Boolean Laws and Theorems – SOP – Karnaugh Map– Karnaugh Map Simplifications– Don't care Conditions - POS – POS Simplification. Simplification by quine-McClusky method –Static and Dynamic Hazards.	12
III	**Arithmetic and Combinational Circuits** **Arithmetic Circuits:** Binary Addition – Binary Subtraction – Unsigned Binary Numbers- Sign- magnitude Numbers – 2's Complement Representation – 2's Complement Arithmetic. **Combinational Circuits:** Adder-Subtractor – Arithmetic Logic Unit – Binary Multiplication and Division– Multiplexers– Magnitude comparator – De-multiplexers – Decoder– Encoder-Parity generator/Checker	12
IV	**Sequential Logic Circuits** Flip Flops: RS, Clocked RS, D, JK, JK Master Slave and T Flip Flops. Counters: Asynchronous counter – Synchronous counter – Up/Down counter – Modulus counters – Decade counter. Shift Registers: Serial In/Serial Out – Serial In/Parallel Out – Parallel In/Serial Out – Parallel In/Parallel Out.	12
V	**D/A and A/D Converters** Digital to Analog converters: Weighted Resistor Method – R-2R Ladder Method – Accuracy and Resolution of DAC. Analog to Digital converters: Simultaneous converter – Counter type converter – Continuous type converter –Successive approximation type converter – Ramp type A/D converter – Dual slope converter – Flash Accuracy and resolution of ADC.	12

Text Books:

1. *A. S. Salivahanan, S. Arivazhagan, "Digital Electronics", Vikas Publishing House Pvt. Ltd., First Edition, 2010.*
2. *Donald P. Leach, Albert Paul Malvino & Goutam Saha, "Digital Principles and Applications", Tata McGrawHill, 7th Edition, 2011.*

Reference Books:

1. *Thomas L. Floyd & R.P.Jain, "Digital Fundamentals", Pearson Education, 8th Edition, 2005.*
2. *M.Morris Mano, "Digital Logic and Computer Design", PHI, 2005.*

Course Designed by	Verified by HOD	Checked by	Approved by

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Course Code:	19ELU09	Course Title	Batch:	2019- 2020 Batch Only
		ELECTRONIC CIRCUITS	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective:

This course describes the working of rectifiers, filters, voltage regulators, various types of amplifiers & oscillators and to enable the students to become an electronic circuit designer.

Course Outcomes (CO)

K1	CO1	Acquire basic knowledge on the working of various amplifiers, oscillators and multivibrator.
K2	CO2	Develop analysis capability in rectifiers, filters and voltage regulators.
K3	CO3	Design competence in power and feedback amplifiers.
K4	CO4	Implementation of various amplifier circuits for practical applications.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	M	S
CO3	S	M	S	M
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELU09	ELECTRONIC CIRCUITS	III
Units	**Topics**	**Hours**
I	**Rectifiers, Filters and Voltage Regulators** Half wave, Full wave and bridge rectifiers – RMS value – Average value - Ripple Factor – Rectification Efficiency – Filters: Inductor Filter– Capacitor Filter – LC Filter – π-Filter – Voltage Regulation – Zener Diode Shunt Regulator – Transistor Shunt and Series Regulator – DC Power Supply - Clipper and Clamper circuits.	12
II	**Single and Multistage Transistor Amplifiers** Transistor as an Amplifier – Common Emitter, Common Base and Common Collector Amplifiers - Gain of Multistage Amplifiers – RC Coupled Amplifier – Impedance Coupled Amplifier – Transformer Coupled Amplifier – Direct Coupled Amplifier – Frequency response - Darlington pair Amplifier - Advantages, disadvantages and Applications	12
III	**Power Amplifiers** Performance parameter and AC load line – Classifications – Class A power Amplifier – Class B Power Amplifier – Class B Push-Pull Amplifier – Crossover Distortion – Class C Amplifiers – Characteristics and overall efficiency of Class A, Class B and Class C Power Amplifiers.	12
IV	**Feedback Amplifiers** Principle of Feedback amplifiers – Types – Effect of Negative Feedback on gain - Gain stability – Bandwidth– Distortion – Noise - Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedbacks – Comparison of feedback connections – Negative Feedback in transistor amplifier – CE amplifier without emitter bypass capacitor – Emitter Follower – Negative feedback in multistage amplifiers.	12
V	**Oscillators and Multivibrators** Classification - Barkhausen Criterion – Hartley Oscillator – Colpitt's Oscillator – Clapp Oscillator – Quartz crystal – RC Phase Shift – Wien Bridge Oscillators – Astable, Monostable and Bistable Multivibrators – Schmitt Trigger.	12

Text Book:

1. *Salivahanan, S., Suresh Kumar, N., & Vallavaraj A. Electronic Devices and Circuits, Tata Mc Graw Hill publishing Company Limited, 4th Edition, 2013.*

Reference Books:

1. *B.L.Theraja, "Basic Electronics Solid State", S.Chand Company Ltd., 2006.*
2. *R.S. Sedha, "A Text Book of Electronic Circuits", 3rd Revised Edition, S.Chand, 2010.*
3. *S.K. Sahdev, "Electronic Principles", Dhanpat Rai & Co (P) Ltd, 2nd Edition, 1998.*

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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU10	Course Title	Batch:	2019- 2020 Batch Only
		PROGRAMMING IN C	Semester:	III
Hrs/Week:	5		Credits:	4

Course Objective:
On successful completion of this course the students have the programming ability in C Language.

Course Outcomes (CO)

K1	CO1	Create algorithms to solve simple programming problems
K2	CO2	Analyze programming problems to choose when regular loops should be used and when recursion will produce a better program.
K3	CO3	Design, implement, test and debug programs that use different data types, such as simple variables, arrays, and structures.
K4	CO4	Apply the programming skills in real time applications.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	M
CO2	S	S	M	S
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELU10	PROGRAMMING IN C	III
Units	**Topics**	**Hours**
I	**Introduction** Overview of C– Names – Data types and Qualifiers – Constant – variables – Assignment of variables – Variable Initialization. Operators: Arithmetic, Assignment, Relational, Logical, Bitwise, Conditional, Compound assignment, Unary and other operators – Order of precedence and associativity of operators.	12
II	**Program Control Constructs** Conditional & multiple branching iteration – Jump constructs – Console input and output: Console I/O Functions – getch, putch, getchar, putchar, gets, puts, printf and scanf functions – Formatted I/O Functions: Definition– prototype – recursion – simple programs.	12
III	**Arrays** Initializations – Multidimensional arrays – character arrays. Pointers: Declaration and initialization of pointer variables – Pointers and Functions – Pointers and arrays – Pointers and strings – Arrays of pointers and pointer to an array – Command line arguments – Dynamic memory allocation.	12
IV	**Structures & Unions** Definition & initializing structure variables – Array of structures – Pointer to structures – Array of pointers structures – Passing structures to functions – bit fields – Union.	12
V	**Files** File structure – Opening & closing of files – Character functions – Line I/O functions – Formatted I/O functions – Block I/O functions. Preprocessor directive: file inclusion – Macro substitution – Conditional compilation.	12

Text Book:

1. *E.Balagurusamy, "Programming in ANSI C", Tata McGraw-Hill, 2004.*

Reference Books:

1. *Yashavant P. Kanetkar, "Let us C", BPB Publications, 14th Edition, 2016.*
2. *Stephen G. Kochan, "Programming in C", Addison-Wesley, Fourth Edition, 2015.*
3. *Rajaraman.V, "Computer Programming in C", Prentice-Hall of India Private Limited, Sixteenth Printing, 2006.*

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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU11	Course Title	Batch:	2019- 2020 Batch Only
		PRACTICAL III: C PROGRAMMING	Semester:	III
Hrs/Week:	5		Credits:	3

Course Objective:
Students will be able to develop logics which will help them to create programs, applications in"C".

Course Outcomes (CO)

K1	CO1	Read, understand and trace the execution of programs written in C language.
K2	CO2	Able to write the C code for a given algorithm.
K3	CO3	Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor.
K4	CO4	Apply the C language program skills and write programs that perform operations using derived data types.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	M
CO3	S	M	M	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No.	Course	Semester No.
19ELU11	PRACTICAL III: C PROGRAMMING	III

(Any 10 Experiments)

1. Find the sum, average, standard deviation for a given set of numbers.
2. Generate n prime numbers.
3. Generate Fibonacci series.
4. Find the greatest among the Three Numbers.
5. Check Whether the Given Number is Armstrong Number or Not.
6. Find the Sum of Given All Digits.
7. Find the Given Number is Prime or not.
8. Find the given number is odd or even.
9. Matrix Addition, Subtraction and Multiplication.
10. Sort the given set of numbers in ascending order.
11. Check whether the given string is a palindrome or not using Pointers.
12. Count the number of Vowels in the given sentence.
13. Find the factorial of a given number using recursive function.
14. Print the students Mark sheet assuming roll no, name, and marks in five subjects in a structure. Create an array of structures and print the mark sheet in the university pattern.
15. Write a function using pointers to add two matrices.

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU12	Course Title	Batch:	2019- 2020 Batch Only
		MICROWAVE AND FIBER OPTIC COMMUNICATION	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective:

To learn the basics of Wave Guides, fundamentals of Electromagnetic Waves &Microwaves, Concepts of Optical Fibers, the principles of Optical sensors and its Applications.

Course Outcomes (CO)

K1	CO1	Understand the basic concepts of microwave and electromagnetic theory.
K2	CO2	Analyze the waveguides, microwave components, instruments and microwave tubes.
K3	CO3	Identify the working of optical fibers and their properties.
K4	CO4	Apply microwave and fiber optic concepts for real time applications.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	M
CO2	S	S	S	S
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELU12	MICROWAVE AND FIBER OPTIC COMMUNICATION	IV
Units	**Topics**	**Hours**
I	**Microwave and Electromagnetics** Microwave region and band designations - Advantages & Applications of Microwave – Electro Magnetic wave principles – Maxwell's Equations: Amperes Law –Faraday's Law –Gauss's Law – Wave Equations – TEM/TE/TM/HE wave definitions.	12
II	**Waveguides** Propagation of Waves and Rectangular waveguide – Propagation of TEM waves – TE and TM Modes – Propagation of TM waves and Rectangular waveguide – Propagation of TE waves and Rectangular waveguide – TE, TM modes in rectangular waveguide.	12
III	**Microwave Components, Instruments and Microwave Tubes** Overview of Microwave Components, Measurement devices and instruments – Two Cavity Klystron Amplifier –Multicavity Klystron – Two Cavity Klystron Oscillator – Reflex Klystron – Travelling Wave Tube– Backward Wave Oscillator – Magnetrons.	12
IV	**Optical Fibers and Their Properties** Introduction to Optical Fiber – Basic Structure of Optical Fiber – Total Internal Reflection – Principles of light propagation – Types of fibers: Step Index & Graded Index fibers. Modes of Propagation: Single and Multimode fibers – Acceptance Angle – Numerical Aperture – Advantage and Application.	12
V	**Light Sources & Photo Detectors** Light Sources: LED - Fiber LED Coupling – LASERS. Photo Detectors: Characteristics – Photo Emissive Type – Photo Conductive – Photo Voltaic Devices – PIN Photo diode – Avalanche Photo Diode. Application: ADM – CATV – Digital Video Transmission.	12

Text Books:

1. *M.Kulkarni, "Microwave and Radar Engineering", Umesh Publications, 2nd Edition, 2009.*
2. *Subir Kumar Sarkar, "Optical Fibers and Fiber Optic Communication Systems", S. Chand Publication, 2nd Edition 2001.*

Reference Books:

1. *Annapurna Das & Sisir K. Das, "Microwave Engineering", Tata McGraw Hill Publications, 2nd Edition, 2009.*
2. *Gerd Keiser, "Optical Fiber Communications", TMH, 4th Edition, 10th Reprint, 2011.*
3. *Samuel Y. Liao, "Microwave Devices and Circuits", Pearson Education, Third Edition, 2008.*

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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU13	Course Title	Batch:	2019- 2020 Batch Only
		INTEGRATED CIRCUITS AND INSTRUMENTATION	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective:

To learn the basics of IC fabrication techniques and to equip the students with detailed knowledge of various analog IC's, Transducers and basic electronic instruments.

Course Outcomes (CO)

K1	CO1	Understand the basic concepts for the circuit configuration for the design of linear Integrated circuits.
K2	CO2	Analyze and develop skills to design simple circuits using OP-AMP.
K3	CO3	Recognize the Op-Amp based comparators, waveform generators, VCO and PLL operation and its application
K4	CO4	Evaluate various applications of special function of transducers and electronic instruments.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	M	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELU13	INTEGRATED CIRCUITS AND INSTRUMENTATION	IV
Units	**Topics**	**Hours**
I	**IC Fabrication Technology** Introduction – Fundamentals of Monolithic IC technology – Basic planar process – Wafer preparation – Epitaxial growth– Oxidation – Photolithography – Diffusion of impurities – Isolation techniques – Metallization – Monolithic transistors –Integrated resistors – Integrated capacitors – Integrated inductors – Thin and Thick Film Technology. **Logic Families:** Introduction to Digital IC families – DTL-DCTL-RTL – HTL – TTL–CMOS.	12
II	**Operational Amplifier** Op-Amp Non-Inverting and Inverting Amplifiers – Instrumentation Amplifier – V to I and I to V Converters –Differentiator and Integrator – Sample and Hold Circuits – Log and Antilog Amplifiers– Comparators – Square Wave Generator – Monostable Multivibrator – Triangle Wave Generator – Saw-tooth Wave Generator – Phase Shift Oscillator – Wien Bridge Oscillator.	12
III	**Timer and PLL** Block diagram of Timer (NE555) – Monostable Operation. Applications of Monostable Mode – Astable Operation – Applications of Astable Mode– Basic Principle of PLL – Phase Detector – VCO – Low Pass Filter– Monolithic PLL NE 565 – PLL Applications – Voltage Controlled Oscillator (LM566).	12
IV	**Transducers** Electrical Transducer – Advantages – Classifications – Characteristics and Choice of Transducer – Resistive Transducers – Potentiometers – Stain Gauge – Thermistors – Thermocouples – Variable Inductance Transducer– LVDT– RVDT – Capacitive Transducer – Piezoelectric Transducers – Hall Effect Transducers – Optoelectronic Transducers.	12
V	**Electronic Instruments** Q Meters- CRO: Block Diagram – Cathode Ray Tube – Measurement of Frequency – Measurement of Voltage and Current – Digital Oscilloscope– Digital Voltmeter: Ramp Type DVM – Dual Slope Integrating type DVM – Digital Multimeter – Humidity Measurement – Measurement of PH.	12

Text Books:

1. *D. Roy Choudhury &Shail B. Jain, "Linear Integrated Circuits" New Age International, 2004.*
2. S. Salivahanan& s. Arivazhagan "Digital Electronics" Vikas Publishing House Pvt,2010.
3. *wJ.B.Gupta "A Course in Electronic and Electrical Measurements and Instrumentation", S.K Kataria& sons, 12th Edition.*

Reference Books:

1. *K.R.Botkar, "Integrated Circuits", Khannan Publishers, 1991.*
2. *Ramakant A.Gayakwad, "Op–Amps and Linear Integrated Circuits", PHI, 2nd Edition, 1991.*
3. *H.S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill Publication Company Limited, Sixth Reprint, 2006.*

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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU14	Course Title	Batch:	2019- 2020 Batch Only
		PYTHON PROGRAMMING	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective:
To master the fundamentals of writing Python scripts.

Course Outcomes (CO)

K1	CO1	Understand the pros and cons on scripting languages vs. classical programming Languages (at a high level).
K2	CO2	Analyze the object-oriented programming, create and execute Python programs.
K3	CO3	Design data using appropriate Python visualization libraries.
K4	CO4	Develop python programming skills in real life applications.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Subject	Semester No
19ELU14	PYTHON PROGRAMMING	IV
Units	**Topics**	**Hours**
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms-building blocks of algorithms (statements, state, control flow, functions)- notation (pseudo code, flow chart, programming language) - algorithmic problem solving - simple strategies for developing algorithms (iteration, recursion) - Illustrative problems: find minimum in a list - insert a card in a list of sorted cards - guess an integer number in a range - Towers of Hanoi.	12
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode - values and types: int – float – Boolean – string - and list; variables – expressions – statements - tuple assignment - precedence of operators - comments; modules and functions - function definition and use - flow of execution - parameters and arguments; Illustrative programs: exchange the values of two variables - circulate the values of n variables - distance between two points.	12
III	**CONTROL FLOW, FUNCTIONS** Conditionals: Boolean values and operators - conditional (if) - alternative (if-else) - chained conditional (if-elif-else) - Iteration: state – while – for – break – continue – pass - Fruitful functions: return values – parameters - local and global scope - function composition – recursion - Strings: string slices – immutability - string functions and methods - string module - Lists as arrays - Illustrative programs: square root – gcd - exponentiation - sum an array of numbers - linear search - binary search.	12
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations - list slices - list methods - list loop – mutability – aliasing - cloning lists - list parameters - Tuples: tuple assignment - tuple as return value - Dictionaries: operations and methods - advanced list processing - list comprehension - Illustrative programs - selection sort - insertion sort – mergesort - histogram.	12
V	**FILES, MODULES, PACKAGES** Files and exception: text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - Illustrative programs - word count - copy file.	12

TEXT BOOKS:

1. *Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O 'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)*
2. *2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.*

REFERENCE BOOKS:

1. John V Guttag, —Introduction to Computation and Programming Using Python '', Revised and expanded Edition, MIT Press, 2013

2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

3. Timothy A. Budd, —Exploring Python|, Mc-Graw Hill Education (India) Private Ltd., 2015.

4. Kenneth A. Lambert, —Fundamentals of Python: First Programs|, CENGAGE Learning, 2012.

5. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

6. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3|, Second edition, Pragmatic Programmers, LLC, 2013.

Course Designed by	Verified by HOD	Checked by	Approved by

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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU15	Course Title	Batch:	2019- 2020 Batch Only
		PRACTICAL IV: ELECTRONIC CIRCUITS	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective:

To impart knowledge on assessing performance of electronic circuit through monitoring of sensitive parameters.

Course Outcomes (CO)

K1	CO1	Understand the theoretical principles essential for understanding the operation of electronic circuits.
K2	CO2	Analyze and measure the characteristics of electronic circuits and present experimental results.
K3	CO3	Develop, design and create simple electronic circuits and explain the concepts of feedback and construct feedback amplifiers and oscillators.
K4	CO4	Apply design competence in signal and power amplifiers using BJT.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No.	Course	Semester No.
19ELU15	PRACTICAL IV: ELECTRONIC CIRCUITS	IV

(Any 18 Experiments)

1. Half Wave Rectifier.
2. Full Wave Rectifier.
3. Filter Circuits.
4. DC Power Supply Design using IC 78XX and 79XX Series.
5. Clipper Circuit.
6. Clamper Circuit.
7. Voltage doubler.
8. Transistor Biasing Circuit.
9. RC Coupled Amplifier.
10. Transformer Coupled Amplifier.
11. Emitter Follower.
12. Class B Power Amplifier.
13. Class AB Power Amplifier.
14. Feedback Amplifier.
15. RC Phase Shift Oscillator using BJT.
16. Wien Bridge Oscillator using BJT.
17. Hartley Oscillator using BJT.
18. Colpitt's Oscillator using BJT.
19. Clapp Oscillator using BJT.
20. Crystal Oscillator.
21. Monostable Multivibrator using BJT.
22. Astable Multivibrator using BJT.
23. Bistable Multivibrator using BJT.
24. Schmitt Trigger using BJT.
25. Construction of DC Regulated power supply using IC 723.

Course Designed by	Verified by HOD	Checked by	Approved by
[SUDHA.S]	Dr. P Thoniscan	K. Thomas	

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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU16	Course Title	Batch:	2019- 2020 Batch Only
		PRACTICAL V: ANALOG AND DIGITAL IC	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective:

Students will learn and understand the Basics of digital electronics and able to design basic logic circuits, combinational and sequential circuits.

Course Outcomes (CO)

K1	CO1	Understand the principles of analog and digital IC's
K2	CO2	Identify the various digital ICs and understand their operation.
K3	CO3	Analyze the function of Boolean expressions, operational amplifiers and multiplexers.
K4	CO4	Apply Boolean laws and K-map to simplify the digital circuits.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No.	Course	Semester No.
19ELU16	PRACTICAL V: ANALOG AND DIGITAL IC	IV

(Any 18 Experiments)

1. Verification of Basic Logic Gates and Universal Gates.
2. Verification of Boolean Laws and Demorgan's Theorem.
3. Parity Generator and Checker.
4. Half Adder and Full Adder.
5. Half Subtractor and Full Subtractor.
6. Multiplexer and De multiplexers.
7. Encoder and Decoder.
8. BCD to 7-Segment Display.
9. Flip Flops.
10. Shift Registers and Ring Counter.
11. Analog to Digital Converter.
12. Digital to Analog Converter.
13. Inverting and Non-inverting Amplifier using Op-Amp.
14. Adder and Subtractor using Op-Amp.
15. Instrumentational Amplifier using Op-Amp.
16. First and Second order Low pass filter using Op-Amp.
17. First and Second order High pass filter using Op-Amp.
18. Band pass filter using Op-Amp.
19. Notch filter using Op-Amp.
20. Phase Shift and Wein Bridge Oscillator using Op-Amp.
21. Square Wave Generator using Op-Amp.
22. Zero crossing detector and Schmitt Trigger using Op-Amp.
23. Monostable Multivibrator using Timer.
24. Astable Multivibrator using Timer.
25. Voltage Controlled Oscillator using NE566.

Course Designed by	Verified by HOD	Checked by	Approved by

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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU17A	Course Title	Batch:	2019- 2020 Batch Only
		PRACTICAL VI: COMMUNICATION SYSTEMS	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective:
To equip the students with basic knowledge in Communication systems.

Course Outcomes (CO)

K1	CO1	Understand the principles of wave propagation and communication system.
K2	CO2	Analyze the need of modulation and frequency spectrum of PAM, PWM, & PPM.
K3	CO3	Develop the practical knowledge about theories of analog & digital communication.
K4	CO4	Apply analog and digital modulation scheme for real time knowledge transfer.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No.	Course	Semester No.
19ELU17A	PRACTICAL VI: COMMUNICATION SYSTEMS	IV

(Any 10 Experiments)

1. Amplitude Modulation and Demodulation.
2. Frequency Modulation LM565/NE565.
3. PAM Modulation and Demodulation.
4. PWM Modulation and Demodulation.
5. PPM Modulation and Demodulation.
6. Voltage Controlled Oscillator using Timer.
7. ASK Generation and Detection.
8. FSK Generation and Detection.
9. PSK Generation and Detection.
10. BPSK & DPSK Generation and Detection.
11. QAM Generation and Detection.
12. Pulse Code Modulation and Demodulation.
13. Delta & Adaptive Delta Modulation and Demodulation.
14. Establishment of Analog Fiber Optic Link.
15. Establishment of Digital Fiber Optic Link.

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	ELU	Programme Title: B.Sc ECS		
Course Code:	19ELU17B	Course Title	Batch:	2019- 2020 Batch Only
		PRACTICAL VI: PYTHON PROGRAMMING	Semester:	IV
Hrs/Week:	5		Credits:	4

Course Objective:

To acquire programming skills in core Python and describe the need for Object-oriented programming concepts in Python.

Course Outcomes (CO)

K1	CO1	Understand the basics of Object-Oriented Skills in Python.
K2	CO2	Analyze the concepts of object-oriented programming as used in Python: classes, subclasses, inheritance, and overriding.
K3	CO3	Interpret the concepts of Object-oriented programming as used in Python using encapsulation, polymorphism and inheritance.
K4	CO4	Discover the capabilities of Python regular expression for data verification and utilize matrices for building performance efficient Python programs.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	M	S	M
CO2	S	S	M	S
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No.	Course	Semester No.
19ELU17B	PRACTICAL VI: PYTHON PROGRAMMING	IV

(Any 10 Experiments)

1. Write Python program to print Hello World.
2. Write Python program to Hello World using string variable.
3. Write Python program to store data in list and then try to print them.
4. Write Python program to do basic trim and slice on string.
5. Write Python program to print list of numbers using range and for loop.
6. Write Python program to store strings in list and then print them.
7. Write Python program to let user enter some data in string and then verify data and print welcome to user.
8. Write Python program in which a function is defined and calling that function prints Hello World.
9. Write Python program in which a function(with single string parameter) is defined and calling that function prints the string parameters given to function.
10. Write Python program in which a class is define, then create object of that class and call simple print function define in class.
11. Find the maximum of a list of numbers.
12. Write a Python program to multiply matrices.
13. Write a Python program to find first n prime numbers.
14. Write a Python Program to perform selection sort.
15. Write a Python Program to perform Merge sort.

Course Designed by	Verified by HOD	Checked by	Approved by

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Code No	Course	Semester No
19ELU18	CELLULAR COMMUNICATION SYSTEM	V
Units	**Topics**	**Hours**
I	**Cellular Mobile System** Introduction – Basic Cellular System – Performance criteria – Operation of Cellular System – Analog Cellular System – Digital Cellular System – Elements of Cellular Mobile System Design: Frequency reuse channels – Co-channel interference reduction factor – Handoff Mechanism – Cell Splitting.	12
II	**Cell Coverage for Signal and Traffic** Mobile Point-to-point Model – Propagation over Water – Foliage loss – Propagation in Near-in Distance – Long distance propagation – Cell site antenna heights and signal coverage cells – Mobile-to-Mobile propagation.	12
III	**Frequency Management and Channel Assignment** Frequency Management – Frequency Spectrum Utilization – Set-up Channels – Channel Assignment – Fixed Channel Assignment – Non-Fixed Channel Assignment – Operate with additional Spectrum – Trafficand Channel Assignment – Perception of Call blocking from the Subscribers.	12
IV	**Handoffs and Dropped Calls** Implementing Handoffs – Initiation of a Handoff – Delaying a Handoff – Forced Handoffs – Queuing of Handoffs – Power difference Handoffs – Mobile assisted Handoff and Soft Handoff – Cell-site Handoff – Intersystem Handoff – Dropped call rate – Formula of Dropped call rate– Finding the values of δ and μ.	12
V	**Digital Cellular Systems** Global System for Mobile (GSM) – GSM Architecture – Layer modeling– Transmission – Radio resource management – Mobility Management – Communication Management – TDMA \ Architecture – Transmission and Modulation – CDMA – Terms ofCDMA systems – Call processing – Hand over Procedures.	12

TEXT BOOK:

1. *William C.Y.Lee, "Mobile Cellular Telecommunications", McGraw Hill Publications, Second Edition, 2008.*
2. *Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.*

REFERENCE BOOKS:

1. *Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson, 2013.*
2. *V.Jeyasri Arokiamary, "Cellular and Mobile Communications", Technical Publications Pune, 1st Edition, 2009*
3. *William C.Y.Lee, "Wireless and Cellular Telecommunications", Tata Mc-Graw Hill, 3rd Edition, 2006.*

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU19	Course Title	Batch:	2019- 2020 Batch Only
		VLSI DESIGN TOOLS	Semester:	V
Hrs/Week:	5		Credits:	4

Course Objective:

1. Recall the hardware abstraction of VHDL
2. Observe the Behavioral Modeling statements of VHDL.
3. Examine Structural Modeling of VHDL
4. Explore advanced features in VHDL for real time application.

Course Outcomes (CO)

K1	CO1	Understand the capabilities and hardware abstraction of VHDL.
K2	CO2	Clarify the behavioral modeling techniques used in different types of statements.
K3	CO3	Determine the dataflow, structural and configuration specifications used in VHDL.
K4	CO4	Appraise the various advanced features in VHDL and usage of design files and libraries.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	M	M
CO3	S	S	S	S
CO4	S	S	S	M

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU19	VLSI DESIGN TOOLS	V
Units	**Topics**	**Hours**
I	**Introduction and Basic Concepts of VHDL** History of VHDL – Capabilities of VHDL – Hardware Abstraction – Basic Terminology – Entity Declaration – Architecture Body Declaration– Basic Language Elements – Identifiers – Data Objects– Data Types and Operators.	12
II	**Behavioral Modeling Techniques of VHDL** Behavioral Modeling: Entity Declaration – Architecture Declaration - Process Statements– Variable Assignment Statements – Signal Assignments Statements – Wait Statement – IF Statement – Case Statement – Null Statement – Loop Statement – Exit Statement – Next Statement – Assertion Statement – Report Statements– More on Signal Assignment Statement – Multiple Process – Postponed Process.	12
III	**Data Flow Structural Modeling Techniques of VHDL** Data Flow Style of Modeling: Concurrent Signal Assignment Statement Versus Signal Assignment Statement – Delta Delay Revisited – Multiple Drivers – Conditional Signal Assignment Statement – Selected Signal Assignment Statement – Unaffected Value – Block Statement – Concurrent Assertion Statement.	12
IV	**Structural Modeling Techniques, Generics & Configuration of VHDL** Structural Modeling: Component Declaration – Component Instantiation– Resolving Signal Value – Examples of Structural Modeling– Half Adder– Full Adder – Four to One Multiplexers – Decoders and Encoders. Generics – Configuration – Configuration Specification – Configuration Declaration – Default Rules – Conversion Functions – Direct Instantiation– Incremental Binding	12
V	**Advanced Features in VHDL** Subprograms – Sub Program Overloading – Operator Overloading – Signatures – Default Value of Parameters – Package Declaration – Package Body – Design File – Design Libraries – Implicit Visibility – Explicit Visibility.	12

TEXT BOOK:

1. *J. Bhaskar, "VHDL Primer", Low price Edition, PHI, 2001.*
2. *Stephen Brown and Zvonko Vranesic," Fundamentals of Digital Logic with VHDL Design", Mc-Graw-Hill (2nd edition).*ISBN-*10: 0077211642*

REFERENCE BOOKS

1. *Charles H. Roth & Jr. Lizy Kurian John, "Digital System Design Using VHDL" Cengage Learning.*
2. *Douglas L. Perry, "VHDL: Programming by Example", Tata McGraw Hill, 4th Edition, 2002.*
3. *Kenneth L. Short, "VHDL for Engineers", Pearson, 1st Edition, 2009.*

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU20A	Course Title	Batch:	2019- 2020 Batch Only
		8051 MICROCONTROLLER	Semester:	V
Hrs/Week:	5		Credits:	4

Course Objective:

1. Recall the basic concept of digital fundamentals to Microcontroller Based system
2. Understand working principles of 8051Microcontroller
3. Familiarize with the assembly level and embedded C programming using 8051
4. Formulate appropriate computing solution and apply it to the Microcontroller based real-time Applications

Course Outcomes (CO)

K1	CO1	Recognize the architectural and operational configuration of 8051 MC entities.
K2	CO2	Summarize the different types of instruction set of 8051 microcontroller.
K3	CO3	Classify assembly language instructions and skills for assembly language programming.
K4	CO4	Apply assembly language programming to interface peripherals with 8051 microcontroller.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU20A	8051 MICROCONTROLLER	V
Units	**Topics**	**Hours**
I	**Overview and Instruction Set** Introduction to Computing – Microprocessor and Microcontrollers – Microcontrollers and Embedded Processors – Overview of 8051 Family– 8051 Architecture – Timers – Registers and Memory Organizations.	12
II	**8051 Assembly Language Programming** Inside the 8051 – Pin Out – Instruction Set: Addressing Modes – Data Transfer Instruction – Logical Instruction– Arithmetic Instructions – Jump and Call Instructions – Bit Oriented Instructions – Flags and Stack.	12
III	**Programming with C** Data types – Time delay programming – I/O programming – Logic Operations – Arithmetic Operations – Timer Programming – Counter Programming.	12
IV	**8051 Interrupts & Peripherals** 8051 Interrupts – Programming External Hardware Interrupts – 8051 Serial Communication Programming – Programming with Serial Communication Interrupts – Peripheral and Interrupt Programming in C.	12
V	**Real World Applications and Case Studies** LCD Interfacing – Keyboard Interfacing – Parallel and Serial ADC Interfacing – DAC Interfacing – Sensor Interfacing and Signal Conditioning – RTC Interfacing – Relays and Opto-Isolator Interfacing –Stepper Motor Interfacing – DC Motor Interfacing and PWM.	12

TEXT BOOK:

1. *Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", PHI, 2nd Edition, 2006.*
2. *Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson/Cengage Learning.*

REFERENCE BOOKS:

1. *Kenneth J. Ayala, "The 8051 Microcontroller", Delmar Cengage Learning, 3rd Edition.*
2. *D.Karuna Sagar, "Microcontroller 8051", Narosa Publishing House, 2011.*
3. *A.P. Godse, D.A. Godse, "Microprocessor and Microcontroller", Technical Publications Pune, First Edition, 2007.*

Course Designed by	Verified by HOD	Checked by	Approved by
Mrs. S. SOUNDARYA	Dr. K. THANGAVEL	Dr. K. THANGAVEL	Co-ordinator Curriculum Development Cell Hindusthan College of Arts & Science, Coimbatore-641 028.

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Coimbatore-641 028

Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU20B	Course Title	Batch:	2019- 2020 Batch Only
		PIC MICROCONTROLLER	Semester:	V
Hrs/Week:	5		Credits:	4

Course Objective:

1. Identify function of different blocks of PIC microcontroller.
2. Elaborate programs for data transfer, arithmetic, logical and I/O port operations.
3. Characterize the various ports available in PIC microcontroller
4. Interface LCD, Keyboard, ADC, DAC, Sensors, Relays, DC motor and Stepper motor with PIC18 microcontroller.

Course Outcomes (CO)

K1	CO1	Recite the architecture of the PIC 16F877 and its programming aspects (assembly Level)
K2	CO2	Elaborate the internal and external interrupts.
K3	CO3	Design real time embedded systems using the concepts of I/O Ports and Serial Port Interface
K4	CO4	Develop the real time application by interfacing peripherals

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU20B	PIC Microcontroller	V
Units	**Topics**	**Hours**
I	**PIC 16F877 Architecture and Instruction Set** Device Overview – Architecture – Memory Organization– Status Register – Option Register – INTCON Register – PCON Register– I/O Ports – Data EEPROM – Instruction Set: Byte Oriented Operations – Bit Oriented Operations – Literal and Control Operations.	12
II	**External Interrupts and Timers** RB0/INT External interrupt – Timer0 – Compare Mode – Capture Mode– Timer1 External Event Counter – PWM module – Port B – Change interrupts.	12
III	**I/O Ports and Serial Port Interface** I/O Ports – Synchronous serial Port Module – Serial Peripheral Interface – I2C Bus Interface – ADC Converter – USART.	12
IV	**Special Features** Configuration Word- Oscillator Configurations – Reset Alternatives – Low power Operation- Low Voltage Serial Programming – Parallel Slave Port.	12
V	**Interfacing and Applications** Digital logic – relays and solenoids - LCD interfacing –I2C interfacing – DAC interfacing – stepper motor interfacing – DC motor interfacing – ADC application -PWM applications	12

TEXT BOOKS:

1. *John B. Peatman, "Design with PIC Micro Controllers", Pearson Education, 2009.*
2. *PIC 16F87X Data book, Microchip Technology*

REFERENCE BOOKS:

1. *Muhammad Ali Mazidi, Rolind D. McKinlay and Danny Causey, "PIC Microcontroller and Embedded Systems using Assembly and C for PIC18", Pearson Education, 2013.*
2. *http://nptel.ac.in/courses/11710407*

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU21	Course Title	Batch:	2019- 2020 Batch Only
		PRACTICAL VII: CIRCUIT SIMULATION	Semester:	V
Hrs/Week:	5		Credits:	3

Course Objective:

1. Recall the characteristics of Electrical circuits & proteus Simulation.
2. Discuss a given network by applying various network theorems.
3. Construct laboratory experiments on proteus simulation.
4. Verify the given electrical circuit using proteus simulation.

Course Outcomes (CO)

K1	CO1	Understand the network theorem in Electrical circuits.
K2	CO2	Apply working knowledge of software package to simulate and solve electronics circuits for real time applications
K3	CO3	Analyze and Solve various DC & AC circuits.
K4	CO4	Categorize various Analog and Digital Electronics circuits.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No.	Course	Semester No.
19ELU21	PRACTICAL VII: CIRCUIT SIMULATION	V

(Any 10 Experiments)

1. Voltage and Current Divider
2. Super position Theorem
3. Thevenin's Theorem
4. Norton's Theorem
5. Maximum Power Transfer Theorem
6. Half Wave and Full Wave Rectifier
7. Low Pass and High Pass Filter
8. Band Pass and Band Reject Filter
9. Clipper and Clamper
10. RC Coupled Amplifier
11. RC Phase Oscillator
12. Wien Bridge Oscillator
13. Adder and Subtractor using OPAMP
14. Schmitt Trigger
15. Astable and Monostable Multivibrator

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU22A	Course Title	Batch:	2019- 2020 Batch Only
		MEDICAL ELECTRONICS	Semester:	V
Hrs/Week:	4		Credits:	4

Course Objective:

1. Outline the concepts of bio-potentials and bio-medical instruments.
2. Summarize the Practical considerations for ECG recording
3. Examine the application and specification of medical Diagnostic equipment.
4. Enhance the troubleshooting skills of bio-medical instruments.

Course Outcomes (CO)

K1	CO1	Review Components of Bio medical instrument system
K2	CO2	Characterize the recording system of medical terminology relevant for biomedical instrumentation
K3	CO3	Attain the knowledge of Biotelemetry and Patient Safety need for biotelemetry
K4	CO4	Facilitate the Computer based patient monitoring system for different instrumentation methods and basicelectrical safety.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU22A	MEDICAL ELECTRONICS	V
Units	**Topics**	**Hours**
I	**Human Physiological Systems** Cells and their structure – Transport of potentials – Bio-electric potentials. **Bio-potential Electrodes:** Design of medical instruments – Components of Bio medical instrument system – Electrodes – Half cell potential – purpose of the electrode paste. Types of electrode: Microelectrode – Depth and Needle electrodes – Surface electrode	9
II	**Bio Potential Recorders** Characteristics of the recording system – Electrocardiography – Origin of cardiac action potential – ECG lead configurations – ECG recording setup. Practical considerations for ECG recording – Echocardiography. Electroencephalography (EEG): Origin of EEG – Brain waves – Placement of electrodes – Recording setup.	10
III	**Diagnostic Equipment's** Electromyography (EMG): Recording setup – Determination of conduction velocities in motor nerves– Electroretinography (ERG) – Electro Oculography (EOG) – Blood pressure measurement (Indirect methods) – Audio meter – X- ray machine.	9
IV	**Biotelemetry** X-ray imaging – Radio fluoroscopy – Image Intensifiers – Angiography – Endoscopy – Diathermy. Biotelemetry and Patient Safety: Need for biotelemetry – Elements of telemetry system – Radio telemetry system – Physiological signals used in telemetry – TDM and FDM – Implantable units	10
V	**Physiological Assist Devices** Need for Pacemakers – Pacemaker parameters and circuits – Different modes of operation – DC defibrillator – Artificial heart valves – Heart lung machines – Artificial lung machines – Artificial kidney machine – Nerve and Muscle stimulator. Computer Applications: Data acquisition systems – Analysis of ECG signals – Computerized Axial Tomography(CAT) Scanner – Ultrasonic scanner – Magnetic resonance imaging – Computer based patient monitoring system.	10

TEXT BOOKS:

1. *Arumugam.M, "Biomedical Instrumentation", Anuradha Agencies Publishers, Chennai, 1992.*
2. *Khandpur, "Handbook on Biomedical Instrumentation", Tata McGraw Hill Company, New Delhi, 1989.*

REFERENCE BOOKS:

1. *Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education Asia, New Delhi, 4th Education, 2001.*
2. *Leslie Cromwell., Fred J. Weibell., Erich A. Pfeiffer., "Bio-medical Instrumentation and Measurements", Prentice Hall of India, New Delhi, 1990.*
3. *John G Webster, Ed., "Medical Instrumentation Application and Design", Third edition, John Wiley & Sons, Singapore, 1999*

Course Designed by	Verified by HOD	Checked by	Approved by
Mr. M. KUMARESAN	Dr. K. THANGAVEL	Dr. K. THANGAVEL	

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU22B	Course Title	Batch:	2019- 2020 Batch Only
		CONSUMER ELECTRONICS	Semester:	V
Hrs/Week:	4		Credits:	4

Course Objective:

1. Identify working principles of various blocks of car computer.
2. Explain the consumer electronics products like microwave oven, washing machine and AC.
3. Examine different product safety, compliance standards and techniques associated with digital devices
4. Enhance the knowledge in digital access devices.

Course Outcomes (CO)

K1	CO1	Recite operating principles of different types of CPU for cars.
K2	CO2	Elaborate the working of washing machine, Microwave ovens with block diagram.
K3	CO3	Illustrate the Block diagram of digital devices.
K4	CO4	Categorize the Digital Access Devices in the real time application.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU22B	CONSUMER ELECTRONICS	V
Units	**Topics**	**Hours**
I	**Car Computers** Electronic Ignition – Electronic Ignition Lock System– Antilock Braking System (ABS) – Electronically controlled suspension (ECS) – Instrument panel displays – Ultrasonic car safety belt system – Air bag system – Vehicle proximity detection systems – car navigation system.	9
II	**Microwave Ovens** Microwaves – Properties and generation – Microwave oven block diagram – LCD timer with alarm – Controllers Types of Microwave ovens – Microwave Cooking Safety instructions – Care andCleaning. **Washing Machines:** Electronic controller for washing machines – Washing machine hardware and software – Types of washing machines: Fuzzy logic washing machines – Features of washing machines.	10
III	**Air Conditioners** Air Conditioning: Components of air conditioning systems – All water Air conditioning systems – All air conditioning systems – Unitary and central air conditioning systems – Split air conditioners. **Refrigerators** Refrigeration – Refrigerants – Refrigeration systems – Domestic refrigerators.	9
IV	**Home / Office Digital Devices** Facsimile machine – Xerographic copier Calculators– Structure of a calculator – Internal Organization of a calculators – Servicing electronic calculators – Digital clocks – Block diagram of a digital clock.	10
V	**Digital Access Devices** Bar codes – Bar coding – Bar code scanner and decoder – Automated Teller Machines (ATM): Electronic Funds Transfer– Point of sale Terminal **Automated Teller Machines Set-Top Boxes** Interoperable set– top boxes – Middle ware for set-top boxes – PersonalVideo Recorder – Digital cable TV – Video on demand.	10

TEXT BOOK:

1. *S.P. Bali, "Consumer Electronics", Pearson Education, New Delhi, 2005.*

REFERENCE BOOKS:

1. *J.S.Chitode, "Consumer Electronics", Technical Publications, 2007.*
2. *Douglas Kinney, "A Beginners Guide to Consumer Electronics Repair: Hand Book and Tutorial", iUniverse, 2006.*
3. *Philip Hoff, "Consumer Electronics for Engineers", Cambridge University Press, 1998.*

Course Designed by	Verified by HOD	Checked by	Approved by
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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU23	Course Title	Batch:	2019- 2020 Batch Only
		SATELLITE AND NETWORK COMMUNICATION	Semester:	VI
Hrs/Week:	5		Credits:	4

Course Objective:

1. Understand the Orbital Period and Velocity of Satellite.
2. Interpret the communication subsystems
3. Illustrate the different types of data communication in satellite.
4. Explore various protocols in LAN and ISDN

Course Outcomes (CO)

K1	CO1	Understand the communication satellite orbit design and applications
K2	CO2	Design the satellite antenna equipment and satellite links.
K3	CO3	Analyze how digital technologies are used data communication protocols and network architecture.
K4	CO4	Implementation of LAN and ISDN standards used in network signaling systems.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	S	S
CO2	S	S	M	S
CO3	S	S	S	M
CO4	S	S	S	M

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU23	SATELLITE AND NETWORK COMMUNICATION	VI
Units	**Topics**	**Hours**
I	**Communication Satellite Orbit and Description** History of Satellite Communication – Satellite Frequency Bands – Satellite Systems – Applications – Orbital Period and Velocity –Effects of Orbital Inclination – Azimuth and Elevation – Coverage angle and slant Range – Eclipse – Orbital Perturbations – Placing Satellites into a Geo-Stationary orbit.	12
II	**Satellite Sub-Systems** Attitude and Orbit Control system – TTC&M Subsystem – Attitude Control Subsystem – Power Systems – Communication subsystems – Satellite Antenna Equipment. Satellite Link: Basic Transmission Theory – System Noise Temperature and G/T ratio – Basic Link Analysis – Interference Analysis – Design of satellite Links for a specified C/N – (With and without frequency Re-use) –Link Budget.	12
III	**Data Communication** Introduction – Basic Terms and Concepts – Line Configurations – Topology – Transmission Media – MODEM: Standard and Types – Analog and Digital transmission: Encoding and Modulating – Channel Capacity – Base Band and Broad Band – Transmission Impairments – Multiplexing: FDM – TDM – Error Detection and Control: CRC.	12
IV	**Network Architecture and Protocols** Layered Architecture – OSI model – Functions of Layers – Data Link Control Protocols – ARQ – Stop and Wait – Sliding Window – Go backN and Selective Repeat – Asynchronous Protocol: X Modem – Y Modem– Kermit – Synchronous Protocol: BSC– SDLC – HDLC– TCP/IP Model – SMTP – HTTP – FTP.	12
V	**LAN and ISDN** LAN: Standard, Protocol – IEEE 802 Standards: ETHERNET – LLC – MAC – CSMA/CD – Token Ring – Token Bus – FDDI –ALOHA– SONET – ISDN: IDN – Channels – User Interfaces – ISDN Layers – Broad Band ISDN – Frame Relay – ATM: Concept and Architecture – ISDN Protocol– Physical Layer Protocol – D-channel Data Link Layer –Layer 3 Protocols– Network Signaling Systems: SS7 Protocol.	12

TEXT BOOKS:

1. *Timothy Pratt, Charles Bostian& Jeremy Allnutt, "Satellite Communications" John Wiley & Sons, 2nd Edition, 2003. (Unit – I&II)*
2. *Behrous. A.Forouzan, "Data Communication and Networking", Tata McGraw Hill, 4th Edition, 2000. (Unit – III, IV and V)*

REFERENCE BOOKS:

1. *Satellite Communications-Dennis Roddy, McGraw Hill, 2nd Edition, 1996.*
2. *Ulysess Black, "Data Communications and Distributed Networks", 3rd Edition, 2012.*

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU24	Course Title	Batch:	2019- 2020 Batch Only
		INDUSTRIAL AND POWER ELECTRONICS	Semester:	VI
Hrs/Week:	5		Credits:	4

Course Objective:

1. Acquire knowledge about Construction and Operating principle of Thyristor.
2. Identify basic requirements for Thyristor Triggering.
3. Analyze different power Inverters and Choppers with their applications.
4. Design and develop various power electronic circuits for industrial applications.

Course Outcomes (CO)

K1	CO1	Recall the overview of thyristor used in power electronics.
K2	CO2	Analyze various thyristor triggering circuits and understand their applications.
K3	CO3	Investigate different types of choppers for power electronics-based design.
K4	CO4	Formulate the applications of thyristors in commercial and industrial application.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU24	INDUSTRIAL AND POWER ELECTRONICS	VI
Units	**Topics**	**Hours**
I	**Overview of Thyristor** Introduction – Symbolic representation – Specifications – Thyristor ratings – Construction – Operating Principle of an SCR–Two transistor analogy of SCR – Comparison of Thyristors with Gas Tubes and Transistors – Construction and Operating principle of DIAC, TRIAC, UJT, SCS, SUS, SBS, LASCR and LASCS.	12
II	**Thyristor Triggering and Commutation** Methods of triggering a Thyristor: Thermal Triggering – Radiation Triggering – Voltage triggering – dv/dt triggering – Gate triggering. Commutation of a Thyristor: Natural Commutation – Forced Commutation – Thyristor Configurations.	12
III	**Inverters and Choppers** Inverters: Working Principle – Thyristor based inverters – Series& Parallel inverters – Bridge inverters – Mc-Murray Bedford inverter– Voltage control and Current Source inverters. Choppers: DC Chopper – Single-Thyristor Chopper, Two-Thyristor Chopper, Morgan Chopper Circuit, Step-up Chopper – AC Chopper.	12
IV	**Dual Converters and Cycloconverters** Dual Converters: Block diagram– Types: Single-phase dual converter – Three-phase dual converter – Non-circulatory current dual converter – circulating current dual converter. Cycloconverters: Block diagram – Types: Single-phase Cycloconverter – Three-phase Cycloconverter.	12
V	**Applications of Thyristors** Temperature control – Illumination Control – TRIAC as a Three-position static switch – Automatic Street Lighting Circuit using LDR and SCR – Emergency Light using SCR – Automatic Water Level Indicator using SCR – Automatic Battery Charger using SCR – Light operated SCR Alarm – Burglar Alarm Circuit using SCR – Flip-Flop Circuit using SCR.	12

TEXT BOOK:

1. *S.K.Bhattacharya and S. Chatterjee, "Industrial Electronics and Control", Tata McGraw-Hill Publishing Company Limited, 13th Reprint, 2006.*

REFERENCE BOOKS:

1. *Rashid .M.H, "Power Electronics – Circuits, Devices and Applications", Prentice Hall, Third Edition, 2011.*
2. *Dr.Bimbhra.P.S, "Power Electronics", Khanna Publishers, Fifth Edition, 2014.*
3. *http://nptel.ac.in/courses/108101038.*

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU25A	Course Title	Batch:	2019- 2020 Batch Only
		EMBEDDED SYSTEMS	Semester:	VI
Hrs/Week:	5		Credits:	4

Course Objective:

1. Identify hardware and software components to build an embedded system.
2. Develop an understanding of the technologies behind the communication bus protocols.
3. Analyse interrupt service mechanism and develop Program Modeling Concepts for embedded systems
4. Improve inter process communication in embedded systems.

Course Outcomes (CO)

K1	CO1	Outline the concepts of embedded systems
K2	CO2	Acquire knowledge about devices and buses used in embedded networking
K3	CO3	. Develop programming skills in embedded systems for various applications.
K4	CO4	Incorporate the synchronization of process in embedded design

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU25A	EMBEDDED SYSTEMS	VI
Units	**Topics**	**Hours**
I	**Introduction To Embedded Systems** Embedded system – Processor embedded into system – embedded hardware units and devices in system – embedded software system – examples – embedded system on chio (Soc) and use of VLSI circuit design technology– complex systems design and processors – design process in embedded system – formalization of system design	12
II	**Devices and Communication Buses for Devices Network** IO types and examples – serial communication devices – parallel device ports – sophisticated interfacing features in device ports – wireless devices – timer and counting devices –watchdog timer–real time clock–networked embedded systems – serial bus communication protocols – parallel bus device protocols parallel communication – internet enabled systems network protocols – Wireless and mobile system protocols	12
III	**Device Drivers Interrupts Service Mechanism** Programmed I/O busy-wait approach without interrupt service mechanism – ISR concept –interrupt sources – interrupt servicing mechanism – multiple interrupts – direct memory access – device driver programming	12
IV	**Program Modeling Concepts** Program models – DFG models – state machine programming models for event controlled program flow – modeling of multiprocessor systems – UML modeling	12
V	**Interprocess communication and synchronization of process** Threads and tasks Multiple processes in an application – multiple threads in an application – tasks – task states – task states – task and data – concept of semaphores – shared data – interprocess communication – signal function – semaphore functions – message queue functions – mail functions – pipe functions – socket functions – RPC functions	12

TEXT BOOK:

1. *Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGrawHill, second Edition Fourteenth reprint, 2013.*

REFERENCE BOOKS:

1. *Lyla B.Das, Embedded Systems: An Integrated Approach Pearson Education, 2013.*
2. *David. E. Simon, An Embedded Software Primer, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.*

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU25B	Course Title	Batch:	2019- 2020 Batch Only
		IOT AND ITS APPLICATIONS	Semester:	VI
Hrs/Week:	5		Credits:	4

Course Objective:

1. Understand the definition and significance of the Internet of Things and its protocols.
2. Discuss the architecture, operation, and business benefits of an IoT solution.
3. Compare Web of Things versus Internet of Things
4. Explore the application of IOT in smart application.

Course Outcomes (CO)

K1	CO1	Recall the fundamentals of Internet of Things and its logical design.
K2	CO2	Understand the various Protocol Standardization for IoT and Network layer structure
K3	CO3	Analyze the IoT architecture and various models like domain, information and functional models etc,
K4	CO4	Summarize the applications of IoT in Industry.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU25B	IOT AND ITS APPLICATIONS	VI
Units	**Topics**	**Hours**
I	**IOT** What is the IoT – why is it important elements of an IoT– eco system Technology drivers – Business drivers – Trends and implications– Overview of Governance – Privacy and Security Issues.	12
II	**IOT PROTOCOLS** Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4 – BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security	12
III	**IOT ARCHITECTURE** IoT Open source architecture (OIC) – OIC Architecture & Design Principles – IoT Devices and deployment models – IoTivity : An Open source IoT stack – Overview- IoTivity stack architecture- Resource model and Abstraction.	12
IV	**WEB OF THINGS** Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.	12
V	**IOT APPLICATIONS** IoT applications for industry: Future Factory Concepts – Brownfield IoT, Smart Objects – Smart Applications. Study of existing IoT platforms /middleware, IoT – A, Hydra etc.	12

TEXT BOOKS:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press,2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011.
3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applicationsand Protocols", Wiley, 2012.

REFERENCE BOOKS:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything", 1st Edition, Apress Publications, 2013

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU26	Course Title	Batch:	2019- 2020 Batch Only
		PRACTICAL VIII:INDUSTRIAL ELECTRONICS	Semester:	VI
Hrs/Week:	3		Credits:	4

Course Objective:

1. Outline the triggering circuits of SCR.
2. Contrast the various control system using SCR.
3. Test the thyristor protection circuit using SCR.
4. Elucidate practical knowledge of power semiconductor devices and their applications

Course Outcomes (CO)

K1	CO1	Recite the basic operation of various power semiconductor devices and passive components.
K2	CO2	Compare the various converters by using SCR, DIAC, TRIAC.
K3	CO3	Analyze different power electronics circuits
K4	CO4	Improve the knowledge in power electronic circuits for different loads

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No.	Course	SemesterNo.
19ELU26	PRACTICAL VIII:INDUSTRIAL ELECTRONICS	VI

(Any 18 Experiments)

1. Resistance Triggering of SCR.
2. RC Phase Shift Triggering of SCR.
3. UJT Triggering of SCR.
4. Half Controlled Bridge Rectifier.
5. Power Control using SCR.
6. Automatic Street Light Control using DIAC and TRIAC.
7. Phase Control using TRIAC.
8. AC Motor Control using SCR.
9. Design of Snubber Circuit.
10. Fan Regulator using TRIAC.
11. Thyristor Chopper.
12. Burglar Alarm.
13. Switching Regulators.
14. ON / OFF Relay Control using Opto – coupler.
15. Temperature controller using AD 590/ LM 35.
16. Digital Bidirectional control using TRIAC.
17. Servo Stabilizer.
18. Cycloconverter.
19. Thyristor protection circuit.
20. Light Dimmer.
21. Automatic Battery Charger.
22. Fire Alarm.
23. Power Inverter.
24. Time delay circuit.
25. DC Motor Controller.

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU27	Course Title	Batch:	2019- 2020 Batch Only
		PRACTICAL IX: EMBEDDED SYSTEMS	Semester:	VI
Hrs/Week:	3		Credits:	4

Course Objective:

1. Study embedded systems hardware design tools.
2. Observe both simulation and practical implementation of the basic building blocks of a microcontroller including timers, counters, PWM generation.,etc
3. Examine a set of tools for embedded systems programming and debugging.
4. Justify several embedded systems with particular focus on the interaction between multiple devices.

Course Outcomes (CO)

K1	CO1	Review the hardware for embedded system application based on the processors.
K2	CO2	Interpolate suitable microcontroller along with appropriate interfacing circuits.
K3	CO3	Relate the interfacing circuits for an application with software programs.
K4	CO4	Summarize the features of the microcontrollers and provide apt solutions for any embedded application.

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No.	Course	SemesterNo.
19ELU27	PRACTICAL IX: EMBEDDED SYSTEMS	VI

(Any 18 Experiments)

(Using 8051 / PIC16F877 / PIC16F84A)

1. 16-bit Addition.
2. 8-bit Array Addition.
3. Subtraction of 8 –bit and 16-bit Numbers.
4. Square root of array of number.
5. Factorial of array of number.
6. Sort an array in an Ascending and descending order.
7. Largest/Smallest number among the array of data.
8. Generate the Fibonacci series.
9. Find odd/ even number.
10. Arithmetic and Logic Operations.
11. Data transfer with parallel port.
12. Time Delay generation using internal timer.
13. PWM Generation.
14. Object Counter.
15. Interfacing Matrix Keypad.
16. LCD Interface.
17. ADC Interface.
18. DAC Interface.
19. Solid State Relay Interface.
20. Seven Segment Display Interface.
21. Traffic Light Controller.
22. Water level controller.
23. Stepper Motor Interface.
24. Serial Communication.
25. Digital Clock.

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU28A	Course Title	Batch:	2019- 2020 Batch Only
		ROBOTICS AND AUTOMATION	Semester:	VI
Hrs/Week:	5		Credits:	4

Course Objective:

1. Recognize the various robot structures and their workspace.
2. Compare the different types of sensors used in robotics.
3. Identify proper actuators used in robotics and automation
4. Evaluate the Arduino Platform for robotics in real time application.

Course Outcomes (CO)

K1	CO1	Label the classification of robotics
K2	CO2	Examine sensors and actuators are to be controlled in a robot
K3	CO3	Distinguish Communication between Arduino hardware and PC.
K4	CO4	Categorize the application of robotics

Mapping of Outcomes

CO \ PO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU28A	ROBOTICS AND AUTOMATION	VI
Units	**Topics**	**Hours**
I	**Introduction to Robotics** History – Laws of robotics – Robot definition – Robot usage rules – Applications– Robot subsystems: Manipulators – End effectors – Actuators – Transmissions – Sensors and controllers – Classification of robots: Cartesian robot – Cylindrical robot – Spherical robot – Articulated robot.	12
II	**Sensors in Robotics** Requirements of a sensor – Tactile sensors – Temperature sensors LVDT Sensor – High Resolution Pneumatic tactile Sensor – Slip type Sensors –Piezo electric Contact Sensors – Remote Sensor Compliance– Range and Proximity Sensors – Electro-optical Sensors –CCD Camera.	12
III	**Actuators** Electrical actuator systems: Solenoids – Relays – Solid state switches – DC Motors – AC motors – Servo motor and stepper motor – Vacuum grippers – Mechanical gripper – Magnetic gripper – Mechanical actuator systems: Involving linkages – Gears – Ratchet and pawl – Belt and chain drives – Bearings.	12
IV	**Electronics for robot** Introduction to Microcontrollers – The Arduino Platform – Arduino Board– Arduino Family – Fundamentals of Arduino Programming– Keywords – Inbuilt functions – Libraries – Digital GPIO programming – Working with pins as input and output – Working with PWM Outputs – Working with Analog Inputs using on-chip ADC–Serial Communication between Arduino hardware and PC – Arduino Interrupt Programming.	12
V	**Robot Applications** Blinking of LED – LED brightness control using PWM – Motor Direction Control – Motor Speed Control using PWM – Name display in LCD – IR sensor Interface – Ultrasonic sensors interface – Tone generation – Line follower Robot – Obstacle avoider Robot – Never Falling Robot – Wireless Robot – PC control Robot.	12

TEXT BOOKS:

1. *Saha, S.K., "Introduction to Robotics", 2nd Edition, McGraw-Hill Education, New Delhi, 2014.*
2. *S.R. Deb, "Robotics Technology and Flexible Automation", 2nd edition, Tata McGraw Hill, New Delhi.*
3. *Michael McRoberts, "Beginning Arduino", 2nd edition, Apress, 2013.*
4. *John-David Warren, Josh Adams, Harald Molle, "Arduino Robotics", Apress, 2011.*

REFERENCE BOOKS:

1. *Maja J. Mataric, "The Robotics Primer", MIT Press, 2007.*
2. *B. R.Mitile, I.Nagrath, "Robotics and Control", Tata Mcgraw-Hill Education, 2003.*

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Programme Code:	ELU	Programme Title: B.Sc. ECS		
Course Code:	19ELU28B	Course Title	Batch:	2019- 2020 Batch Only
		AUTOMOTIVE ELECTRONICS	Semester:	VI
Hrs/Week:	5		Credits:	4

Course Objective:

1. Recite Charging Systems and Starting Systems.
2. Explain Electronic Fuel Control in ignition.
3. Classify different Types of Visual Display in instrumentation systems.
4. Summarize various engine Management Systems in automotive electronics.

Course Outcomes (CO)

K1	CO1	Review the automotive components, subsystems, and basics of ElectronicEngine Control in today's automotive industry.
K2	CO2	Examine the vehicle Condition Monitoring Trip Computer which used in Visual Display
K3	CO3	Use available automotive sensors and actuators while interfacing with microcontrollers / microprocessors during automotive system design.
K4	CO4	Organize the Safety standards, advances in towards autonomous vehicles.

Mapping of Outcomes

PO / CO	PO1	PO2	PO3	PO4
CO1	S	S	M	S
CO2	S	S	S	M
CO3	S	M	S	S
CO4	S	M	M	S

S – Strong; M-Medium; L-Low.

Code No	Course	Semester No
19ELU28B	AUTOMOTIVE ELECTRONICS	VI
Units	**Topics**	**Hours**
I	**Introduction** System approach – Electrical Wiring, Terminals and Switching – Multiplexed Wiring Systems – Circuit Diagrams and Symbols. **Charging Systems and Starting Systems:** Charging System Principles – Alternators and Charging Circuits – New Developments. Requirements of the Starting System – Starter motor and Circuits.	12
II	**Ignition Systems** Ignition fundamentals – Electronic Ignition – Programmed Ignition – Distributor less Ignition – Direct Ignition – Spark Plugs. Electronic Fuel Control: Basics of Combustion – Engine Fueling and Exhaust Emissions– Electronic Control of Carburation – Petrol Fuel Injection – Diesel Fuel Injection.	12
III	**Instrumentation Systems** Introduction to Instrumentation Systems – Various Sensors used for Different Parameters – Sensing Driver Instrumentation Systems– Vehicle Condition Monitoring Trip Computer – Different Types of Visual Display.	12
IV	**Electronic Control of Braking and Traction** Description Control Elements and Control Methodology – Electronic Control of Automatic Transmission: Introduction and Description Control of Gear Shift and Torque Converter Lockup – Electric Power Steering – Electronic Clutch.	12
V	**Engine Management Systems** Combined Ignition and Fuel Management Systems – Exhaust Emission Control – Digital Control Techniques – Complete Vehicle Control Systems – Artificial Intelligence and Engine Management – Automotive Microprocessor uses. Lighting and Security Systems: Vehicles Lighting Circuits – Signaling Circuit – Central Locking and Electric Windows Security Systems – Airbags and Seat Belt tensioners – Miscellaneous Safety and Comfort Systems.	12

TEXT BOOK:

1. *Tom Denton, "Automobile Electrical and Electronic Systems", Edward Arnold pb., 1995.*

REFERENCE BOOKS:

1. *Don Knowles, "Automotive Electronic and Computer controlled Ignition Systems", Don Knowles, Prentice Hall, Englewood Cliffs, New Jersey 1988.*
2. *William, T.M., "Automotive Mechanics", McGraw Hill Book Co.,*
3. *William, T.M., "Automotive Electronic Systems", Heiemann Ltd., London, 1978.*
4. *Ronald K Jurgen, "Automotive Electronics Handbook", McGraw Hill, Inc, 1999.*

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