KUVEMPU UNIVERSITY

BOARD OF STUDIES (BOS) IN ELECTRONICS
(UNDER GRADUATE PROGRAMME)

APPROVED SYLLABUS

(To be effective from the academic year 2021-22)

For

I AND II SEMESTER ELECTRONICS PAPERS

of

B.Sc./B.Sc.(HONS.) DEGREE PROGRAMME

[Framed in according with the National Education policy (NEP-2020)
&Based on ***Model Electronics Syllabus*** prepared by Electronics expert committee,
Karnataka State Higher Education Council, Bangalore]

Syllabus approved in the Board of Studies (BOS) meeting held on 23rd September 2021at the

Department **of Post-Graduate in Physics and Research, Jnana Sahyadri, Shankaraghatta**

CONTENTS

APPENDIX-1: COURSE PATTERN AND SCHEME OF EXAMINATION for B.Sc./B.Sc. (Hons.) as per NEP (2021-22 and onwards)

SUBJECT: ELECTRONICS

SlN	Semester	Title of the Paper	Teaching Hours	Hours / Week		Examination Pattern Max. Marks/Paper				Duration of Exam (hours)		Total Marks / paper	Theory Credits	Practical Credits
						Theory		Practical						
				Theory	Practical	Exam	IA	Exam	IA	Theory	Practical			
1	I	**ELE-CT 1:** Electronic Devices and Circuits	**60**	**4**	**4**	**60**	**40**	**25**	**25**	**3**	**4**	**150**	**4**	**2**
		ELE-OE1.1/1.2	**30**	**2**	**1****	**40**	**10**	**-**	**-**	**3 ***	**-**	**50**	**2**	
2	II	**ELE-CT2:** Analog and Digital Electronics	**60**	**4**	**4**	**60**	**30**	**25**	**25**	**3**	**4**	**150**	**4**	**2**
		ELE-OE2.1/2.2	**30**	**2**	**1****	**40**	**10**	**-**	**-**	**3 ***	**-**	**50**	**2**	

***Questions from practical have to be included in theory examinations of Open Electives (Since electronics is a practical oriented subject)**

**** Tutorial Class**

Basis for Awarding Theory Internal Assessment Marks:

SlN	Particulars	IA Marks
1	Minimum of Two internal Tests	**20**
2	Assignments/Seminar/Case Study/Project work/Reports on-visits to industries/exhibitions/science center's/active participation in Electronics competitions, etc.	**20**
TOTAL Theory IA Marks		**30**

Basis for Awarding Practical Internal Assessment Marks:

SlN	Particulars	IA Marks
1	Practical Test	**10**
2	Report on data sheet of electronic devices/Seminar on electronics experiments, etc.	**10**
3	Active participation in practical classes	**05**
TOTAL Practical IA Marks		**25**

B.Sc. DEGREE FORMATIVE AND SUMMATIVE ASSESSMENTS

(Under New syllabus of NEP-2020 Scheme; Effective from Academic Year 2021-22)

SEMESTER: I/II

CORE COURSE and PAPER: ELECTRONICS – I/II

1. FORMATIVE ASSESSMENT (Max. Marks = 30)		
ASSESSMENT TYPE	**DETAILS/METHOD**	**MARKS**
Test	Theory paper IA tests	**20** (Average of Two tests)
Assignments/Seminar/Case Study/Project work/Reports on visits to industries/exhibitions/science centre's/active participation in Electronics competitions, etc.		**20**
TOTAL Theory IA Marks		**40**

2. SUMMATIVE ASSESSMENT (End Semester Examination)

A. Theory Examination (Max. Marks = 70; Duration -3 Hrs)

Question Paper Pattern

(There are THREE sections A, B and C. Each Section has **EIGHT** main questions out of which **FIVE** main questions are to be answered

Section – A (Short Answer questions)

- **Each question carries 2 marks**
- Max. Marks = 2 x 5 = 10 Marks.

Section – B (Medium Length Answer questions)

- **Each question carries 4 marks**
- Max. Marks = 4 x 5 = 20 Marks

.

Section – C (Long Answer questions)

- **Each question carries 6 marks**
- Max. Marks = 6 x 5 = 30 Marks

APPENDIX- 2: Syllabus

Semester-I

ELE-CT1: ELECTRONIC DEVICES AND CIRCUITS

(Credits: Theory–04, Practical–02) Total Teaching hours:60

Course Objectives

Upon completing the course, ELE-CT1, the student will be able to understand various fundamental principles of network analysis, number systems and Boolean algebra and become familiar with the basic operation of electronic devices and circuits which are the building blocks of all electronic circuits, devices and gadgets.

UNIT-1 **15 HOURS**

Electronic Components: Electronic passive and active components, types and their properties, Concept of Voltage and Current Sources, electric energy and power. (Qualitative only)

Network Theorems: Superposition, Thevenin's, Norton's, Maximum Power Transfer, DC and AC analysis of RC and RL circuits, RLC series and parallel Resonant Circuits.

PN junction diode: Ideal and practical diodes, Formation of Depletion Layer, Diode Equation and I-V characteristics. Idea of static and dynamic resistance, Zener diode, Reverse saturation current, Zener and avalanche breakdown.

Rectifiers- Half wave and Full wave (center tap and bridge) rectifiers, expressions for output voltage, ripple factor and efficiency (mention only), Shunt capacitor filter. (Numerical examples wherever applicable).

UNIT-2 **15 HOURS**

Voltage regulator: Block diagram of regulated power supply, Line and Load regulation, Zener diode as voltage regulator– circuit diagram, load and line regulation, disadvantages. Clippers (shunt type) and clampers (Qualitative analysis only).

Bipolar Junction Transistor: Construction, types, CE, CB and CC configurations (mention only), VI characteristics of a transistor in CE mode, Regions of operation (active, cut off and saturation), leakage currents (mention only), Current gains α, β and y and their inter-relations, dc load line and Q point. Applications of transistor as amplifier and switch circuit and working. (Numerical examples wherever applicable).

UNIT-3 **15 HOURS**

Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal run away, stability and stability factor. Transistor as a two-port network, h-parameter equivalent circuit.

Amplifier: Class A, B and C Amplifiers (qualitative). Types of coupling, two stage RC Coupled Amplifier–circuit, working and its Frequency Response, loading effect, GBW product, Darlington transistor.

UNIT-4 **15HOURS**

Boolean Algebra: Constants, variables, operators, basic logic gates-AND, OR, NOT, Positive and negative logic, Boolean laws, Duality Theorem, De Morgan's Theorem, simplification of Boolean expressions-SOP and POS. Derived logic gates (NAND, NOR, XOR & XNOR). Universal property of NOR and NAND gates. (Numerical examples wherever applicable).

Course Outcomes

At the end of this course, students will be able to

- Study and analyze basic networks using network theorems in a systematic manner.
- Build simple electronic circuits used in various applications.
- Describe the behavior of basic semiconductor devices.
- Reproduce the I-V characteristics of diode/BJT devices.
- Describe the frequency response of BJT amplifiers.
- Explain the behavior, characteristics and applications of Varactor diode, Schottky diode, Tunnel diode, LED, LCD and solar cells.
- Apply standard device models to explain/calculate critical internal parameters of semiconductor devices.
- Understand and represent numbers in powers of base and converting one from the other, carry out simple arithmetic operations.
- Understand the basic knowledge of Digital system building blocks, effectively can construct simple digital designs with the knowledge of Boolean algebra.

Reference Books:

1. Robert L Boylestad, "Introductory circuit analysis", 5th edition., Universal Book 2003.
2. R.S.Sedha,"ATextbook of Applied Electronics", 7th edition., S.Chand and Company Ltd.2011
3. A.P.Malvino, "Principles of Electronics", 7th edition.TMH, 2011.
4. Electronic devices and circuit theory by Boylestad, Robert Nashelsky
5. David A. Bell "Electronic Devices and Circuits", 5th Edition, Oxford Uni.Press,2015
6. Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia(1994)
7. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha,7thEd., 2011, Tata McGraw
8. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHIL earning Pvt. Ltd.
9. Digital Circuits and systems, Venugopal, 2011, Tata McGrawHill.
10. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001,PHI Learning.
11. M. Nahvi& J. Edminister, "Electrical Circuits", Schaum's Outline Series TMGH 2005
12. S. A. Nasar," Electrical Circuits", Schaum's outline series, Tata McGraw Hill,2004
13. J. Millman and C. C. Halkias, "Integrated Electronics", Tata McGraw Hill,2001
14. A.S.Sedra,K.C. Smith,A.N. Chandorkar "Microelectroniccircuits", 6thEdn., Oxford University Press, 2014
15. J.J.Cathey, "2000 Solved Problems in Electronics", Schaum's outline Series, TMG1991

ELE-CP1: Electronic Devices and Circuits–Lab

(Hardware and Circuit Simulation Software)

Minimum of TEN Experiments to be performed excluding demonstration experiments

1. Verification of Thevenin's and Maximum Power Transfer Theorem.
2. Verification of Superposition Theorem.
3. Study of the I-V Characteristics of (a)p-n junction Diode, and(b)Zener diode.
4. Study of the I-V Characteristics of LED softwood different colors and 7-segmentdisplay.
5. Study of Half wave rectifier without and with shunt capacitor filter–ripple factor for different values of filter capacitors.
6. Study of full wave bridge rectifier without and with shunt capacitorfilter–ripple factor for different values of filter capacitors.
7. Study of Zener diode as a Voltage Regulator using bridge rectifier with shunt capacitor filter [Load and line regulation].
8. Study of Clipping, Clamping and Voltage Multiplier circuits.
9. Study of Transistor characteristics in CE configuration– determination of h-parameters.
10. Study of single stage CE amplifier (frequency response, input andoutput impedances in mid-band)
11. Study of two- stage RC-coupled CE amplifier (A_{V1}, A_{V2}, A_V) at mid-band frequency.
12. Study of Series and Parallel Resonance circuits–determination of its
    (a) Resonant frequency
    (b) Impedance at resonance
    (c) Bandwidth

(d) Quality Factor

13. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using respective ICs. Realization of XOR and XNOR using basic gates.

14. Universal property of NAND and NOR gates

ELE-OE1.1: Renewable Energy and Energy Harvesting

(Credits: Theory–02, Tutorial–01) **Total Teaching hours:30**

Unit-1 **15Hours**

Fossil fuels and Alternate Sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An over view of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models, equivalent circuits, and sun tracking systems.

Wind Energy harvesting**:** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

Unit – 2 **15 Hours**

Ocean Energy**:** Ocean Energy Potential against Wind and Solar, Wave Characteristics, and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

Geothermal Energy: Geothermal Resources, Geothermal Technologies.

Hydro Energy**:** Hydro power resources, hydro power technologies, environmental impact of hydro power sources. *Piezoelectric Energy harvesting*: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power. *Electromagnetic Energy Harvesting*: Linear generators, physics mathematical models, recent applications, Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.

Demonstration Experiments: **30 Hours**

1. Demonstration of training modules on solar energy, wind energy etc.
2. Conversion of vibration to voltage using piezoelectric voltages
3. Conversion of thermal energy into voltage using thermoelectric module.

Reference Books:

1. Non-conventional energy sources, B.H.Khan, McGraw Hill.
2. Solar energy, Suhas P Sukhative, Tata McGraw- Hill Publishing Company Ltd.
3. Renewable Energy, Power for a sustainable future, Godfrey Boyle, Oxford University Press.
4. Renewable Energy Sources and Emerging Technologies, Kothariet.al., PHI Learning.
5. Solar Energy: Resource Assessment Handbook, P Jayakumar.
6. J.Balfour, M.Shawand S.Jarosek, Photovoltaics, Lawrence J Goodrich(USA).
7. http://en.wikipedia.org/wiki/Renewable_energy

ELE-OE1.2: Basics of Electronics, Computers and PCB Design

(Credits: Theory–02, Tutorial–01) TotalTeachinghours:30

Unit-1 15 Hours

Generation of and distribution of electricity*:* Mention of hydro electric generator, diesel generator, thermal generator, wind power, solar, ocean waves. Generation of DC power–Mention of batteries. Single phase, two phase and three phase. Transformers. Power transmission and distribution. Domestic electrical wiring– connection from AC line to the meter, sockets, mention of phase neutral and the need of earthing. Mention of electric shock and safety. Mention of power type (ac or dc) and current ratings for home appliances. Mention of tester. Electric motor working principle.

Computer fundamentals*:* History of computer system, block diagram of a computer system- functions of each units (Input, Output, Memory and CPU), Mention of various input and output devices, Memories - registers, primary memory, secondary memory, cache memory, Software - system software (operating system, program language translators-assembler, interpreter and compiler), utility programs, communication software, performance monitoring software), application software, Software hierarchy and dependence between the different layers, computer languages – Machine, Assembly level and High level, Inverter, Uninterrupted Power supply (UPS) – online and off line UPS, SMPS.

Unit – 2 15Hours

PCB Design: Types of PCB, Single sided board – double sided – Multilayer boards –Plated through holes technology – Benefits of Surface Mount Technology (SMT) –Limitation of SMT– Surface mount components: Resistors, Capacitor, Inductor, Diode and IC's.

LAYOUT AND ART WORK: Layout Planning–General rules of Layout– Resistance, Capacitance and Inductance – Conductor Spacing – Supply and Ground Conductors–Component Placing and mounting–Cooling requirement and package density–Layout check. Basic artwork approaches– Artwork taping guideline–General art work rules–art work check and Inspection.

LAMINATES AND PHOTO PRINTING: Manufacture of copper clad laminates

–Properties of laminates – Types of Laminates – Manual cleaning process – Basic printing process for double sided PCB's – Photo resists – wet film resists – Coating process for wet film resists – Exposure and further process for wet film resists – Dry film resists.

ETCHING AND SOLDERING: Introduction–Etching machine–Etchant system. Soldering: Principles of Solder connection – Solder joints – Solder alloys–Soldering fluxes. Soldering Tools: Soldering, De soldering tools and Techniques – Man Soldering – Solder mask – Safety, health and medical aspects in Soldering practice.

Demonstration Experiments: **30 Hours**

1. Unboxing and assembling of desktop computers
2. Types of motors and transformers used in household appliances
3. Understanding voltage, current, frequency etc. of ac mains.
4. Upgradation of RAM, hard disk and SSD
5. SMPS: Block diagram and working
6. Inverter
7. Types of PCB and fabrication process.

Reference books:

1. Electrical Circuits, K.A.Smithand R.E.Alley, Cambridge University Press.
2. A text book in Electrical Technology -B L Theraja- S Chand &Co.
3. A text book of Electrical Technology-A K Theraja.
4. Performance and design of AC machines-MG Say ELBS Edtion.
5. Basic electrical engineering - V K Mehta and Rohit Mehta, S Chand and Company.
6. Computer fundamentals-Anita Goel, Pearson Edition.
7. Fundamentals of Computers-V Rajaram, Neeharika Adabala-PHI.
8. Computer Fundamentals- Peter Norton, McGraw-Hill Education
9. Walter C. Bosshart "PCB Design and Technology" Tata McGrawHill, Publications, Delhi. 1983.

Semester II

ELE-CT2: ANALOG AND DIGITAL ELECTRONICS

(Credits: Theory–04, Practical–02) Total Teaching hours:60

Course Objectives

Upon completing the syllabus contents of ELE-CT2, the student will become familiar with various working principles of widely used electronic devices, linear and digital ICs which help the students to build small projects and also be able to answer some basic questions that appear in competitive examinations.

UNIT-1 **15HOURS**

JFET–Types-p-channel and n-channel, working and I-V characteristics-n-channel JFET, parameters and their relationships, Comparison of BJT and JFET.

MOSFET: E–MOSFET, D–MOSFET–n-channel and p-channel, Construction, working, symbols, biasing, drain and transfer characteristics, MOS logic, symbols and switching action of MOS, NMOS inverter, CMOS logic, CMOS – inverter, circuit and working, CMOS characteristics, IGBT construction and working.

UJT - basic construction, working, equivalent circuit and I-V characteristics, intrinsic and-off ratio, relaxation oscillator.

SCR - Construction, VI characteristics, working, symbol, and applications – HWR and FWR.

UNIT-2 **15HOURS**

Op-Amp: Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal and Practical Op-Amp, Open and closed loop configuration, Frequency Response, CMRR, Slew Rate and concept of Virtual Ground.

Applications of op-amps: Concept of feedback, negative and positive feedback, advantages of negative feedback (Qualitative Study). Inverting and non-inverting amplifiers, Summing and Difference Amplifier, Differentiator, Integrator, Comparator and Zero-crossing detector.

Filters: First and second order active low pass, high pass and band pass Butter worth filters.

Oscillators: Barkhausen criterion for sustained oscillations, Colpitt's oscillator and crystal oscillators using transistor, Phase Shift oscillator, Wien-bridge oscillator – (no derivation for each)

IC 555Timer: Introduction, Block diagram, Astable and Monostable multivibrator circuits. (Numerical Examples wherever applicable)

UNIT-3 **15HOURS**

Combinational Logic Circuits: Minimization techniques using K-maps - SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and4 variable.

Design of Arithmetic logic circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor. 4-bit parallel binary adder, 2-bit and 4-bit magnitude comparator. Encoder, decimal to BCD priority encoder. Decoder, 2:4 decoder using AND gates, 3:8 decoder using NAND gates, BCD to decimal decoder, BCD to 7-Segment decoder, Multiplexer - 4:1 and 8:1 multiplexer, De multiplexer - 1:4 and 1:8 demultiplexer – logic diagram and truth table of each.

UNIT 4 **15 HOURS**

Sequential Logic Circuits: Flip-Flops - SR Latch, RS, D and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master- Slave JK and T Flip-Flops. Applications of Flip-Flops in semiconductor memories, RAM, ROM and types.

Registers and Counters: Types of Shift Registers, Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits), applications. Ring counter, Johnson counter applications. Asynchronous Counters: Logic diagram, Truth table and timing diagrams of 4bit ripple counter, modulo-n counters, 4 bit Up-Down counter, Synchronous Counter:4-bitcounter, Design of Mod 3, Mod 5 and decade Counters using K-maps.

Course Outcomes

At the end of this course, students will be able to

- Reproduce the I-V characteristics of various MOSFET devices,
- Apply standard device models to explain/calculate critical internal parameters of semiconductor devices.
- Explain the behavior and characteristics of power devices such as UJT, SCR, Diac, Triac etc.
- Perform experiments for studying the behavior of semiconductor devices.
- Calculate various device parameters' values from their IV characteristics.
- Interpret the experimental data for better understanding the device behaviour.
- Understand basic logic gates, concepts of Boolean algebra and techniques to reduce/simplify Boolean expressions
- Analyze combinatorial and sequential circuits

Reference Books:

(1) Electronic devices and circuit theory by Boylestad, Robert Nashelsky
(2) Electronic Devices Conventional Current Version by Thomas L.Floyd
(3) David A. Bell "Electronic Devices and Circuits", 5th Edition, OxfordUni. Press, 2015
(4) OP-Amps and Linear Integrated Circuit, R.A.Gayakwad, 4th edn,2000, Prentice Hall
(5) Operational Amplifiers and Linear ICs, David A.Bell, 3rd Edition, 2011, Oxford University Press.
(6) R.S.Sedha, "A Textbook of Applied Electronics", 7th edition., S.Chand and Company Ltd.2011
(7) Thomas L. Floyd, Digital Fundamentals, Pearson Education Asia (1994)
(8) Digital Principles and Applications, A.P.Malvino, D.P.Leachand Saha,7th Ed., 2011, Tata Mc Graw
(9) Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
(10) Digital Circuits and systems, Venugopal, 2011, Tata McGrawHill.
(11) Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
(12) R.L.Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill(1994)
(13) Digital Electronics, S.K. Mandal, 2010,1st edition, Mc GrawHill

ELE-CP2: ANALOG AND DIGITAL ELECTRONICS-Lab

(Hardware and Circuit Simulation Software)

PART A (Any FIVE)

1. Study of JFET/MOSFET characteristics–determination of parameters.
2. Study of single stage JFET amplifier. (frequency response and bandwidth)
3. UJT characteristics and relaxation oscillator
4. Design of inverting and non-inverting amplifier using Op-amp & study of frequency response.
5. Op-amp inverting and non-inverting adder, subtractor and averaging amplifier.
6. Study of the zero-crossing detector and comparator.
7. Design and study of first order high-pass and low-pass filters using op-amp.
8. Study of Colpitt's and crystal oscillator using transistor.
9. Astable multivibrator using IC555 timer.
10. Study of SCR Characteristics.

PART B (Any FIVE)

11. Half Adder and Full Adder using (a) logic gates (b) using only NAND gates.
12. Half Subtractor and Full Subtractor(a) logic gates(b) using only NAND gates.
13 4-bit parallel binary adder & subtractor using IC7485
14. Study of BCD to decimal decoder using IC7447
15. Study of the Encoders and priority encoders.
16. Study of Multiplexer and De multiplexer sing ICs.
17. Study of 2-bit and 4-bit magnitude comparators.
18. Study of Clocked RS, D and JK Flip-Flops using NAND gates.
19. Study of 4-bit asynchronous counter using JK Flip-Flop IC7476, modify to decade counter and study their timing diagrams.
20. Study of 4-bit Shift Register –SISO, modification to ring counter using IC -7495.
21. Digital to Analog converter using binary weighted resistor method, determination of resolution, accuracy and linearity error.

ELE-OE2.1: Electronics for Everyone

(Credits: Theory–02, Tutorial–01) **Total Teaching hours: 30**

Unit-1

Timer and PLL: Functional block diagram of 555timer, Monostable operation and its Application, Astable operation and its applications.

Phase Locked Loop: Functional block diagram–Phase detector/Comparator, Voltage Controlled Oscillator, Low pass filter, Applications: Frequency multiplier/Division, AM detection.

Unit-2

Operational Amplifier: Inverting and non-inverting amplifier, Op-amp parameters, Summing Amplifier, Difference Amplifier, Integrator, Differentiator, Instrumentation Amplifier, Audio Amplifier (LM386), Voltage to current converter, Current to Voltage converter, Sample and Hold circuits.

First order active filters (Circuit diagram and formula only): lowpass, high pass, band pass, band reject and all pass filters. Phase-shift and Wein bridge oscillator using op-amp.

Unit-3

Transducers (Basic Working): Displacement Transducers-Resistive (Potentiometric, Strain Gauges–Types, Gauge Factor, bridge circuits, Semi-conductor strain gauge) Capacitive (diaphragm), Hall effect sensors, magneto-strictive transducers, Microphone, Touch Switch, Piezoelectric sensors, light (photo-conductive, photo-emissive, photovoltaic, semiconductor, LDR), Temperature (electrical and non-electrical), Pressure sensor.

A-D and D-A Conversion: D-A conversion: 4-bit binary weighted resistor type, circuit and working. Circuit of R-2R ladder-Basic concept. A-D conversion characteristics, successive approximation ADC. (Mention the relevant ICs for all).

Unit-4

Data Acquisition using Arduino: Arduino: Birth, Open-Source community, Functional Block Diagram, Functions of each Pin, Arduino Development Boards: IDE, I/O Functions, Looping Techniques, Decision Making Techniques, designing of 1st sketch, Programming of an Arduino (Arduino ISP), Serial port Interfacing, Basic Interfacing and I/O Concept, Interfacing LED, Switch,7seg LED, different sensors.

SuggestedBooks:

1. B. C. Sarkar and S. Sarkar, Analog Electronics: Devices and Circuits (Revised edition), Damodar Group (Publishers), Burdwan, ISBN:978-93-85775-15-4(2019)
2. Measurement Systems, 4/e, Doeblin McGrawHill, NewYork,1992.
3. Electrical Measurements &Electronic Measurements by A.K.Sawhney
4. B. C. Sarkar and S. Sarkar, Digital Electronics: Circuits and Systems, S UTPrakashani, Burdwan, ISBN:978-81-88391-57-8(2018)
5. Instrumentation- Devices and Systems By Rangan, Sarma, and Mani, Tata-McGrawHill
6. Electronic Instrumentation by H.S Kalsi, McGraw Hill
7. Instrumentation measurements and analysis by Nakra & Choudhary
6. Measurement &Instrumentation- DVS Murthy
7. R.A.Gayakwad, Op-Amps and LinearIC's,Pearson Education(2003)
8. Electronic Sensor Circuits and Projects, IIIVolume, For restMMims, Master Publishing Inc.
9. Timer, OpAmp, and Optoelectronic Circuits &Projects, Forrest MMims, Master Publishing Inc.
10. Exploring Arduino, Jeremy Blum, Wiley
11. Beginning Arduino, Michael McRobetrs, Technology in Action
12. Beginning Arduino Programming, Brian Evans, Technology in Action
13. Practical Arduino Engineering, Harold Timmis, Technology in Action
14. Practical Arduino : Cool Projects for open source hardware, Jonathan Oxer, Hugh Blemings, Technology in Action

Electronics for Everyone Demonstration Lab

(Hardware and Circuit Simulation Software) 30hours

1. Study of basic monostable multivibrator
2. Study of basic Astable multivibrator
3. Light detection using 555timer
4. Rain alarm using 555 timer
5. Motor control by PWM using 555 timer
6. LED flasher circuit using 555 timer

7. Analog light wave Transmitter/Receiverusing555timer
8. Study of basic inverting and non-inverting amplifier
9. Study of basic integrator circuit
10. Study of basic differentiator circuit
11. Design of first order LPF
12. Study of first order HPF
13. Designing of fiber optic-based Transmitter/Receiver using LM386
14. Temperature to voltage converter using741.
15. Shadow sensing using 741
16. Light based PWM using 741and V-F converter
17. Test the different Arduino Boards, Open-Source and Arduino Shields.
18. Install Arduino IDE and its development tool.
19. Develop a program to Blink LED for1second.
20. Develop a program to interface Input Switches and output LEDs with development board (Arduino).
21. Interface7segment display with development board (Arduino)
22. Interface LM35 temperature sensor with Arduino and monitor temperature on serial monitor.
23. Interface DC motor using L293D Motor Driver.
24. Interfacing of various sensors with Arduino development board

ELE-OE 2.2: Mobile Communication

(Credits: Theory–02, Tutorial–01) Total Teaching hours: 60

Unit 1

Evolution of mobile radio communication-Examples of wireless communication system: paging systems, cordless telephone system, cellular telephone system-Trends in cellular radio and personal communication systems.

Unit 2

Frequencies for radio transmission- Basics of multiplexing and multiple access techniques-CDMA-Cellular system concepts-Frequency Reuse-Channel assignment and handoff strategies- Improving capacity in cellular system: cell splitting, sectoring, repeaters for range extension, a microcell zone concept.

Unit3

Introduction to telecommunicating system-GSM: mobile services (Bearer services, tele-services, supplementary services), system architecture (radio subsystem, network and switching subsystem, operation subsystem)

Unit4

Satellite system: history, application, basics, routing, localization and handover-Broadcast system: digital audio broadcasting, digital video broadcasting (basic concepts).

Unit5

Wireless LAN-Infrared vs radio transmission-Bluetooth: user scenario sand architecture-WiMAX: basic concepts and features-Wi-Fi-basic concepts.

Mobile Communication–Demonstration Lab 30hours

1. Demonstration of keypad mobile handset.
2. Demonstration of smart phone handset.
3. Block diagram description.

Text Books

1. Rapapport T. S, 'Wireless Communication Principles and Practices', Pearson Education Asia, NewDelhi, 3rd ED.2003
2. Jochen Schiller,' Mobile communication 'Pearson Education, Asia.

Reference Book

Vijay K Garg, Joseph E Wilkes,'Principles and Applications of GSM', Pearson Edu.

SEMESTER: I/II

ELECTIVE COURSE and PAPER: ELECTRONICS – I/II

1. FORMATIVE ASSESSMENT (Max. Marks = 10)		
ASSESSMENT TYPE	**DETAILS/METHOD**	**MARKS**
Test	Theory paper IA tests	10

2. SUMMATIVE ASSESSMENT (End Semester Examination)

Theory Examination (Max. Marks = 40; Duration -2 Hrs)

Question Paper Pattern

Section – A (Medium Length Answer questions)

- Total Questions = 5. Questions to be answered = 4
- **Each question carries 5 marks**
- Max. Marks = 4 x 5 = 20 Marks

Section – B (Long Answer questions)

- Total Questions = 3. Questions to be answered = 2
- **Each question carries 10 marks**
- Max. Marks = 2 x 10 = 20 Marks