JYOTINIVASCOLLEGEAUTONOMOUS
SYLLABUS FOR 2021-22 Batch Onwards
Programme: B.Sc.
SECOND SEMESTER SYLLABUS
Title: ANALOG AND DIGITAL ELECTRONICS

CourseCode:ELE-CT-2 **No. of Hours: 60**

COURSEOBJECTIVE:

- Familiarize with various working principle of widely used power devices and linear ICs.
- Familiarize with digital ICs which enable students to construct Minor projects and answer basic questions in competitive examinations.
- Apply Logical thinking for problem solving in real time electronic projects.

LEARNINGOUTCOME

At the end of the course the student should be able to

- Understand working of special purpose device and power devices.
- Analyze basic operation and applications of IC 741 and IC 555.
- Analyze combinational and sequential logical circuits.

UNIT I–15 Hrs

Varactordiode,Schottkydiode,Tunneldiode–symbol,characteristicsandapplications.

JFET–Types-p-channelandn-channel,workingandI-Vcharacteristics
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, VMOS,UMOS Power MOSFETs, handling, MOS logic, symbols and switching action of MOS, NMOS inverter, CMOS logic, CMOS–inverter, circuit and working, CMOS characteristics, IGBT applications.

UJT: Construction, working, equivalent circuit and I-Vcharacteristics, intrinsic stand-offratio.Working and output wave form of Relaxation oscillator.

SCR: Construction, VIcharacteristics, working, symbol and applications–HWR and FWR (mention only).

Diac and Triac: Symbol, working, characteristics, applications. Numerical examples wherever applicable

UNIT– 2 **15 Hrs**

Op-Amp: Differential Amplifier, Block diagram of Op-Amp, Characteristics of an Ideal andPractical Op-Amp, Open and closed loop configuration, Frequency Response, CMRR, SlewRateand concept ofVirtual Ground.
Applications of op-amps: Concept of feedback, negative and positive feedback, advantagesofnegativefeedback(QualitativeStudy).Invertingand non-invertingamplifiers.
Summing and Difference Amplifier, Differentiator, Integrator, Comparator and Zero-crossingdetector.(Circuit diagram and output waveform).
Filters: First and Second order active Lowpass, Highpass and Bandpass Butterworth filters.
Oscillators: Barkhausen criterion for sustained oscillations, Colpitt's oscillator and crystal oscillators using transistor, Phase Shift oscillator, Wien-bridge oscillator – (expression

forfrequency)
IC 555Timer: Introduction, Block diagram, Astable and Monostable multivibrator circuits.(NumericalExampleswherever applicable).

UNIT– 315 Hrs

LogicFamilies: Pulse characteristics, Logic Families-classification of digital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole andopencollector.TTLICterminology.CMOSNAND,Comparison of TTL and CMOSfamilies.

CombinationalLogicCircuits: SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables. Half Adder, Full Adder, HalfSubtractor, FullSubtractor.4-bit parallel binary adder,2-bitand4- bit magnitude comparator. Encoder, decimal to BCD priority encoder. Decoder, 2:4 decoder using ANDgates, 3:8 decoder using NAND gates, BCD to decimal decoder, BCD to 7-Segment decoder,Multiplexer - 4:1 and 8:1 multiplexer, Demultiplexer - 1:4 and 1:8 demultiplexer (logic diagram and truth table of each), Realization of Full adder and Full Subtractor using Mux andDecoder.

Digital to Analog Converter: DAC with binary weighted resistor and R-2R resistor laddernetwork.

Analog to Digital converter: Successive approximation method-performance characteristics.

UNIT– 415 Hrs

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

Registers and Counters: Types of Shift Registers (upto4-bits), its applications. Ring counter,Johnson counter applications. Asynchronous Counters: Logic diagram, Truth table and timing diagrams of 4-bit ripple counter, modulo-n counters, 4-bit Up-Down counter, Synchronous Counter:4-bit counter, Design of Mod3, Mod 5and decade Counters using K-maps.

TextBook

1. RobertLBoylestad,"Introductorycircuitanalysis", 5th edition.UniversalBook2003.
2. ElectronicDevicesConventionalCurrentVersionbyThomasL.Floyd,10th edition,Pearson, 2018
3. DavidA.Bell"ElectronicDevicesandCircuits",5thEdition,OxfordUniversityPress,2015
4. OP-AmpsandLinearIntegratedCircuit,R.A.Gayakwad,4thedn.,PrenticeHall.,2000
5. RSSedha,"AText bookofAppliedElectronics",7thedn.,SChand andCompanyLtd.,2011
6. ThomasL.Floyd,DigitalFundamentals,PearsonEducationAsia,1994.

SuggestedReferences:

1. DigitalPrinciplesandApplications,A.P.Malvino,DPLeachandSaha,7thEdition, TMH,2011.
2. OperationalAmplifiersandLinearICs,DavidA.Bell,3rdEdition,OxfordUniversity Press.2011.
3. FundamentalsofDigitalCircuits,AnandKumar,2ndEdn,PHILearningPvt.Ltd.2009
4. DigitalCircuitsandSystems,KRVenugopalandKShyla,TataMcGraw Hill,2011

5. DigitalCircuitsandsystems,Venugopal,TataMcGrawHill.2011
6. DigitalSystems:Principles&Applications,R.J.Tocci,N.S.Widmer,PHI,PHILearning.2001
7. DigitalPrinciples,Schaum"sOutlineSeries,R.L.Tokheim,TMH.,1994
8. DigitalElectronics,S.K.Mandal,1st Edition,McGrawHill.,2010.

ELE-CP2:ANALOGANDDIGITALELECTRONICS–Lab
(HardwareandCircuitSimulationSoftware)

PART-A(AnySixexperimentsincluding2SimulationExperiments)

1. Studyof singlestage JFETamplifier.(frequencyresponse andbandwidth)
2. UJTcharacteristicsandrelaxationoscillator
3. Designofinvertingandnon-invertingamplifierusing Op-amp&studyoffrequencyresponse.
4. Op-ampinvertingandnon-invertingadder,subtractorandaveragingamplifier.
5. Designandstudyofdifferentiatorandintegratorusingop-ampfordifferentinputwaveforms.
6. Designand studyofWien bridgeand RC phaseshift oscillator usingop-amp.
7. Designandstudyoffirstorderhigh-passand low-passfiltersusingop-amp.
8. StudyofColpitt'sandcrystaloscillatorusingtransistor.
9. AstablemultivibratorusingIC-555timer.
10. MonostablemultivibratorusingIC-555timer.

PART–B(AnySixexperimentsincluding2SimulationExperiments)

1. HalfAdderandFull Adderusing(a) logicgates(b)usingonlyNANDgates.
2. HalfSubtractor andFullSubtractor(a)logicgates(b)usingonlyNANDgates.
3. 4-bit parallelbinaryadderandSubtractorusingIC7485.
4. StudyofBCDtodecimaldecoder usingIC7447
5. StudyofMultiplexerandDemultiplexerusingICs.
6. Studyof 2-bit and4-bitmagnitudecomparators.
7. StudyofClockedRS, Dand JKFlip-Flops usingNANDgates.
8. Studyof4-bitasynchronouscounterusingJKFlip-FlopIC7476,modifytodecadecounterand studytheirtimingdiagrams.
9. Studyof 4-bitShiftRegister – SISO,modification toringcounterusingIC7495.
10. DigitaltoAnalogconverterusingbinaryweightedresistormethod,determinationofresolution,accuracyandlinearityerror.