Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE

Syllabus

for

S. Y. B. Sc. (Electronic Science)

[Pattern 2019]

(B.Sc. Semester-III and Semester-IV)

From Academic Year

2020-2021

Deccan Education Society's
Fergusson College (Autonomous), Pune

S. Y. B. Sc. Electronic Science (Pattern 2019)

From academic year 2020-2021

Particulars	Name of Paper	Paper Code	Title of Paper	No. of Credits
S.Y. B.Sc. Semester III	Theory Paper - 1	ELS2301	Analog Electronics	2
	Theory Paper - 2	ELS2302	Digital Principles and Applications	2
	Practical Paper - 1	ELS2303	Electronics Practical -III	2
S.Y. B.Sc. Semester IV	Theory Paper - 3	ELS2401	Operational Amplifiers and Applications	2
	Theory Paper - 4	ELS2402	Instrumentation	2
	Practical Paper - 2	ELS2403	Electronics Practical -IV	2

S.Y. B.Sc. Semester III		
Title of the Course and Course Code	**Analog Electronics (ELS2301)**	**Number of Credits : 02**
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	List the BJT amplifiers and discuss their working.	
CO2	Discuss the application areas of CB, CC, and CE amplifiers.	
CO3	Classify the types of amplifier, power amplifier and types of feedback	
CO4	Determine the performance parameters such as gain, efficiency of various amplifiers	
CO5	Explain the concepts of feedback amplifiers	
CO6	Design RC coupled amplifier, RC oscillators and LC oscillators.	

Unit. No.	Title of Unit and Contents	No of Lectures
I	**Amplifiers** BJT amplifier (CE): design, dc and ac load line analysis, hybrid and r parameter model of CE configuration, Quantitative study of the frequency response of a CE amplifier, Multistage amplifiers with RC, transformer, direct coupling, Effect on gain and bandwidth for Cascaded CE amplifiers (RC coupled), Single tuned amplifiers: Circuit diagram, Working and Frequency Response for each, Limitations of single tuned amplifier, Applications of tuned amplifiers in communication circuits.	**12**
II	**Power Amplifiers** Difference between voltage and power amplifier, classification of power amplifiers, Class A, B, AB and C power amplifiers and their comparisons, Operation of a Class A single ended power amplifier. Operation of Transformer coupled Class A power amplifier, overall efficiency. Circuit operation of complementary symmetry Class B push pull power amplifier, crossover distortion, Efficiency calculation of power amplifiers, Concept of harmonic distortion, Thermal considerations and heat sinks.	**12**
III	**Feedback and Oscillators** Concept of feedback, negative and positive feedback, advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, Effect of negative feedback on gain, stability, nonlinearity, Rin, Rout, bandwidth, Applications of negative and positive feedback. Barkhausen criteria for oscillations, Study of Wein bridge oscillator, phase shift oscillator, Colpitts oscillator, Hartley	**12**

	oscillator and Crystal oscillator.	

References:

1. Electronic devices and circuit theory (11th edition): Robert Boylestad and Louis Nashelsky, Pearson (2013)
2. Electrical Principals: Albert Malvino and David Bates, Mc Graw Hill (2016)
3. Swayam Portal, Analog Electronic Circuits, Prof. Shouri Chatterjee https://swayam.gov.in/nd1_noc19_ee38/preview

S.Y. B.Sc. Semester III		
Title of the Course and Course Code	**Digital Principles and applications (ELS2302)**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Outline the performance parameters of TTL and CMOS logic families.	
CO2	Discuss different combinational and sequential circuits.	
CO3	Examine digital ICs for different combinational and sequential circuits.	
CO4	Analyses the operation of DACs.	
CO5	Compare operating principles of ADCs.	
CO6	Propose the applications of combinational and sequential circuits in day to day life.	

Unit No.	Title of Unit and Contents	No of Lectures
I	**Logic families** Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power product, TTL and CMOS families and their comparison.	**4**
II	**Combinational circuits** Multiplexer, demultiplexer, encoder, decoder, parity generator, parity checker, Applications of multiplexer, de multiplexers, encoders and decoders	**10**
III	**Sequential circuits** **Counters:** Types of triggering, Counters - Natural counters: synchronous and asynchronous, up/down counters, modified counters, resetting logic, modulo counters, scaling circuits, Applications – Auto parking system, Digital clock etc. **Shift registers:** Need of shift operations, Modes of operation - SISO, SIPO, PISO, PIPO, universal shift register, ring counter, Johnson counter. Applications – Time delay generator, Serial to Parallel and Parallel to Serial converter	**14**
IV	**Data Converters: DAC, ADC**	**8**

	DAC: Binary weighted resistor type DAC and R-2R ladder DAC Specifications of DAC – Resolution, non-linearity, gain error, settling time **ADC:** Successive approximation ADC, Dual slope ADC and Flash ADC Specifications of ADC – Resolution, input range, linearity, conversion time Applications of data converters,	

References:

1. Digital Principles and Applications – Malvino, Leach, Saha, Mc Graw Hill (2013)
2. Digital Fundamentals: Thomas Floyd, Pearson (2015)
3. Digital electronics: Fundamental concepts and applications – Christopher Strangio, Pearson Education (1980)

S.Y. B.Sc. Semester III		
Title of the Course and Course Code	**Electronics Practical-I (ELS2303)**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	List and define the objectives of a given experiment.	
CO2	Interpret the results obtained and justify or validate it.	
CO3	Demonstrate the application of each experiment.	
CO4	Compare the results with designed and comment on it.	
CO5	Select the appropriate components and test the measuring equipment.	
CO6	Design the given electronic circuit and construct it.	

List of practicals

Group-[A]: Analog Electronics (Any 5 experiments)

1. Audio amplifier – transistorized (<1W)
2. Class – A, B and C amplifers
3. Power amplifier (>5W)
4. Audio frequency oscillator
5. Radio frequency oscillator
6. Measurement of Gain, Bandwidth and feedback factor in feedback circuits
7. Crystal oscillator

Group-[B]: Digital Principles and Applications (Any 5 experiments)

1. Multiplexer/ Demultiplexer - Study and application
2. Encoder/ Decoder - Study and application
3. Counters - Study and application
4. Shift register - Study and application

Digital to analog converter - Study and application

5. Analog to digital converter - Study and application
6. Static and dynamic displays

Group-[C]: One Project like experiments (PLE) based on Group – A or B: equivalent to 2 experiments)

S.Y. B.Sc. Semester IV		
Title of the Course and Course Code	**Operational amplifiers and applications (ELS2401)**	**Number of Credits : 02**
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Identify the internal blocks of op-amp and describe it.	
CO2	Explain the DC/AC characteristics of operational amplifiers and various op-amp parameters.	
CO3	Illustrate the basic op-amp circuits, signal conditioning circuits and applications of an op-amp.	
CO4	Select the appropriate components and ICs for a given application circuits and justify its use	
CO5	Design the basic circuits, oscillators, multivibrators, and filter circuits using op-amps	
CO6	Design multivibrators circuits using IC 555 and voltage regulators using 3-pin regulators.	

Unit. No.	Title of Unit and Contents	No of Lectures
I	**Basic Operational Amplifier and parameters** Basic Operational Amplifier: Concept of differential amplifiers (Dual input balanced and unbalanced output), constant current bias, current mirror, cascaded differential amplifier stages with concept of level translator, block diagram of an operational amplifier (IC 741), Op-Amp parameters: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.	**6**
II	**Op Amp Circuits** Op-Amp Circuits: Open and closed loop configuration, Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, Summing and difference amplifier, Integrator, Differentiator, Voltage to current converter, Current to voltage converter; Comparators: Basic comparator, Level detector, Voltage limiters, Schmitt Trigger, Signal generators: Phase shift oscillator, Wein bridge oscillator, Square wave generator, triangle wave generator, saw tooth wave generator	**14**

III	**Signal Conditioning Circuits** Sample and hold (S/H) circuit, Its need/application, Active filters (1'st order): Low Pass Filter, High Pass Filter, Band Pass Filter, Band Stop Filter, bridge amplifier, Precision rectifier, log and antilog amplifiers	**8**
IV	**Timing Circuits and voltage regulators** Concept of multivibrator, three types of multivibrators, Op-amp based multivibrators, IC 555 – block diagram, multivibrator circuits, Applications; Fixed and variable IC regulators: Block diagram of regulated power supply, series and shunt regulators. three terminal regulators 78xx and 79xx series, LM 317 regulator	**8**

References:

1. Op-Amps and Linear IC's, R. A. Gayakwad, Pearson Education (2003)
2. Operational amplifiers and Linear Integrated circuits, R. F. Coughlin and F. F. Driscoll, Pearson Education (2001)
3. Electronic Principals, A. P. Malvino, Tata McGraw-Hill, (2003)
4. OP-AMP and Linear Integrated Circuits, K. L. Kishore, Pearson (2011)

S.Y. B.Sc. Semester IV		
Title of the Course and Course Code	**Electronic Instruments (ELS2402)**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Describe the working principle of different measuring instruments.	
CO2	Outline the technical specifications of instruments.	
CO3	Illustrate how to use galvanometer into voltmeter, ammeter and ohmmeter.	
CO4	Analyze different instruments, signal generators and oscilloscopes with reference to their specifications	
CO5	Select appropriate measuring instruments for measuring various parameters for given application.	
CO6	Specify the role of test and measuring instruments for laboratory and industrial applications.	

Unit. No.	**Title of Unit and Contents**	**No of Lectures**
I	**Measurement principles and basic instruments** Qualities of Measurement: Specifications of instruments, their static and dynamic characteristics, Error (Gross error, systematic error, absolute error and relative error) and uncertainty analysis. Statistical analysis of data and curve fitting; Basic Measurement Instruments: PMMC instrument, galvanometer, DC measurement - ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and nonintegrating types), digital	**12**

	multimeters, digital frequency meter system (different modes and universal counter); Connectors and Probes: low capacitance probes, high voltage probes, current probes, identifying electronic connectors – audio and video, RF/Coaxial, USB etc.	
II	**Bridges** Measurement of Resistance and Impedance: Low Resistance: Kelvin's double bridge method, Medium Resistance by Voltmeter Ammeter method, Wheatstone bridge method, High Resistance by Megger. A.C. bridges, Measurement of Self Inductance, Measurement of Capacitance, Measurement of frequency, Wien's bridge.	**6**
III	**Oscilloscopes and signal generators** Oscilloscopes: CRT, wave form display and electrostatic focusing, time base and sweep, synchronization, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope, Sampling Oscilloscope, DSO and Powerscope: Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, rise time); Signal Generators: Audio oscillator, Pulse Generator, Function generators (Principle, block diagram, working and specifications)	**12**
IV	**Power supplies** Fixed and variable power supplies - CVCC, SMPS and UPS (on-line and off-line), typical functions and specifications	**6**

References:

1. Electronic Instrumentation, H. S. Kalsi, TMH (2006)
2. Electronic Instrumentation and Measurement Techniques, W.D. Cooper and A. D. Helfrick, Prentice- Hall (2005).

S.Y. B.Sc. Semester IV		
Title of the Course and Course Code	**Electronic Science Practical- IV (ELS2403)**	**Number of Credits : 02**
Course Outcomes (COs) **On completion of the course, the students will be able to:**		
CO1	Define the objectives of a given experiment.	
CO2	Demonstrate use of bridge for sensor interfacing applications.	
CO3	Measure the electrical/ electronic parameters of a given instrument and analyse the results obtained.	
CO4	Select the appropriate components and test and measure equipment for the given experiment.	
CO5	Design and construct the given electronic circuit.	
CO6	Summarise the observations taken during the experimentation and tabulate the results.	

List of practical

Group-[A]: Operational Amplifiers and applications (Any Five experiments)

1. Study of op-amp adder, subtractor
2. Designing of an amplifier of given gain for an inverting and non-inverting configuration using an opamp.
3. Designing of an integrator and differentiator using op-amp for a given specification and study its frequency response.
4. Designing of a First Order Low/High-pass filter using op-amp.
5. Designing of a RC Phase Shift Oscillator using op-amp.
6. Study of Multivibrator using Op-amp and IC-555
7. Designing of Fixed voltage power supply using IC regulators using 78 series and 79 series.

Group-[B]: Electronic Instrumentation (Any Five experiments)

1. Multirange voltmeter and ammeter
2. Measurements with DC and AC bridges
3. Measurements of signal parameters – phase, rise time, fall time, duty cycle etc.
4. Study of fixed and variable power supply
5. Study of CVCC and SMPS
6. Application of bridges for sensor interfacing

Group-[C]: One Project like experiments (PLE) based on Group – A or B: equivalent to 2 experiments)