Mangalore University

Curriculum for

B.Sc. Degree with Electronics

I and II Semester Syllabus

From the Academic Year 2024-25

Electronics

Department of Electronics
Mangalagangotri. 574 199

July 2024

Preamble

The proposed curriculum content for B.Sc.Degree in Electronics as per GoK and University Guidelines 2024 is designed to train the students and equip them to respond to thecurrent needs of the Industry with skills relevant for National and Global standards. The frame work encourages innovation in teaching-learning process and appropriate assessment of student learninglevels.

Introduction

B.Sc. Degree in Electronics is a program that develops a specialized skill set among thegraduates to cater to the need of Academia and Industries. The curriculum is designed to help learners to analyze, appreciate, understand and critically engage in learning the courses and to provide better learning experience to the graduates. Apart from impartingdisciplinary knowledge, the curriculum is aimed to equip the graduates with competencies like problem solving and analytical thinking which provide them professional competencies. To achieve the Course and Program Outcomes, the University encourages its faculties to make suitable pedagogical innovations, in addition to teaching/learning processes suggested in the curriculum.

SignificanceofElectronics

In recent years, Electronics has made unprecedented growth in terms of new technologies, new ideas and principles. The research organizations and industries that work in the frontier area of Electronics are in need of highly skilled and scientifically oriented manpower. This is addressed by flexible, adaptive, and progressive training programs and acohesive interaction among the Institutions, Universities, and Industries. The key areas of study and hands on training with in the subject area of Electronics comprising of Semiconductor Devices, Circuit Analysis, Analog and Digital Circuit Design, Microprocessors and Microcontrollers, Embedded Systems, Knowledge on Coding/Programming in High Level Languages, Basic and Advanced Communication Systems like IoT, 4G, 5G, Satellite and Optical communication, Signal Processing, VLSI Technology, Basics of Control Systems and Robotics, etc.

EligibilityCriteria

A candidate who has passed two year Pre-University Examination with Science CoursesconductedbythePre-University Board of Education, Government of Karnataka or any other examination considered equivalent by the University is eligible for admission to the first Semester of the UG programme.

Programme Objectives

- To impart quality education to the students so that the acquire knowledge in Electronics.
- To provide students with the fundamental skill so different domains in Electronics To enhance the knowledge and understanding of key concepts of Electronics.
- To equip students with advanced Scientific and Technological capabilities for analyzing and tackling the issues and problems in the field of Electronics.
- To build mathematical and numerical background for the design and analysis of Electronic Circuits..
- To develop self and continuous learning and practice professional ethics for societal benefits.
- To provide students with skills that enables the to get employment in Industries or pursue higher studies or research assignments or become entrepreneurs.

Programme Outcomes

- Understand comprehensively the entire range of Electronic Devices and Circuits with the state-of art knowledge on advanced electronic systems.
- Identify, formulate and solve problems in the area of Electronics.
- Design and manage Electronic Systems or Processes that conforms to a given specification within ethical and economic constraints
- Ability to use Modern Tools/Techniques in solving problems in the field of Electronics.
- Function effectively as an individual and as a member in diverse teams and in multidisciplinary settings
- Excel in their professional endeavors through self-education.

Semester I								
Sl. No	**Course Code**	**Title of the Course**	**Category of Courses**	**Teaching Hours per Week**	**SEE**	**IA**	**Total Marks**	**Credits**
1		Analog and Digital Electronics	Theory	4	80	20	100	3
2		Analog and Digital Electronics Lab	Practical	4	40	10	50	2
Semester II								
3		Electronic Devices and Circuits	Theory	4	80	20	100	3
4		Electronics Devices and Circuits Lab	Practical	4	40	10	50	2

I Semester

ProgramName	**BSc with Electronics**	Semester	**FirstSemester**
CourseTitle	**Analog and Digital Electronics**		
CourseCode	ELE –101	No.ofCredits	**3**
ContactHours	**56Hours**	DurationofExam	**3Hours**
IAMarks	**20**	SEM Exam Marks	**80**

CourseObjectives:

- Toacquiretheknowledgeof workingprinciplesof Electronic components
- TounderstandNetworktheoremswithexamples
- Toknowtheclassificationandcharacteristicsofsemiconductordiodes
- Deliberateindetail theapplicationofsemiconductordiodes

CourseOutcomes:

- Analyzebasicnetworksusingnetworktheorems.
- Demonstratetheworkingofanalogcircuitsasperthespecifications.
- Explaintheprinciplesandbehaviorofbasicsemiconductordevices
- Buildsimpleelectroniccircuits

Contents	**56 Hrs**
Unit1	14Hrs

Network Theorems: KCL & KVL, Superposition, Thevenin's, Norton's, Maximum Power Transfer and Reciprocity Theorems. DC analysis of RC circuits, AC analysis of RLC series and parallel Resonant Circuits.
PN Junction diode, Zener diode: Working, characteristics and applications.
Rectifiers: Half wave and Full wave rectifiers, expressions for output voltage, ripple factor and efficiency (bridge rectifier), Shunt capacitor filter.
Voltage regulator: Line and Load regulation, Zener diode as voltage regulator - circuit diagram, load and line regulation , disadvantages, Fixed and Variable IC Voltage Regulators(78xx, 79xx, LM317), Clippers and Clampers, Voltage Multipliers, SMPS block diagram.

Unit2	14Hrs

Bipolar Junction Transistor: Types, Construction, working and configurations, characteristics in CE mode, leakage currents, Current gains α, βand γ and their interrelations, dc load line and Q point. Transistor as a switch.
Transistor biasing: Thermal runaway, Stability and stability factor. Types of biasing, Voltage Divider Bias.
Amplifier: Classification, parameters, Derivation for voltage and current gain of CE amplifier using r_e– model. Advantages of CC amplifier. Two stage RC Coupled Amplifier – circuit,

working and its Frequency Response. Concept of feedback- positive and negative – advantages and disadvantages.
Unit3 14Hrs
Number System: Decimal, Binary and Hexadecimal number systems, base conversions, representation of signed and unsigned numbers. Addition, Subtraction, BCD code (8421), grey code, error checking and correction codes, ASCII codes. Positive and negative logic, Boolean laws, Duality Theorem, De Morgan's theorems, Logic gates – AND, OR, NOT, NAND, NOR, XOR & XNOR. Universal property of NOR and NAND gates. SOP and POS, Minterm, Maxterm, SSOP, SPOS, Simplification of Boolean expressions, K-Map for 3 and 4 variables.
Unit 14Hrs
Half Adder, Full Adder, Half Subtractor, Full Subtractor, 4-bit parallel binary adder, 2- bit magnitude comparator. Encoder: 4:2 encoder, decimal to BCD priority encoder (74147). Decoder: 2:4 decoder using AND gates, 3:8 decoder using NAND gates. BCD to decimal deoder (7445), BCD to 7- segment decoder (7446), Multiplexer: 4:1 multiplexer, 1:4-De-multiplexer (logic diagram and truth table of each).

ReferenceBooks	
1	Robert L Boylestad, "Introductory Circuit Analysis", 5th edition, Universal book 2003
2	R S Sedha, "A Text book of Applied Electronics", 7th edition, S. Chand and Company Ltd. 2011
3	P. Malvino, "Principles of Electronics", 7th edition, TMH, 2011.
4	Electronic Devices and Circuit Theory by Boylesstad, Robert Nashelsky, 11thEdn., Pearson, 2013.
5	David a Bell, "Electronic Devices and Circuits", 5th edition, Oxford University, 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, 7thEdn., TMH, 2011.
8	Fundamentals of Digital Circuits, Anand Kumar, 2ndEdn., PHI Learning Pvt. Ltd., 2009
9	Digital Circuits and Systems, K RVenugopal and K Shyla, Tata McGraw Hill, 2011
10	Digital Systems: Principles & Application, R. J Tocci, N. S. Widmer, PHI Learning, 2001
11	M. Nahvi& J. Edminnister, "Electrical Circuits", Schaum's Outline Series, TMH, 2005
12	S. A nasar, " Electrical Circuits", Schaum's outline series, Tata McGraw hill, 2004
13	J. Millmam and C. C. Halkias, " Integrated Electronics", Tata MCGraw Hill, 2001
14	A. SSedra, K. C. Smith, A. N Chandorkar, " Microelectronic Circuits", 6thEdn., Oxferd University press, 2014.
15	J. J. Cathey, "2000 Solved Problems in Electronics", Schaum's outline series, TMG, 1991.

ProgramName	**BScwithElectronics**		Semester	**FirstSemester**
CourseTitle	**Analog and Digital Electronics Lab**			
CourseCode	ELE-P-101		No.ofCredits	**2**
	IAMarks	**10**	SEM Exam Marks	**40**
Note:Minimumof 12Experimentstobecompleted				

CourseObjectives:

- Togainpracticalknowledgeinthe fieldofelectroniccircuitsthroughexperiment
- AnalyzeElectroniccircuitsbyapplyingNetworktheorems
- Understandthe V-IcharacteristicsofDiodes
- Buildsimpleelectroniccircuits

CourseOutcomes:

- UnderstandtheworkingofElectronicInstruments
- UnderstandcircuitreductionusingNetworktheorems
- Understandthebehaviorofsemiconductordevices
- Ableto designasimple power supply

(Hardware implementation and Analysis of Circuit using Simulation Software)

1. Demonstration Experiments: Hands on Experimental Skills and Familiarization with
   a) Electronic Components
   b) Resistance in series, Parallel and series-parallel
   c) Capacitors and inductors in series and parallel
   d) Multimeter and LCR meter-checking of components/ measurements.
   e) Voltage source in series, parallel and series-parallel
   f) Voltage and current dividers
   g) Measurement of Amplitude, Frequency & Phase difference using Oscilloscope
2. Verification of Thevenin's Theorem
3. Verification of Maximum Power Transfer.
4. Verification of Superposition Theorem.
5. Study of the I-V Characteristics of a P-n Junction diode.
6. Study of the I-V Characteristics of a Zener diode
7. Study of half wave rectifier without and with shunt capacitor filter.
8. Study of full wave bridge rectifier without and with shunt capacitor filter.
9. Study of Zener diode as a Voltage Regulator.
10. Study of Clipping, Clamping and Voltage Multiplier Circuits.
11. Designing and testing of fixed positive and negative voltage regulators using 78xx and 79xx series ICs.

12. Designing and testing of variable voltage regulator using IC LM317.
13. Study of Transistor Characteristics in CE configuration.
14. Study of Voltage divider bias circuit.
15. Study of single stage CE amplifier.
16. Study of two-stage RC-coupled CE amplifier.
17. Study of series and parallel resonance circuits.
18. Verification of truth tables of OR, AND, NOT, NAND, NOR, XOR and XNOR gates using respective ICs.
19. Universal Property of NAND and NOR gates.
20. Binary to Gray and Gray to Binary code conversion and parity checker using XOR gates IC 7486.
21. 2-bit Comparator using logic gates.
22. Multiplexer &Demultiplexer Circuits.
23. Encoder & Decoder circuits.

IISemester

ProgramName	**B.Sc.withElectronics**		Semester	**SecondSemester**
CourseTitle	**Electronic Devices and Circuits**			
CourseCode	ELE 102		No.ofCredits	**3**
Contacthours	**56Hours**		DurationofExam	**3Hours**
	IAMarks	**20**	SEM Exam Marks	**80**

CourseObjectives:

- Understandtheoperationandapplicationsoftransistors
- Understandandanalyze thedesignoftransistorAmplifiersandOscillators
- Understandthecharacteristicsandapplicationsof operationalamplifiers
- Designofelectroniccircuits usingop-amp

CourseOutcomes:

- Analyzebiasingtechniquestooperate atransistor.
- Understandanddemonstratetheworkingoftransistoramplifiercircuits
- Understandanddemonstratetheworkingoftransistoroscillator circuits
- Designandbuildthecircuitsusingop-amp

Contents	**56Hrs**
Unit1	14Hrs

Varactor Diode, Schottky diode, Tunnel Diode – LED, LCD, Solar Cell: working and applications for each.
JFET: Types, Working, characteristics of n-channel JFET, parameters and their relationships, Comparision of BJT and JFET.
MOSFET: Types, CMOS- inverter, circuit and working, IGBT construction and working.
UJT: Working, equivalent circuit and characteristics, intrinsic stand-off ratio, Relaxation oscillator.
SCR: Working, characteristics, equivalent circuit, applications.
Diac and Triac: characteristics, equivalent circuit, working and applications for each.

Unit2	14Hrs

OP-AMP: DifferentialAmplifier,BlockdiagramofOp-Amp,CharacteristicsofanIdealandPracticalOp-Amp,Openandclosedloop configuration, Frequency Response, CMRR, Slew Rate and concept of Virtual Ground.
Applications of Op-Amps: Invertingandnon-inverting amplifiers, Summing amplifier, Differentiator, Integrator, Logarithmic amplifier, Comparator.
Filters: First order active low pass, high pass and Band pass Butterworth filters.
Oscillators: Barkhausen criterion for sustained oscillations, crystal oscillators, Phase Shift oscillator, Wien-bridge oscillator using Op-amp.
IC 555 Timer: Astable and Mono stable multivibrator circuits.

Unit3	14Hrs

Logic Families: Pulse characteristics, Logic Families-classification of Digital ICs. Characteristics of logic families, circuit description of TTL NAND gate with totem pole and open collector. TTL IC terminology, CMOS NAND, Comparison of TTL and CMOS families.
Digital and Analog Convertor: DAC with binary weighted resistor and R-2R resistor ladder network. Analog and Digital Converter: Successive approximation method-performance characteristics.
Sequential Logic Circuits: Flip-Flops-SR Latch, Level and Edge Triggered concept, Clocked RS, D JK and T Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master-Slave JK Flip-Flops. Applications of Flip-Flops in semiconductor memories, ARM, ROM and types.

Unit4	14Hrs

Registers and Counters: types of Shift Registersup to 4-bits), its applications. Ring counter, Johnson counter applications. Asynchronous Counters: Logic diagram, Truth table and timing diagrams of 4-bit ripple counter, module-n counters, 4-bit Up-Down counter, Synchronous Counter: 4-bit counter, Design of Mod 3, Mod 5 and decade Counters using K-maps.
Basic Computer system: Block diagram, input and output devices, interfacing techniques, expansion of memory, Programming techniques, Flowchart, Types of languages.

ReferenceBooks	
1	Robert L Boylestad, "Introductory circuit analysis", 5th edition, Universal book 2003.
2	Electronic Devices Conventional Current Version by Thomas L. Floyd, 10th edition, Pearson, 2018
3	David A Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University, Press, 2015
4	OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4thedn., Prentice Hall., 2000
5	Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, Oxford University Press, 2011.
6	R S Sedha, "A Text book of Applied Electronics", 7thedn., 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 Leach and Saha, 7th Edition, TMH, 2011.
9	Fundamentals of Digital Circuits, Anand Kumar, 2ndEdn, PHI Learning Pvt. Ltd, 2009.
10	Digital Circuits and Systems, K R Venugopal and K Shyla, Tata Megraw Hill, 2011.
11	Digital Circuits and Systems, Venugopal, Tata Megraw Hill 2011
12	Digital Systems: Principles & Applications, R. J. Tocci, N. S. Widmer, PHI Learning, 2001.
13	Digital Principles, Schaum's Outline Series, R. L. Tokheim, TMH., 1994
14	Digital Electronics, S. K Mandal, 1st Edition, Megraw Hill, 2010

ProgramName	**BSc with Electronics**		Semester	**Second Semester**
CourseTitle	**Electronics Devices and Circuits Lab**			
CourseCode	ELE-P-102		No. of Credits	**2**
	IA Marks	**10**	SEM Exam Marks	**40**

Note: Minimum of 12 Experiments to be completed

Course Objectives:

- Study the characteristics of transistor in CE mode
- Understand the working of amplifiers
- Understand different applications of op-amp.
- Design different signal conditioning circuits like filters.

CourseOutcomes:

- Analyze practical behavior of BJT
- Design simple circuits using op-amp
- Understand the concept and working of Filters

1. Study of JFET characteristics - determination of parameters.
2. Study of Single stage JFET amplifier.
3. UJT characteristics and relaxation oscillator
4. SCR characteristics.
5. Design of inverting and non-inverting amplifier using Op-amp & study of frequency response.
6. Op-amp inverting and non-inverting adder, Subtractor and averaging amplifier.
7. Design and study of differentiator and integrator using op-amp for different input waveforms.
8. Design and study of Wien bridge oscillator using op-amp.
9. Design and Study of RC phase shift oscillator using op-amp.
10. Design and Study of first order high-pass and low-pass filters using op-amp.
11. Study of Crystal Oscillator using op-amp.
12. Astablemultivibrator using IC-555 timer.
13. Monostablemultivibrator using IC-555 timer.
14. Digital and Analog converter using binary weighted resistor method.
15. Study of Clocked RS and D Flip-Flops using NAND gates.
16. Study of Clocked JK and T Flip-Flops using NAND gates.
17. Study of mod-16 asynchronous counter using JK Flip-Flop.
18. Study of decade counter using JK Flip-Flop.
19. Study of 4-bit Shift register-SISO.

Scheme of Evaluation

The Scheme of Examination, Evaluation, Passing Criteria, etc., are as per the Regulations of Mangalore University. The performance of the students in Theory, Practical, and Project Work are assessed based on three discrete components identified as C1, C2, and C3. The components C1 and C2 are the Continuous Internal Assessments (IA) and C3 is the Semester End Examination (SEM Exam). The IA C1 and C2 are to be conducted during 8th and 15th weeks of the Semester. The SEM Exam for C3 is conducted during 18th to 20th week based on University notification.

C1 and C2 Internal Assessment for Theory Courses

The C1 and C2 components of each Courses are evaluated for 20 marks.

The C3 component is evaluated for 80 marks through SEM Exam. The duration of semester end Examination is 3 Hours.

The scheme of evaluation of C1 and C2 shall be 2 Tests (Best of Two Tests) for 10 Marks. Assignment 05 Marks and 05 Marks for Seminar/Mini Project Work/Case Study/ Report on Industry Visit, etc.,

Scheme of Evaluation for Practical Courses

In the practical courses, students are evaluated on the basis of skill, comprehension, and recording the results.

The Internal Assessment components in practicals are evaluated for 10 marks.

The Sem Exam component is evaluated for 40 marks.

The scheme of evaluation for Practical Courses shall be based on Test, Regularity and Performance in the Practical Sessions, etc. 05 Marks and 05 Marks for Laboratory records.

A candidate appearing for the Practical examination should submit a duly signed and certified practical record.

Each candidate has to perform given experiment in the specified duration for forty marks.

The evaluation scheme for Practical Examination is based on Write up (Circuit Diagram / Program / Formula / Tabular Column/Expected Results, etc.) for 20 Marks. Conducting of experiments / Programme Execution / Recording of Results, etc. 15 Marks and Viva 05 Marks, Total 40 Marks

Question Paper Pattern:

Part A – 08 Questions to be answered out of 10 Questions. Each question shall carry 02marks. Atleast 02 questions to be set from each unit compulsorily (16 Marks).

Part B – 04 Questions to be answered out of 08 Questions. Each question shall carry 16 Marks.

Atleast 02 questions to be set from each unit compulsorily (64 Marks). Every Question can be subdivided into Questions as a, b, c, etc,.