Bachelor of Science
Electronics - Semester: IV (Major)

Course Code	US04MAELE01	Title of the Course	INSTRUMENTATION
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	The course is to make the students understand the fundamentals of Measurement systems and the units of measurements, AC/DC measuring instruments, transducers and their interfacing with the Bridges used for R-L-C-F measurements.

Course Content		
Unit	**Description**	**Weightage In %**
1.	**Measurement and error:** Definitions, Accuracy and Precision, Significant figure, Types of errors: Gross errors, Systematic errors, Random errors, Statistical analysis: Arithmetic Mean, Deviation from the mean, Average deviation, Probability of errors: Normal distribution of errors, Probable error, Limiting errors	**25**
2.	**Electro mechanical indicating instruments:** Suspension Galvanometer, Steady state deflection, Dynamic behaviour, PMMC, D'Arsonval movement, Construction, DC Emitters, Shunt resistor, Ayrton shunt, DC voltmeters; multiplier resistance, Multi range voltmeter, Voltmeter sensitivity, Series – shunt type Ohm meters.	**25**
3	**Bridge Measurements:** Wheatstone bridge, Kelvin bridge, AC bridges and their applications: Conditions for bridge balance, Applications of the balance equations, Maxwell bridge, Hay bridge, Schering bridge, Unbalance conditions, Wien bridge	**25**
4	**Transducers:** Classification of transducers, Selecting a transducer, strain gages: gage factor, Metallic sensing elements, Gage configuration, Unbonded strain gage, Displacement transducers: Capacitive transducer, Inductive transducer, Variable differential transformer transducer, Temperature measurements: Resistance Thermometer, Thermocouples, Thermistor; characteristics and Applications.	**25**

Teaching-Learning Methodology	Online and Board work

Evaluation Pattern:		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the measuring systems and units used for different systems.
2.	Understand various measuring instruments for measuring AC/DC quantities.
3	Understand the Bridges for measurement of R-L-C-F.
4	Understand the effect of various physical quantities like pressure and Temperature on electrical parameters of electronics components and their measurements.

Suggested References:	
Sr. No.	References
1.	Modern Electronic instrumentation and Measurement Techniques By Albert D. Halftrack & William D. Cooper
2.	Instrumentation Devices & Systems By C. S. Rangan, G. R. Sarma & V.S.V. Mani

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics - Semester: IV (Major)

Course Code	US04MAELE02	Title of the Course	Digital Electronics – 2
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	The course is to make the students understand the Digital combinational circuits and their applications as Registers, Counters, Digital to Analog converter, Analog to Digital converter and Memories.

Course Content		
Unit	**Description**	**Weightage In %**
1.	**Registers:** Buffer register, Controlled buffer register, Data transmission in shift register, Serial–in Serial out , shift register, Serial–in Parallel–out , shift register, Parallel–in Serial–out , shift register, Parallel–in Parallel–out , shift register, Bidirectional Shift register, Applications of Shift registers, Universal Asynchronous receiver Transmitter	**25**
2.	**Counters:** Asynchronous counters (ripple counters), Synchronous counters, Ring counters, Mod – 10 counter, Up – Down counter, three state registers, bus organised computers	**25**
3	**D/A and A/D converters:** Introduction, Digital to analog conversion, Parameters of DAC, The R – 2R ladder DAC, Weighted register DAC. A/D converter: counter type ADC, tracking type ADC, Flash type ADC, Dual slope ADC and the successive type ADC.	**25**
4	**Memories:** ROMs: ROM, PROM, EPROM, EEPROM RAMs: static RAM, Dynamic RAM, ECL RAM Magnetic memory: Magnetic core memory, Magnetic disk memory, Magnetic recording formats, Hard disk systems, Magnetic tape memory, Magnetic bubble memory, Optical disk memory	**25**

Teaching-Learning Methodology	Online and Board work

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand construction of registers using Various Flip Flops.
2.	Understand construction of Counters using Various Flip Flops.
3	Understand analog to digital conversion and digital to analog conversion circuits.
4	Understand different types of primary and secondary memories.

Suggested References:	
Sr. No.	References
1.	Fundamentals of Digital Circuits By Anand Kumar
2.	Digital Computer Electronics By Malvino and Brown.
3.	Digital Integrated Electronics By Herbert Taub and Donald Schilling

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics - Semester: IV (Major)

Course Code	US04MAELE03	Title of the Course	Electronics Practicals.
Total Credits of the Course	4	Hours per Week	8

Course Objectives:	The course is to make the students understand i) The fundamentals of Measurement systems and the units of measurements, AC/DC measuring instruments, transducers and their interfacing with the Bridges used for R-L-C-F measurements. ii) The course is to make the students understand the Digital combinational circuits and their applications as Registers, Counters, Digital to Analog converter, Analog to Digital converter and Memories.

Part -1

Course Content		
No	**Title of Practical**	
1.	Wheatstone bridge	
2.	Kelvin bridge	
3.	Maxwell Bridge	
4.	Hay bridge	
5.	Schering bridge	
6.	Characteristics of Thermistor	
7.	LVDT	
8.	Thermocouple	
	Other experiments based on Theory.	

Part -2

Course Content		
No	**Title of Practical**	

1.	Synchronous counters	
2.	Asynchronous counters	
3.	Registers	
4.	RAM	
5.	R- 2R Ladder type DAC	
6.	Weighted resistor type DAC	
7.	Counter type ADC	
8.	Successive – approximation type ADC	

Teaching-Learning Methodology	Online and Board work

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the measuring systems and units used for different systems.
2.	Understand various measuring instruments for measuring AC/DC quantities.
3.	Understand the Bridges for measurement of R-L-C-F.
4.	Understand the effect of various physical quantities like pressure and Temperature on electrical parameters of electronics components and their measurements.
5.	Understand construction of registers using Various Flip Flops.
6.	Understand construction of Counters using Various Flip Flops.

7.	Understand analog to digital conversion and digital to analog conversion circuits.
8.	Understand different types of primary and secondary memories.

Suggested References:	
Sr. No.	References
1.	Modern Electronic instrumentation and Measurement Techniques By Albert D. Helfrick & William D. Cooper
2.	Instrumentation Devices & Systems By C. S. Rangan, G. R. Sarma & V.S.V. Mani
3.	Fundamentals of Digital Circuits By Anand Kumar
4.	Digital Computer Electronics By Malvino and Brown.

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics - Semester: IV (Minor)

Course Code	US04MIELE01	Title of the Course	Transistor Circuits.
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	The course is to make the students understand the fundamentals of Transistor, their characteristics and biasing.

Course Content		
Unit	**Description**	**Weightage In %**
1.	**Transistors:** Structure of Transistor, Working, Transistor Amplifying Action, Configurations, Input and Output characteristics of CB, CE and CC configurations. Comparison of three configurations, Basic CE amplifier circuit, DC Load Line.	**50**
2.	**Transistor Biasing:** Why bias a transistor?, Selection of operating point, Need for Bias Stabilization, Requirements of Biasing circuit, Different Biasing circuits, Fixed Bias circuit, Collector to base bias Circuit, Bias Circuit with Emitter Resistor, Voltage divider Biasing Circuit. Emitter Bias Circuit, PNP transistor biasing circuit, Single stage Transistor Amplifier, Frequency Response curve of an RC coupled amplifier, Bandwidth of amplifier.	**50**

Teaching-Learning Methodology	Online and Board work

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the construction of transistors their characteristics, various configurations and parameters in different modes.
2.	Understand biasing a transistor for various applications.

Suggested References:	
Sr. No.	References
1.	Basic Electronics and Linear Circuits By Bhargava, Kulshreshtha and Gupta.
2.	Electronics Devices and Circuits By David A. Bell.

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics Semester: IV (Minor)

Course Code	US04MIELE02	Title of the Course	Electronics Practicals.
Total Credits of the Course	2	Hours per Week	4

Course Objectives:	The course is to make the students understand the fundamentals of Transistor, their characteristics and biasing.

Course Content		
No	**Title of Practical**	
1.	Study of Transistor fixed bias circuit with and without emitter resistor	
2.	Study of Transistor collector to base bias circuit	
3.	Study of Transistor potential divider bias circuit	
4.	PNP transistor Characteristics	
5.	NPN transistor Characteristics	
6.	Single stage CE amplifier frequency response	
7.	Other experiments based on Theory.	

Teaching-Learning Methodology	Online and Board work

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the various biasing circuits of transistors circuit.
2.	Understand characteristics of transistor and its application as an amplifier.
3.	Understand positive and negative feedback effect in transistorised circuit.

Suggested References:	
Sr. No.	References
1.	Basic Electronics and Linear Circuits By Bhargava, Kulshreshtha and Gupta.
2.	Electrical Engineering Fundamentals By Del Toro.

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics Semester: IV (Minor)

Course Code	US04MIELE03	Title of the Course	Logic gates and its applications
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	The course is to make the students understand the various basic and universal Logic gates, XOR and XNOR gate and its applications, various Flip flops and the working of registers.

Course Content		
Unit	**Description**	**Weightage In %**
1.	**Logic gates**: AND, OR, NOT, Universal gates: NAND, NOR, XOR-XNOR Gates and their applications, Parity Checker, Code Convertor, Controlled Inverter, Comparator, Half and Full Adder, Half and Full Subtractor, Two's complement Addition and Subtraction using parallel Adders.	**50**
2.	**Flip Flops:** RS Flip Flop, Clocked R S Flip Flop, D Flip Flop, Edge Triggered D Flip Flop, J K Flip Flop, JK Master/Slave Flip Flop, Registers: Introduction, Buffer Register, Controlled Buffer Register, Data Transmission in shift registers, Serial-in serial-out shift registers, serial in parallel-out shift registers, Parallel-in serial-out shift register, parallel in parallel-out shift registers, Bidirectional shift registers.	**50**

Teaching-Learning Methodology	• Online and Board work, • ICT enabled teaching, • Group discussion, • Case Study, • Problem solving.

Evaluation Pattern (Internal / External Examinations)			
Sr. No.		Details of the Evaluation	Weightage
1.	Continuous and Comprehensive Evaluation	• Class test/Internal Written test (30%) • Quiz (30%) • Active learning (10%) • Home Assignments (10%) • Class Assignments (10%)	50%

		• Attendance (10%)	
2.	End Semester Examination	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand about basic and universal logic gates and their applications, various applications of X-OR and XNOR gates, arithmetic logic circuits.
2.	Understand about various Flip Flops.
3.	Understand about data transmission in shift registers, and its application.

Suggested References:	
Sr. No.	References
1.	Digital Electronics by W. H. Gothmann
2.	Digital Principles and Applications by A. P. Malvino and D. P. Leach
3.	Fundamental of Digital circuits By : A. Anand Kumar

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics Semester: VI

Course Code	US04MIELE04	Title of the Course	Electronics Practicals.
Total Credits of the Course	2	Hours per Week	4

Course Objectives:	The course is to make the students understand the various basic and universal Logic gates, XOR and XNOR gate and its applications, various Flip flops and the working of registers.

Course Content		
No	**Title of Practical**	**Weightage**
1.	Logic gates using ICs	**100%**
2.	Logic gates using discrete components	
3.	XOR and XNOR gate applications	
4.	Half and Full adder	
5.	Half and Full subtractor	
6.	Flip- flops	
7.	Shift register	
	Other experiments based on Theory.	

To maintain uniformity in assessment of practical examination the below mentioned marks distribution pattern is followed:

Sr. No.	Details of the Evaluation	Weightage
1.	University examination.	08
2	Diagram/Circuit Diagram / Expected Graph	08
3	Setting up of the experiment + Tabular Columns + taking readings	14
4	Calculations (explicitly shown) + Graph	10
5	Accuracy of results with units	04

6	Round the year Performance/ Records (to be valued at the time of practical Examination through oral viva)	06
	Total practical	50
Sr. No.	Details of the Evaluation	Weightage
1.	• Internal Continuous Assessment in the form of Practical Examination, • Quizzes, Assignments, • Active learning, • Viva-voce, Seminars, • Attendance (As per NEP Guideline)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand about basic and universal logic gates and their applications, various applications of X-OR and XNOR gates, arithmetic logic circuits.
2.	Understand about various Flip Flops.
3.	Understand about data transmission in shift registers, and its application.

Suggested References:	
Sr. No.	References
1.	Digital Electronics by W. H. Gothmann
2.	Digital Principles and Applications by A. P. Malvino and D. P. Leach
3.	Fundamental of Digital circuits By : A. Anand Kumar

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics Semester: IV (Skill Enhancement)

Course Code	US04SEELE01	Title of the Course	Renewable Energy Sources
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make the students aware about i) Different renewable energy sources such as solar, geothermal, wind and fuel cells and technological advancements in this field. ii) Importance of using nonconventional energy resources and their utilization for the present day and future energy needs.

Course Content		
Unit	**Description**	**Weightage In %**
1.	**Solar Thermal Energy Conversion Systems:** Introduction-Subsystems, Solar Thermal Collectors, Characteristics features of a collectors, Important aspects of solar thermal Collectors, Collector Efficiency, Simple Flat plate Collectors, Installation of Flat Plate Collectors, Guidelines for Installation, Shadow Effect, Cosine loss factor and reflective Loss Factor, Heliostats with Central Receiver, Heat Transfer-fluid. Solar Photovoltaic Systems: Introduction to Photovoltaic systems, Merits and Limitations of Solar PV Systems, V-I characteristics of Solar Cell and Efficiency of a solar cell, Configuration of a solar PV Panel, Small and Large PV systems.	**50**
2.	**Geothermal Energy and Wind Energy:** Fundamentals and Applications Geothermal Energy: Introduction, Application, Geothermal Energy Resources, Origin of Geothermal Resources, Hydro Geothermal Resources. **Wind Energy:** Fundamentals and applications: Introduction of Wind Energy, Wind power density, Power in a wind stream, Wind turbine Efficiency, Power of a wind Turbine for given incoming Wind Velocity, Types of wind turbine –Generator Units, Mono Blade Horizontal axis Wind turbine (HAWT), Twin- Blade Horizontal axis Wind turbine (HAWT) and Three-Blade Horizontal axis Wind turbine (HAWT). **Tidal Energy Conversion and Ocean Energy:** Technology Tidal Energy Conversion: Introduction-Tidal range, high and low Tides, Tidal Energy Conversion, Tidal Power Ocean Energy Technology: Introduction to Energy from Ocean, Ocean Energy Resources, Ocean Thermal Energy, Ocean Waves, Ocean Tides, Advantages and Limitations of Ocean Energy Conversation	**50**

	Technologies, Ocean Energy Routes.	

Teaching-Learning Methodology	Online and Board work

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	
3.	University Examination	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	The various sources of renewable energy and their conversion methods.
2.	Gain the knowledge of various fuel cells and power plants.

Suggested References:	
Sr. No.	References
1.	Instrumentation Measurement and Analysis By B C Nakra and K K Chaudhary Tata McGraw Hill Publishing Co. Ltd., New Delhi
2.	Biomedical Instrumentation By R S Khandpur (2nd Edition) Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3.	Energy Technology Nonconventional, Renewable and Conventional By S Rao and Dr. B B Parulekar Khanna Publishers.

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics - Semester: IV (Skill Enhancement)

Course Code	US04SEELE02	Title of the Course	Digital Electronics Practicals
Total Credits of the Course	2	Hours per Week	4

Course Objectives:	The course is to make the students understand the various Logic Gates, various Flip flops, Counters and their applications.

No	Title of Practical	Weightage
1.	Logic gates using discrete component	**100**
2.	Logic gates using ICs	
3.	X – OR AND X- NOR gate applications	
4.	Half and Full adder	
5.	Half and Full subtractor	
6.	Flip - Flop	
7.	Asynchronous counter	
8.	Synchronous counter	
9	Astable multivibrator	
10	7 – segment LED display	

Teaching-Learning Methodology	Online and Board work

Sr. No.	Details of the Evaluation	Weightage
1.	• Internal Continuous Assessment in the form of Practical Examination, • Quizzes, Assignments, • Active learning, • Viva-voce, Seminars,	50%

	• Attendance (As per NEP Guideline)	
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Helps to understand Digital Electronics.
2.	Make students understand basic concept of digital circuits.
3.	Helps the student to understand working of arithmetic and logic unit of computer system. .

Suggested References:	
Sr. No.	References
1.	Digital Integrated Electronics By : Herbert Taub & Donald Schilling
2.	Digital principle and applications by D. P. Leach, A. P. Malvino and G. Saha, 8th Ed., McGraw Hill Education, 2014
3.	Fundamentals of Digital Circuits By Anand Kumar
4.	Digital Computer Electronics By Malvino and Brown.

On-line resources to be used if available as reference material
On-line Resources

Bachelor of Science
Electronics - Semester: IV (Skill Enhancement)

Course Code	US04SEELE03	Title of the Course	Hands on electronic projects
Total Credits of the Course	2	Hours per Week	4

Course Objectives:	The course is to make the students understand construct various electronics working projects.

No	Title of Practical	Weightage
1.	To construct and study Half wave rectifier	**100**
2.	To construct and study Full wave rectifier	
3.	To construct and study Half wave rectifier with filter	
4.	To construct and study full wave rectifier with filter	
5.	To construct and study regulated power supply	
6.	To construct light chaser	
7.	To construct electronic siren	

Teaching-Learning Methodology	Online and Board work

Sr. No.	Details of the Evaluation	Weightage
1.	• Internal Continuous Assessment in the form of Practical Examination, • Quizzes, Assignments, • Active learning, • Viva-voce, Seminars, • Attendance (As per NEP Guideline)	50%
2.	University Examination	50%

Course Outcomes: Having completed this course, the learner will be able to

1.	Construct different section of power supply.
2.	Construct multi vibrators and siren.

Suggested References:	
Sr. No.	References
1.	Basic Electronics and Linear Circuits By Bhargava, Kulshreshtha and Gupta.
2.	Electrical Engineering Fundamentals By Del Toro.
3.	Electronics Devices and Circuits By David A. Bell.

On-line resources to be used if available as reference material
On-line Resources