# SIDDHARTHA ACADEMY OF HIGHER EDUCATION

**Deemed to be University**

## V R SCHOOL OF ENGINEERING

**DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING**

**SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME**

## SU24

# Second Year –Third Semester Syllabus

**Effective from 2025-26**

# VR SCHOOL OF ENGINEERING

## ELECTRONICS & INSTRUMENTATION ENGINEERING

## Scheme of Instructions for Four Year B.Tech Programme-VR24

**SEMESTER I** **CONTACT HOURS: 29**

| S. No | Course Code | Course Category | Course Name | L | T | P | Credits |
|---|---|---|---|---|---|---|---|
| 1. | 24MA101 | BS | Mathematics – I (Linear Algebra, Series and Calculus) | 3 | 0 | 2 | 4 |
| 2. | 24CY102 | BS | Chemistry | 3 | 0 | 0 | 3 |
| 3. | 24BY101 | BS | Biology for Engineers | 3 | 0 | 0 | 3 |
| 4. | 24CS101 | ES | Problem Solving with Python | 3 | 0 | 3 | 4.5 |
| 5. | 24ME181 | ES | Engineering Graphics | 1 | 0 | 3 | 2.5 |
| 6. | 24CY181 | BS | Chemistry lab | 0 | 0 | 2 | 1 |
| 7. | 24ME182 | ES | Workshop Practice | 0 | 0 | 3 | 1.5 |
| 8. | 24UC183 | MC | Sports & Yoga / NSS/ NCC | 0 | 0 | 3 | 0 |
| **Total** | | | | **13** | **0** | **16** | **19.5** |

**SEMESTER II** **CONTACT HOURS: 29**

| S.No | Course Code | Course Category | Course Name | L | T | P | Credits |
|---|---|---|---|---|---|---|---|
| 1. | 24MA102 | BS | Mathematics – II (Differential equations & Computational methods) | 3 | 0 | 2 | 4 |
| 2. | 24PH102 | BS | Engineering Physics | 3 | 0 | 0 | 3 |
| 3. | 24EN101 | HS | Communicative English | 3 | 0 | 3 | 4.5 |
| 4. | 24EE101 | ES | Electrical Network Analysis | 3 | 0 | 0 | 3 |
| 5. | 24IT101 | ES | Programming using 'C' | 2 | 0 | 2 | 3 |
| 6. | 24UC181 | ES | Design Thinking | 0 | 0 | 2 | 1 |
| 7. | 24PH181 | BS | Physics lab | 0 | 0 | 2 | 1 |
| 8. | 24UC182 | ES | AI Tools and Applications | 0 | 0 | 2 | 1 |
| 9. | 24UC101 | MC | Essence of Indian Knowledge Tradition | 2 | 0 | 0 | |
| **Total** | | | | **16** | **0** | **13** | **20.5** |

| Category |
|---|
| BS-Basic Science |
| ES-Engineering Science Courses |
| HS-Humanities and Social Science |
| MC-Mandatory Courses |
| UC- University Common |
| |

**II Year I Semester (Semester III)** **CONTACT HOURS: 26**

| S.No | Course Code | Course Category | Course Name | L | T | P | Credits |
|---|---|---|---|---|---|---|---|
| 1. | 24MA202 | BS | Complex Variables & Transform Techniques | 4 | 0 | 0 | 4 |
| 2. | 24EI201 | ES | Electronics Devices & Circuits | 3 | 0 | 0 | 3 |
| 3. | 24EI202 | PC | Electrical & Electronic Measurements | 3 | 0 | 0 | 3 |
| 4. | 24EI203 | PC | Digital Electronics | 3 | 0 | 2 | 4 |
| 5. | 24EI204 | PC | Sensors and Transducers | 3 | 0 | 0 | 3 |
| 6. | 24EI281 | PC | Measurements Lab | 0 | 0 | 3 | 1.5 |
| 7. | 24EI282 | ES | Electronic Devices & Circuits Lab | 0 | 0 | 3 | 1.5 |
| 8. | 24UC201 | MC | Universal Human Values-II | 2 | 1 | 0 | 3 |
| | | | **Total** | **18** | **1** | **8** | **23** |

Universal Human Values-I Course is covered in Induction Program

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# Second Year
(III Semester)

# 24MA202- Complex Variables & Transform Techniques

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|---|---|---|---|
| **Course Category:** | Basic Science | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practice:** | 4 - 0- 0 |
| **Prerequisites:** | | **Continuous Evaluation:** | 30 |
| | | **Semester end Evaluation:** | 70 |
| | | **Total Marks:** | 100 |

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| **Course outcomes** | Upon successful completion of the course, the student will be able to: | | | | | | | | | | | | | | |
| | CO1 | Employ methods to construct analytic functions | | | | | | | | | | | | | |
| | CO2 | Determine the series expansions of complex variable function and evaluate contour integration | | | | | | | | | | | | | |
| | CO3 | Apply Laplace transform techniques to convolute functions | | | | | | | | | | | | | |
| | CO4 | Use Fourier series and Fourier transforms to solve periodic and non-periodic functions | | | | | | | | | | | | | |
| | CO5 | Find line and parabola of best fit, correlation coefficient and regression lines | | | | | | | | | | | | | |
| **Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High** | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| | CO1 | 2 | 2 | | | 1 | | | | | | | | | | |
| | CO2 | 2 | 2 | | | 1 | | | | | | | | | | |
| | CO3 | 2 | 2 | | | 1 | | | | | | | | | | |
| | CO4 | 2 | 2 | | | 1 | | | | | | | | | | |
| | CO5 | 2 | 2 | | | 1 | | | | | | | | | | |

**Course Content**

**UNIT- I**

**Analytic Functions:** Limit of a complex function, Derivative of f(z), Cauchy-Riemann equations in Cartesian and Polar coordinates, Analytic functions, Harmonic functions, Orthogonal systems

**UNIT- II**

**Complex Integration**: Complex integration, Line Integral, Series of complex terms: Taylor and Laurent Series (without proofs), Zeros and Singularities of analytic function, Residues, Calculation of residues, Residue theorem, Bilinear transformation

**UNIT- III**

**Laplace Transforms:** Introduction, Definition, Condition for existence, Transform of elementary functions Properties of Laplace transforms, Transforms of periodic functions, integrals, multiplication by tn and division by t, Evaluation of integrals by Laplace transforms, Inverse transforms, Method of partial fractions, Convolution theorem

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|---|---|
| | **UNIT- IV**<br>**Fourier Series and Transforms:**<br>**Fourier Series**: Euler's Formulae, Conditions for a Fourier Expansion, Functions having point of discontinuity, Change of interval, Even and Odd functions.<br>**Fourier transforms**: Fourier Integral Theorem (without proof & No problems), Fourier sine and cosine integrals (without proof & No problems), Fourier Transforms, Fourier sine and cosine transforms<br><br>**UNIT- V**<br>**Statistics:** Curve fitting, Method of least squares, working procedure to fit straight line and parabola, Correlation, Coefficient of correlation, Lines of Regression |
| **Text books and Reference books** | **Text Book:**<br>[T1] B.S.Grewal, "Higher Engineering Mathematics", 44th Ed., Khanna Publishers, 2019<br>**Reference Books:**<br>[R1] Erwin Kreyzig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, 2015.<br>[R2] R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th Ed., Narosa Publishers, 2016.<br>[R3] Ramana B V, "Higher Engineering Mathematics", 1st Ed., Tata MC Graw Hill. |
| **E-resources and other digital material** | 1. MIT OpenCourseWare: Complex Variables with Applications https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/pages/lecture-notes/<br>2. NPTEL: Complex Analysis https://archive.nptel.ac.in/courses/111/103/111103070/<br>3. MIT OpenCourseWare: Differential Equations https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/laplace-transform-basics/ https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/partial-fractions-and-inverse-laplace-transform/<br>4. NPTEL: Transform Techniques for Engineers https://archive.nptel.ac.in/courses/111/106/111106111/<br>5. Introduction to Fourier Analysis<br>6. Introduction to Fourier Analysis – Course<br>7. MIT OpenCourseWare: Computational Science and Engineering https://ocw.mit.edu/courses/18-085-computational-science-and-engineering-i-fall-2008/resources/lecture-33-filters-fourier-integral-transform/<br>8. NPTEL: Transform Techniques for Engineers https://archive.nptel.ac.in/courses/111/106/111106111/<br>**9.** NPTEL: Mathematics - Regression Analysis |

# 24EI201- Electronics Devices & Circuits

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|---|---|---|---|
| **Course Category:** | Engineering Science | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practice:** | 3 - 0- 0 |
| **Prerequisites:** | Engineering Physics | **Continuous Evaluation:** | 30 |
| | | **Semester end Evaluation:** | 70 |
| | | **Total Marks:** | 100 |

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| **Course outcomes** | Upon successful completion of the course, the student will be able to: | | | | | | | | | | | | | | |
| | CO1 | Analyze the operation and V I characteristics of semiconductor diodes | | | | | | | | | | | | | |
| | CO2 | Design diode circuits for various applications | | | | | | | | | | | | | |
| | CO3 | Analyze the operation and characteristics of transistors | | | | | | | | | | | | | |
| | CO4 | Analyze the operation and V I characteristics of optoelectronic devices | | | | | | | | | | | | | |
| | CO5 | Use the SPICE simulator to implement an electronic circuit using various semiconductor devices | | | | | | | | | | | | | |
| **Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High** | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| | CO1 | | | | | | | | | | | | | | | |
| | CO2 | | | | | | | | | | | | | | | |
| | CO3 | | | | | | | | | | | | | | | |
| | CO4 | | | | | | | | | | | | | | | |
| **Course Content** | **UNIT- I**<br>**Semiconductor Diodes:** Review of Semiconductors, p-n Junction as a Diode, The Volt Ampere Characteristics, The temperature dependence of P-N Characteristics, Diode Resistance, Space Charge or Transition Capacitance, Diffusion capacitances. Breakdown mechanisms, Zener diode<br><br>**UNIT- II**<br>**Diode Applications:** Diode approximations, Clippers, Clampers. Diode as a rectifier, Half wave, Full wave - Centre-tapped, Bridge rectifiers without filter and with filters - Inductor filter, Capacitor filter, L section, Zener voltage regulator<br><br>**UNIT- III**<br>**Bipolar Junction Transistor:** The Junction Transistor, Transistor Current components Characteristics of Common Base, Common Emitter and Common Collector Configuration, Relation between α, β, and γ, Transistor as a Switch, Transistor as an amplifier, Operating Point, Factors affecting the operating point<br><br>**UNIT- IV** | | | | | | | | | | | | | | |

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| | **Field Effect Transistors**: Introduction to FET, Construction, and Characteristics of JFETs, Drain and Transfer Characteristics of JFET, FET parameters, FET as an amplifier, JFET biasing circuits - Fixed bias, Voltage divider bias. Depletion-type MOSFET and Enhancement-type MOSFET, Drain and Transfer Characteristics of MOSFET<br><br>**UNIT- V**<br>**Special Semiconductor Devices:** Tunnel diode, Varactor Diode, PIN Diode, IMPATT diode, Solar Cell, LED, LCD, Photodiode, Phototransistor, UJT, SCR. |
| **Text books and Reference books** | **Text Book:**<br>[T1] Jacob Millman, Christos C Halkias & Satyabrata JIT, "Millman's Electronic Devices and Circuits", 4th Ed., TMH, 2015.<br>[T2] Ryder, John Douglas "Electronic Fundamental and Applications", 5th Ed., PHI.<br>**Reference Books:**<br>[R1] GK Mithal," Electronic Devices and Circuits", 23rd ED., Khanna Publishers<br>[R2] Robert L Boylested and Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Ed., Pearson India, 2009<br>[R3] David A Bell., "Electronic Devices and Circuits", 5th Ed., Oxford University Press, 2008 |
| **E-resources and other digital material** | 1. http://www.nptelvideos.in/2012/12/basic-electronics-drchitralekha-mahanta.html<br>2. http://nptel.ac.in/courses/117103063/<br>3. http://nptel.ac.in/courses/117106033/<br>4. http://nptel.ac.in/courses/117102061/ |

# 24EI202- Electrical & Electronic Measurements

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|---|---|---|---|
| **Course Category:** | Professional Core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practice:** | 3 - 0- 0 |
| **Prerequisites:** | Circuit analysis | **Continuous Evaluation:** | 30 |
| | | **Semester end Evaluation:** | 70 |
| | | **Total Marks:** | 100 |

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| **Course outcomes** | Upon successful completion of the course, the student will be able to: | | | | | | | | | | | | | | | |
| | CO1 | Design and calibrate electronic measurement Systems for the measurement AC & DC voltage, current and power | | | | | | | | | | | | | | |
| | CO2 | Analyze the bridge circuits to measure the unknown values of R, L and C. | | | | | | | | | | | | | | |
| | CO3 | Compare the operation of various oscilloscopes and probes. | | | | | | | | | | | | | | |
| | CO4 | Explain the principles of various signal generators and wave analyzers. | | | | | | | | | | | | | | |
| | CO5 | Study of electronic counters, digital systems and digital display devices. | | | | | | | | | | | | | | |
| **Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High** | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| | CO1 | 3 | | | | | | | | | | | | | | |
| | CO2 | | 3 | | | | | | | | | | | | | |
| | CO3 | | 2 | | | | | | | | | | | | | |
| | CO4 | | | | | | | | | | | | | | | |
| | CO5 | | | | | | | | | | | | | | | |

**Course Content**

**UNIT- I**

**Electromechanical Indicating Instruments**: Suspension galvanometer; Torque and deflection of the galvanometer - Steady state deflection, Dynamic behaviour; Permanent magnet moving coil mechanism - D'Arsonval movement, Temperature compensation

**Electrical Measurements**: DC ammeters - Shunt resistor, Ayrton shunt, Multirange ammeters, The Ayrton shunt, DC voltmeters - Multiplier resistor, Multirange voltmeter, Voltmeter sensitivity - Ohms per volt rating, Loading effect, Calibration of dc instruments, Alternating current indicating instruments - Electrodynamometer, Rectifier type instruments, Electrodynamometers in power measurements, Watt hour meter, Power factor meters

**UNIT- II**

**Bridges:** Wheatstone's bridge (Measurement of resistance), Kelvin's double bridge, Maxwell's bridge, Hay's bridge, Schering bridge, Wien's bridge, Wagner's ground connection

**Electronic Instruments**: AC Voltmeter using rectifiers, True RMS voltmeter,

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| | Digital voltmeters - Ramp technique, Staircase ramp DVM, Successive approximation type DVM, Dual slope integrating type DVM, Q Meter - Impedance measurement using Q Meter<br><br>**UNIT- III**<br>**Oscilloscopes**: Block diagram of oscilloscope, Vertical amplifier, Horizontal deflecting system, Delay line in triggered sweep, Dual beam CRO, Dual trace oscilloscope (basic block diagrams), Sampling oscilloscope, Probes for CRO - Direct probes, Passive voltage probe, Active probes, Attenuators - Uncompensated attenuators, Simple compensated attenuator<br><br>**UNIT- IV**<br>**Signal Generators:** Basic standard sine wave generator, Standard signal generator, Function generator, Laboratory square wave and pulse generator<br>**Wave Analyzers:** Basic wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, Harmonic Distortion Analyzer- Tuned circuit type, Basic Spectrum analyzer<br><br>**UNIT- V**<br>**Frequency Counters and Time Interval Measurements:** Digital frequency meter - Principle of operation, Basic circuit of a digital frequency meter, Digital measurement of time - Principle of operation, Time base selector, Period measurement, Electronic Counter - Totalizing, Frequency mode, Ratio mode, Period mode, Time interval mode.<br>**Digital Display Devices:** Segmental Display - 7 segment, Dot Matrix, LED and LCD, Typical applications of digital display |
| **Text books and Reference books** | **Text Book:**<br>[T1] W D Cooper & A D Helfrick, "Electronic Instrumentation and Measurement Techniques", PHI, 1998 (Unit-I)<br>[T2] H.S.Kalsi, "Electronic Instrumentation", 2nd Ed., TMH. (Units-II, III and IV)<br>**Reference Books:**<br>[R1] A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation",Dhanpat Rai & Co<br>[R2] Oliver & Cage, "Electronic Measurements and Instrumentation", Mc Graw Hill, 1975 |
| **E-resources and other digital material** | https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio |

# 24EI203- Digital Electronics

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|---|---|---|---|
| **Course Category:** | Professional Core | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practice:** | 3 - 0- 2 |
| **Prerequisites:** | | **Continuous Evaluation:**<br>**Semester end Evaluation:**<br>**Total Marks:** | 30<br>70<br>100 |

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| **Course outcomes** | Upon successful completion of the course, the student will be able to: | | | | | | | | | | | | | | | |
| | CO1 | Demonstrate proficiency in codes and number system converting circuits | | | | | | | | | | | | | | |
| | CO2 | Select suitable logic families and minimization methods for digital system design | | | | | | | | | | | | | | |
| | CO3 | Design and Analyze Combinational and Sequential logic circuits | | | | | | | | | | | | | | |
| | CO4 | Use the spice software to design the digital electronic circuits | | | | | | | | | | | | | | |
| **Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High** | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| | CO1 | 2 | | | | | | | | | | | | | 1 | |
| | CO2 | 2 | | | | | | | | | | | | | 1 | |
| | CO3 | | 3 | | | | | | | | | | | | 2 | |
| | CO4 | | | | | 2 | | | | | | | | | | 2 |

**Course Content**

**UNIT- I**

**Number Systems**: Number systems representation, Conversion of bases, Binary Arithmetic, Representation of Negative numbers, Codes: Binary, BCD, Excess 3, Gray.

**Boolean Algebra**: Basic Theorems and properties, Boolean Functions, Canonical and standard forms.

**Digital Logic Gates**- AND, OR, NAND, NOR, XOR, XNOR

**Exercises**:

1. Realization of logic gates using universal gates
2. Simplify the given Boolean function and Implement using NAND gates

**UNIT- II**

**Logic Families**: Introduction, Characteristics of Digital ICs, Transistor-Transistor Logic (TTL), Emitter Coupled Logic (ECL), CMOS Logic.

**Gate Level Minimization:** The K-Map Method: 4-variable maps, Don't Care conditions, NAND and NOR implementation, Quine-McCluskey method

**Exercises**:

1. Implement the given Boolean function using logic gates in SOP and POS forms
2. Simplify the given Boolean function and Implement using NOR gates

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| | **UNIT- III**<br>**Combinational Logic Design:** Combinational circuits, Adders & Subtractors, Magnitude comparator, Binary to Gray and Gray to Binary code converters, Multiplexers, De-Multiplexers, Decoders, BCD to 7 Segment decoder, Encoders, Priority encoder<br>**Exercises:**<br>1. Implement Adders & Subtractors<br>2. Design of MUX and DEMUX<br>3. Design and implementation of code converters<br>4. Design BCD-to 7 segment decoder<br><br>**UNIT- IV**<br>**Flip-Flops**: Clocked S-R flip-flop, Preset and clear, J-K flip-flop, Race around condition, Master slave J-K flip-flop, D & T flip-flops, Excitation tables of flip-flops, Flip-Flop conversions.<br>**Shift Registers:** Types, Bi-directional shift register, Universal Shift Register, Applications of shift resisters: Ring counter, Twisted ring counter<br>**Exercises:**<br>1. Verification of Flip-Flops using gates<br>2. Realization of shift registers<br><br>**UNIT- V**<br>**Counters:** Asynchronous counters – Up/Down counters, Modulus of the counter, Design of Synchronous counters, Finite State Machines: Mealy, Moore.<br>**Memory Devices:** Functional block diagram and operation - ROM, PROM, EPROM, EEPROM, Flash memory, RAM: Static and dynamic RAM, PAL, PLA.<br>Exercises:<br>1. Design of synchronous counters using IC 74163<br>2. Implementation of Boolean functions using PLA and PAL |
| **Text books and Reference books** | **Text Book:**<br>[T1] M. Morris Mano, "Digital Logic and Computer Design", PHI, 2003<br>[T2] R P Jain "Modern Digital Electronics", 4th Ed., TMH<br>**Reference Books:**<br>[R1] A. Anand Kumar, "Fundamentals of Digital Circuits", PHI, 2006<br>[R2] Thomas L. Floyd "Digital Fundamentals", 11th Ed., Pearson Education, 2015 |
| **E-resources and other digital material** | 1. https://nptel.ac.in/courses/117/106/117106086/ |

# 24EI204- Sensors and Transducers

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|---|---|---|---|
| **Course Category:** | Professional Core | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practice:** | 3 - 0- 0 |
| **Prerequisites:** | | **Continuous Evaluation:**<br>**Semester end Evaluation:**<br>**Total Marks:** | 30<br>70<br>100 |

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|---|---|---|
| **Course outcomes** | Upon successful completion of the course, the student will be able to: | |
| | CO1 | Analyze various performance characteristics of instrument and the quality of measurement |
| | CO2 | Apply various types of resistive and reactance variation sensors in real time applications |
| | CO3 | Interpret the design aspects of signal conditioning circuits for resistive and reactance variation sensors |
| | CO4 | Comprehend the principles of piezoelectric and optical transducers |
| | CO5 | Illustrate the operation of miscellaneous transducers |

**Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | | | | | |
| CO2 | 2 | | | | | | | | | | | | | | |
| CO3 | | 3 | | | | | | | | | | | | | |
| CO4 | 2 | | | | | | | | | | | | | | |
| CO5 | 2 | | | | | | | | | | | | | | |

**Course Content**

**UNIT- I**

**Instrument Characteristics**: Block diagram of generalized instrument system, Calibration and Standards, Static characteristics - Desirable & Undesirable characteristics; Dynamic characteristics.

**Errors in Measurement and Statistical Analysis**: Classification of errors, Limiting error and probable error, Statistical analysis of measurement data

**UNIT- II**

**Transducers**: Classification of transducers, Characteristics of transducers.

**Variable Resistance Transducers**: Principle of operation, Construction and Characteristics of Resistance potentiometers, Strain gauge, Resistance thermometer, Thermistors, Resistive hygrometer, Signal conditioning of resistive transducers

**UNIT- III**

**Inductance Transducers**: Principle of operation, Construction and Characteristics of

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| | Variable reluctance sensors, Eddy current sensors, Linear variable differential transformers (LVDTs), Magneto elastic sensors, Signal conditioning of inductive transducers<br>**Capacitive Transducers** – Principle of operation, Construction and Characteristics of Capacitive sensors using change in area of plates, distance between plate and change of dielectric constant<br><br>**UNIT- IV**<br>**Piezoelectric Sensors**: Principle of operation, Expression for output, Piezoelectric materials, Equivalent circuit of Piezo-electric Transducers, Loading effects and frequency response.<br>**Optical Transducers**: Principle of operation of Photo-emissive cells, Semi-conductor Photoelectric transducers<br><br>**UNIT- V**<br>**Miscellaneous Sensors**: Digital sensor, IR radiation Sensors, Ultrasonic Sensors, Fiber optic sensors, Smart sensors, Colour sensor, Bio Sensors |
| **Text books and Reference books** | **Text Book:**<br>[T1] Sawhney A. K., and Sawhney, Puneet, A Course in Electrical and Electronic Measurements and Instrumentation, 2016, 19th Ed., Dhanpat Rai & Company<br>[T2] D. Patranabis, Sensors and Transducers, 2nd Ed., Prentice Hall of India, 2011.<br>**Reference Books:**<br>[R1] Doebelin, E. O., and Manik, D. N., Measurement systems: application and design, 2020, 7th Ed., McGraw Hill Education<br>[R2] Murty, D. V. S, Transducers and Instrumentation, 2nd Ed., PHI Learning Pvt.Ltd, 2012<br>[R3] Dr. D.S. Kumar, " Mechanical Measurements & Control", 3rd Ed., Metropolitan Book Co. Pvt. Ltd. 2015 |
| **E-resources and other digital material** | https://nptel.ac.in/courses/108/108/108108147 |

# 24EI281- Measurements Lab

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|---|---|---|---|
| **Course Category:** | Professional Core Lab | **Credits:** | 1.5 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practice:** | 0 - 0- 3 |
| **Prerequisites:** | | **Continuous Evaluation:**<br>**Semester end Evaluation:**<br>**Total Marks:** | 30<br>70<br>100 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course outcomes** | Upon successful completion of the course, the student will be able to: | | | | | | | | | | | | | | |
| | CO1 | Apply the basic measurement techniques to measure the parameters such as resistance, capacitance, inductance, | | | | | | | | | | | | | |
| | CO2 | Analyze the outputs and interpreted the data generated from the bridge measurements | | | | | | | | | | | | | |
| | CO3 | Conduct experiments as individual or team by using different types of bridges | | | | | | | | | | | | | |
| | CO4 | Make an effective report based on experiments | | | | | | | | | | | | | |
| **Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High** | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| | CO1 | 3 | | | | | | | | | | | | | | |
| | CO2 | | | | 3 | | | | | | | | | | | |
| | CO3 | | | | | | | | | 1 | 2 | | | | | |
| | CO4 | | | | | | | | | | | 1 | | | | |
| **Course Content** | **List of Experiments**<br>1. DC meters and their range extension.<br>2. AC meters and their range extension.<br>3. Measurement of voltage, frequency and phase angle using a CRO.<br>4. Measurement of resistance of small resistors using Kelvin double bridge.<br>5. Measurement of inductance using Maxwell bridge.<br>6. Measurement of capacitance using Shearing bridge.<br>7. Measurement of resistance, inductance and capacitance using a LCR meter.<br>8. Measurement of amplitude and frequency of different types of waveforms using function generator.<br>9. Measurement of inductance of high Q coils using Hay bridge.<br>10. Measurement of frequency using a Wien bridge.<br>11. Calibration of voltmeter using potentiometer.<br>12. Simulation of CRO, Function generator using Analog discovery kit. | | | | | | | | | | | | | | |

# 24EI282- Electronic Devices & Circuits Lab

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| **Course Category:** | Engineering Science Lab | **Credits:** | 1.5 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practice:** | 0 - 0- 3 |
| **Prerequisites:** | | **Continuous Evaluation:**<br>**Semester end Evaluation:**<br>**Total Marks:** | 30<br>70<br>100 |

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| **Course outcomes** | Upon successful completion of the course, the student will be able to: | | | | | | | | | | | | | | |
| | CO1 | Analyze the operation of diodes, by evaluating their I-V characteristics and circuit configurations | | | | | | | | | | | | | |
| | CO2 | Analyze the operation of transistors by evaluating their I-V characteristics and circuit configurations | | | | | | | | | | | | | |
| | CO3 | Design basic diode circuits related to various applications using PSPICE tools | | | | | | | | | | | | | |
| | CO4 | Analyze the working of BJT, FET and its application as an amplifier virtually (using NI Multisim) and infer their salient parameters | | | | | | | | | | | | | |
| **Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High** | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| | CO1 | | | | | | | | | | | | | | | |
| | CO2 | | | | | | | | | | | | | | | |
| | CO3 | | | | | | | | | | | | | | | |
| | CO4 | | | | | | | | | | | | | | | |
| **Course Content** | **List of Experiments**<br>**A. Electronic Devices Module:**<br>1. Characteristics of PN junction diode<br>2. Characteristics of Zener diode<br>3. Characteristics of a transistor in common emitter configuration<br>4. Drain and transfer characteristics of the junction field effect transistor<br>5. Characteristics of a Uni Junction Transistor<br>6. Analyze the effects of operation point location on amplifier response<br><br>**B. P-Spice Module:**<br>7. Design of unbiased clampers.<br>8. Design voltage regulator using Zener.<br>9. Analyze the performance of full-wave rectifier operation with and without a filter.<br>10. Frequency response of CE amplifier.<br>11. Frequency response of CS Amplifier.<br>12. Design of UJT Relaxation Oscillator | | | | | | | | | | | | | | |

# 24UC201- Universal Human Values-II

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| **Course Category:** | Mandatory Course | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture - Tutorial - Practice:** | 2 - 1- 0 |
| **Prerequisites:** | | **Continuous Evaluation:**<br>**Semester end Evaluation:**<br>**Total Marks:** | 30<br>70<br>100 |

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| **Course outcomes** | Upon successful completion of the course, the student will be able to: | |
| | CO1 | Apply the right understanding of the concepts of value education and basic human aspirations through self-exploration for the fulfillment of human aspirations [K3]. |
| | CO2 | Analyse various aspects of the human being as the combination of Self and Body for attaining harmony at the level of human being (individual) [K4]. |
| | CO3 | Apply the knowledge of nine universal values in human-human relationship for harmony at the level of family, and appreciate all the essential factors that help in attaining harmony at the level of society [K3]. |
| | CO4 | Differentiate the characteristics and activities of various orders of Nature and study the mutual fulfillment among them, and also identify the existence as co-existence at all levels [K4]. |
| | CO5 | Present sustainable solutions to various challenges in society and Nature, and identify that the solutions are practicable [K3]. |

**Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | | | | |

**Course Content**

**UNIT- I**

**Course Introduction, Need, Basic Guidelines, Content and Process for Value Education Contents:** Purpose and motivation for the course, recapitulation from UHV-I, Self-exploration: what is it? Its content and process, 'Natural acceptance' and experimental validation – as the process for self-exploration, Continuous happiness and prosperity – a look at basic human aspirations.

Right understanding, relationship and physical facility – the basic requirements for fulfillment of aspirations of every human being with their correct priority, understanding happiness and prosperity correctly – a critical appraisal of the current scenario, method to fulfill the above human aspirations: understanding and living in harmony at various levels

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| | **UNIT- II**<br>**Understanding Harmony in the Human Being – Harmony in Myself**: Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' – happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer).<br>Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs. meaning of Prosperity in detail, Programs to ensure Sanyam and Health<br><br>**UNIT- III**<br>**Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.<br>Understanding the harmony in the society (society being an extension of family); Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society–Undivided Society, Universal Order–from family to world family<br><br>**UNIT- IV**<br>**Understanding Harmony in Nature & Existence – Whole existence as Coexistence:**<br>Understanding the harmony in the Nature, Inter-connectedness and mutual fulfillment among the four orders of Nature – recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all-pervasive Understanding Existence as Co-existence of mutually interacting units in all-pervasive<br><br>**UNIT- V**<br>**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for humanistic education, humanistic constitution and humanistic universal order, Competence in professional ethics: a) ability to utilize the professional competence for augmenting universal human order, b) ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) at the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) at the level of society: as mutually enriching institutions and organizations |

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| **Text books and Reference books** | **Text Book:**<br>[T1] Gaur, R.R., Sangal, R, & Bagaria, G.P. "A Foundation Course in Human Values and Professional Ethics", Excel Books Private Limited, New Delhi, 2010.<br>[T2] Gaur, R.R., Sangal, R, & Bagaria, G.P. "A Foundation Course in Human Values and Professional Ethics", Excel Books Private Limited, New Delhi, 2019<br>**Reference Books:**<br>[R1] Jeevan Vidya: Ek Parichaya, A. Nagaraj, Jeevan Vidya Prakashan, Amarkantak , 1999<br>[R2] Human Values, A. N. Tripathi, New Age International Publishers, New Delhi, 2004<br>[R3] The Story of Stuff: The impact of overconsumption on the planet, our communities, and our health and how we can make it better, Annie Leonard, Free Press, New York 2010<br>[R4] The story of my experiments with truth: Mahatma Gandhi Autobiography, Mohandas Karamchand Gandhi, B. N. Publishing 2008<br>[R5] Small is beautiful: A study of economics as if people mattered, E. F. Schumacher, Vintage Books, London 1993<br>[R6] Slow is beautiful: New Visions of Community, Cecile Andrews, New Society Publishers, Canada 2006<br>[R7] Economy of Permanence, J. C. Kumarappa, Sarva-Seva-Sangh Prakashan, Varanasi 2017<br>[R8] Bharat Mein Angreji Raj, Pandit Sunderlal, Prabhath Prakashan, Delhi 2018<br>[R9] Rediscovering India, Dharampal, Society for Integrated Development of Himilayas 2003<br>[R10] Hind Swaraj or Indian Home Rule, M. K. Gandhi, Navajivan Publishing House, Ahmedabad 1909<br>[R11] India Wins Freedom: The Complete Version, Maulana Abul Kalam Azad, Orient Blackswan 1988)<br>[R12] The Life of Vivekananda and the Universal gospel, Romain Rolland, Advaitha Ashrama, India 2010<br>[R13] Mahatma Gandhi: The Man who become one with the Universal Being, Romain Rolland, Srishti Publishers & Distributors, New Delhi 2002. |
| **E-resources and other digital material** | 1. Textbook-1: https://dokumen.pub/a-foundation-course-in-human-values-and-professional-ethics-firstnbsped-9788174467812.html<br>2. AICTE – SIP Youtube Channel: https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ<br>3. AICTE – UHV Teaching Learning Material: https://fdp-si.aicte-india.org/download.php#1 |