**KRUPAJAL ENGINEERING COLLEGE, BHUBANESWAR**

**Department of Electronics & Telecommunication Engineering**

**Course Articulation Matrix of Basic Electronics (RBL1B002)(First Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C RBL1B002.1 | To learn the fundamentals of semiconductors, devices, and their uses in various fields. | 1 | | | 2 | | | | | | | | | 3 | 1 | 3 |
| C RBL1B002.2 | To investigate various biasing methods for BJT circuits, operational amplifiers, FETs, MOSFETs, and transistors. | 2 | 3 | 3 | 1 | 3 | | | | | | | | 2 | 1 | 3 |
| C RBL1B002.3 | Examine the output from various semiconductor devices in various operational modes. | 3 | 3 | 3 | | 3 | 2 | 3 | | | 2 | | 2 | 2 | 2 | 3 |
| C RBL1B002.4 | Compare fundamental electronics components' design challenges, benefits, drawbacks, and restrictions. | 2 | 2 | 2 | 3 | 3 | 2 | 3 | | | | | | 2 | 3 | 3 |

**Course Articulation Matrix of Basic Electronics (RBL2B002)(Second Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C RBL2B002.1 | To learn the fundamentals of semiconductors, devices, and their uses in various fields. | 1 | | | 2 | | | | | | | | | 3 | 1 | 3 |
| C RBL2B002.2 | To investigate various biasing methods for BJT circuits, operational amplifiers, FETs, MOSFETs, and transistors. | 2 | 3 | 3 | 1 | 3 | | | | | | | | 2 | 1 | 3 |
| C RBL2B002.3 | Examine the output from various semiconductor devices in various operational modes. | 3 | 3 | 3 | | 3 | 2 | 3 | | | 2 | | 2 | 2 | 2 | 3 |
| C RBL25B002.4 | Compare fundamental electronics components' design challenges, benefits, drawbacks, and restrictions. | 2 | 2 | 2 | 3 | 3 | 2 | 3 | | | | | | 2 | 3 | 3 |

**Course Articulation Matrix of Analog Electronic Circuit (REC3C 001)(Third Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC3C001.1 | To learn the fundamentals of semiconductors, devices, and their uses in various fields. | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | |
| C REC3C001.2 | To investigate various biasing methods for BJT circuits, operational amplifiers, FETs, MOSFETs, and transistors. | 3 | 3 | 1 | 1 | - | - | - | - | - | - | - | 1 | 1 | - | |
| C REC3C001.3 | Examine the output from various semiconductor devices in various operational modes. | 3 | 3 | 1 | - | 2 | - | - | - | - | - | - | 1 | 1 | - | |
| C REC3C001.4 | Compare fundamental electronics components' design challenges, benefits, drawbacks, and restrictions. | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 1 | 2 | - | |

## Course Articulation Matrix of SIGNALS AND SYSTEMS (REC3C002) (Third Semester)

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC3C002.1 | Understand mathematical description and representation of continuous and discrete time signals & systems. | 3 | 3 | 3 | 2 | 2 | | | | | | | | | | 3 |
| C REC3C002.2 | Develop input output relationship for linear shift invariant system and to understand the convolution operator for continuous and discrete time system | 3 | 3 | 3 | 2 | 2 | | | | | | | | | | 3 |
| C REC3C002.3 | Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain. | 3 | 3 | 3 | 3 | 2 | | | | | | | | | | 3 |
| C REC3C002.4 | Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event. | 3 | 3 | 3 | 2 | 2 | | | | | | | | | | 3 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC4D003.4 | Ability to analyse about thermoelectric and electromagnetic sensing elements | 2 | 3 | 3 | 2 | | | | | | 1 | | 2 | 2 | |

**Course Articulation Matrix of Digital System Design (REC4C 002)(Fourth Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC4C002.1 | To learn about the digital signal, positive and negative logic, Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and how they are converted to other systems | 3 | 2 | 2 | 3 | | | | | | | | | 1 | | |
| C REC4C002.2 | To explore knowledge on how to minimize the hardware requirements for digital circuits, put them into practice, create real-time digital systems, and so forth. | 3 | 2 | 2 | 3 | | | | | | | | | 2 | 1 | |
| C REC4C002.3 | Recognize how various combinational and sequential circuit's function and the rules for their design, as well as their function in the development of digital systems. | 3 | 2 | 2 | 3 | | | | | | | | | 2 | 1 | |
| C REC4C002.4 | Acquired knowledge of a variety of component types, including ADC and DAC, memory components, timing circuits for producing various waveforms, and numerous logic families utilized in digital systems. | 3 | 2 | 2 | 3 | | | | | | | | | 1 | | |

**Course Articulation Matrix of Electro Magnetic Theory (REC4C 001)(Fourth Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC4C001.1 | Apply vector analysis and coordinate systems to solve static electric and magneticfield problems. | 2 | 3 | | | | | | | | | | | 1 | 1 | |
| C REC4C001.2 | Apply Gauss Law, Coulomb's law and Poisson's equation to determine electrostatic field parameters | 2 | 3 | | | | | | | | | | | 1 | | |
| C REC4C001.3 | Determine magnetic fields from current distributions by applying Biot-Savart's law and Amperes Circuital law. | 2 | 3 | | | | | | | | | | | | 1 | |
| C REC4C001.4 | Apply Maxwell Equations for the solution of time varying fields and analyse electromagnetic wave propagation in different media. Mapping of course outcomes with programme outcomes | 2 | 3 | | | | | | | | | | | 1 | 1 | |

## Course Articulation Matrix of Sensor and Transducer (REC4D 003)(Fourth Semester)

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC4D003.1 | Understand basic characteristics of sensors and their frequency response | 3 | 3 | 2 | 1 | | | | | | | 2 | | 1 | 1 | |
| C REC4D003.2 | Student will be able to differentiate the types of sensors and their operation | 2 | 1 | 3 | 3 | | | | | | | 2 | | 1 | 2 | |
| C REC4D003.3 | Ability to gain knowledge about different signal conditioning elements and their applications | 2 | 2 | 3 | 2 | | | | | | | 1 | | 2 | 1 | |

## Course Articulation Matrix of Analog & Digital Communication (REC5C002)(Fifth Semester)

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC5C002.1 | To gain knowledge of analog communication theory in practice. | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | 1 | 1 | |
| C REC5C002.2 | To become more knowledgeable about simulation software. | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | 1 | | |
| C REC5C002.3 | Giving the students practical experience will enable them to put their academic knowledge into practice. | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | | | |
| C REC5C002.4 | Determine the modulation index and evaluate an analog and digital modulated waveform in the time/frequency domain. | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 3 | 2 | 1 | |

## Course Articulation Matrix of Microprocessor and Microcontroller (REC5C203)(Fifth Semester)

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC5C203.1 | Would be able to program for 16 bit arithmetic operations using 8086. | 1 | 1 | 1 | | | | | | | | | 1 | 3 | 3 | |
| C REC5C203.2 | Would be able to program for sorting and searching using 8086. | 2 | 1 | 1 | | | | | | | | | 2 | 3 | 3 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC5C203.3 | Would be able to understand the string formation and its manipulation using 8086 microprocessor. | 2 | 1 | 1 | | | | | | | | | 2 | 3 | 2 | |
| C REC5C203.4 | Would be able to write program for digital clock and digital stop watch along with ADC and DAC using 8086 microprocessor. | 1 | 1 | 1 | | | | | | | | | 1 | 2 | 3 | |

**Course Articulation Matrix of Fiber optics and Optoelectronics Devices (REC5D001)(Fifth Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC5D001.1 | Impart knowledge of the structure, propagation, and transmission characteristics of an optical fibre and its communication link. | 3 | 3 | 1 | | | | | | | | | 1 | | 1 | |
| C REC5D001.2 | To estimate the losses and examine the optical signal's propagation traits in multiple types of fibres. | 3 | 3 | 2 | | | | | | | | | 1 | | 2 | |
| C REC5D001.3 | To define the fundamentals of optical sources and power launching-coupling techniques. | 3 | 3 | 2 | | | | | | | | | 1 | | | |
| C REC5D001.4 | Evaluate the features of fibre optic receivers. | 3 | 3 | 1 | | | | | | | | | 1 | | 2 | |

**Course Articulation Matrix of Digital Signal Processing (REC5C001)(Fifth Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC5C001.1 | Analyzing digital signals and systems with DFT. | 3 | 2 | 2 | | | | | | 2 | 3 | | | 1 | 2 | |
| C REC5C001.2 | Able to design FIR filter circuits and to construct IIR filters. | 2 | 3 | 3 | 3 | | | | | | 2 | | | 2 | 1 | |
| C REC5C001.3 | To describe the impact of finite word length on filters. | 3 | 2 | 3 | 2 | | | | | 2 | 3 | | | 2 | 1 | |
| C REC5C001.4 | To have a thorough knowledge of the fundamentals of digital signal processing that can be used in communication systems. | 2 | 3 | 2 | 3 | | | | | 2 | 2 | | | 1 | 2 | |

## Course Articulation Matrix of Microwave Engineering (RES6C001)(Sixth Semester)

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C RES6C001.1 | To analyze the propagation of waves in the TE, TM, or TEM modes in objects such as rectangular waveguides. | 2 | 2 | 1 | | | | | | | 1 | | 3 | 2 | 1 | |
| C RES6C001.2 | Create different microwave parts including power dividers, hybrid junctions, microwave solid ferrite devices, microwave amplifiers, and state dips | 3 | 3 | 1 | 2 | | | | | | 1 | | 3 | 3 | 1 | |
| C RES6C001.3 | Exhibit different basic passive and active microwave device operating concepts | 3 | 3 | 2 | 1 | | | | | | 1 | | 3 | 3 | 1 | |
| C RES6C001.4 | Use mathematics to analyze how various tubes operate and function. | 2 | 2 | 2 | 1 | | | | | | 1 | | 3 | 3 | 1 | |

## Course Articulation Matrix of Wireless Communication (RES6C002)(Sixth Semester)

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C RES6C002.1 | To understand how wireless communication systems work and how various wireless communication standards and systems have evolved. | 3 | 2 | | | | | | | | | | | 1 | | |
| C RES6C002.2 | Understand various wireless communication methods. | 2 | 2 | | | | | | | | | | | 1 | | |
| C RES6C002.3 | Describe the design, operation, rules, features, and applications of various wireless communication networks. | 2 | 2 | | | | 2 | | | | | 2 | | 2 | 2 | |
| C RES6C002.4 | Show that you can explain different wireless communication strategies. | 2 | 2 | | | | 2 | | | | | 2 | | | 2 | |

## Course Articulation Matrix of Biomedical Instruments (REI5D002)(Sixth Semester)

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REI5D002.1 | Understand the anatomy and physiology of biomedical system | 1 | 2 | 3 | 1 | 1 | 2 | 1 | | | | 1 | 1 | 3 | 1 | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REI5D002.2 | The discision of this physiological systems will cover the levels of cell, tissue,organ | 1 | 1 | 3 | 2 | 1 | 1 | 1 | | | | 1 | 1 | 2 | 2 | |
| C REI5D002.3 | Able to measure biomedical and physiological instruments. | 1 | 2 | 2 | 1 | 1 | 1 | 2 | | | | 1 | 1 | 3 | 2 | |
| C REI5D002.4 | Analyse the applicationof electronics in diagnostics and theraputic area. | 3 | 1 | 2 | 3 | 1 | 1 | 1 | | | | 1 | 1 | 1 | 3 | |

**KRUPAJAL ENGINEERING COLLEGE, BHUBANESWAR**

**Department of Electronics & Telecommunication Engineering**

**Course Articulation Matrix of Advance Digital Signal processing (REC7D003)(Seventh Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC7D003.1 | Understand mathematical description and representation of continuous and discrete time signals and systems. | 1 | 1 | 1 | | | | | | | | | | 3 | | |
| C REC7D003.2 | Able to understand the input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system. | 3 | 2 | 3 | | | | | | | | | | 3 | 3 | |
| C REC7D003.3 | Understand the basic concept of probability, random variables & random signals | 3 | 3 | 3 | | | | | | | | | | 3 | 3 | |
| C REC7D003.4 | Able to analyse the correlation, CDF, PDF and probability of a given event. | 3 | 3 | 3 | | | | | | | | | | 3 | 3 | |

**Course Articulation Matrix of Radar & Television Engineering (REC7D006)(Seventh Semester)**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C REC7D006.1 | Understand and Compare statistical parameters of different types of radars | 2 | 3 | 2 | 2 | | 1 | | | | | | 1 | 2 | 3 | |
| C REC7D006.2 | Able to understand principles and parameters of television. | 2 | 3 | 2 | 2 | | 2 | | | | | | 1 | 1 | 3 | |
| C REC7D006.3 | Able to analyse different Techniques relies with television enginering. | 2 | 3 | 2 | 2 | | 2 | | | | | | 1 | 2 | 3 | |
| C REC7D006.4 | Understand the principle , operation and characteristics of digital TV and display technology. | 2 | 3 | 2 | 2 | | 3 | | | | | | 1 | 2 | 3 | |