Detailed Syllabus
Lecture-wise Breakup

Course Code	18B11EC214	**Semester** Odd **(specify Odd/Even)**		**Semester** III **Session** 2021-2022 **Month from** Aug. to Dec.	
Course Name	Signals and Systems				
Credits	4		**Contact Hours**	3+1	

Faculty (Names)	**Coordinator(s)**	Saurabh Chaturvedi , Sajai Vir Singh
	Teacher(s) (Alphabetically)	Ajay Kumar, Bhawna Gupta, Priyanka Kwatra, Sajai Vir Singh, Saurabh Chaturvedi

COURSE OUTCOMES: At the end of the course, students will be able to		**COGNITIVE LEVELS**
C210.1	Understand the mathematical representation, classification, applications and analyze both continuous-time (CT) and discrete-time (DT) signals and systems.	Understanding Level (C2)
C210.2	Analyze and interpret the response of CT and DT LTI systems in time domain.	Evaluating Level (C5)
C210.3	Choose and demonstrate the use of different frequency domain transforms to examine and explain the spectral representation of the CT and DT signals and systems.	Evaluating Level (C5)
C210.4	Apply Laplace transform and Z-transform to analyze and examine the response and behavior of the CT and DT systems.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Signals and their classifications	Signal: definition, Classifications of Signals (Continuous-time & Discrete-time, Analog & Digital, Energy & Power, Deterministic & Random, Periodic & Aperiodic, Even and Odd etc.)	4
2.	Systems and their classifications	Classifications of Systems Classifications of Systems (Linear & Nonlinear, Time invariant & Time varying, Causal & Non- causal, Memory & Memory less, Stable & unstable system), LTI Systems (continuous-time and discrete-time)	5
3.	Response of LTI system	Impulse response of a system, Response of LTI system, Convolution (Integral and Sum).	5
4.	Fourier analysis of Continuous time signal and system	Continuous Transforms Fourier series, Convergence of Fourier series, Continuous-time Fourier Transform, properties of Fourier series and Transform, Frequency domain analysis of continuous time LTI system	7
5.	Fourier analysis of Discrete time signal and system	Discrete Transforms Fourier series, Convergence of Fourier series, Discrete-time Fourier Transform, properties of Discrete-time Fourier series and Transform, Frequency domain analysis of discrete-time LTI system	7
6.	Laplace Transform	Laplace Transform, Concept of ROC and Transfer function, pole-Zero plot, properties Laplace Transform, solution of differential equations using Laplace Transform, System	7

		function, Laplace approach to analysis the LTI system, stability analysis	
7.	Z-transform	Z- Transform, Concept of ROC, properties Z- Transform, solution of difference equations using Z- Transform, System function, pole-Zero plot , Z- Transform approach to analysis the Discrete-time LTI system, stability analysis of Discrete-time LTI system	6
8.	Introduction to Digital Filters: FIR & IIR	Digital filters:- definition and frequency response of basic filtering function like BP, HP, LP, BR, AP Definition and representation of IIR and FIR digital filter	1
		Total number of lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A.V. Oppenheim, A.S. Willsky & S.H. Nawab, Signals & Systems, 2nd edition, PHI, 2004.
2.	H.P. Hsu, Schaum's outlines of theory and problems of signals and systems. McGraw Hill; 1995.
3.	S. Haykin& B. Van Veen, Signals and Systems, 2nd edition, John Wiley & sons, 2004.
4.	M. Mandal, Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge, 2007.
5.	M. J. Roberts, Signals and Systems, Tata Mcraw-Hill, 2003.
6.	Tarun Rawat, Signals and Systems, Oxford University Press, 2010.
7.	J. G. Proakis & D. G. Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, Fourth edition, PHI, 2007.

Detailed Syllabus
Lab-wise Breakup

Course Code	(18B15EC214)	**Semester** Odd **(specify Odd/Even)**	**Semester-:**III,**Session** 2021 -2022 **Month-:** August-December
Course Name	Signal and Systems Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	**Priyanka Kwatra, Rahul Kaushik**
	Teacher(s) (Alphabetically)	**Abhinav Gupta, Archana Pandey, Atul Kumar, Bhagirath Sahu, JyotiVyas,Priyanka Kwatra, Rahul Kaushik, Ritesh Sharma, SajaiVir Singh, Vijay Khare,**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C270.1	Understanding of MATLAB and its various applications, Classification of continuous time signals and discrete time signals.	Understanding Level (C2)
C270.2	Apply the coding skills of MATLAB for Convolution of continuous time signals and discrete time signals, for DFT and IDFT.	Applying Level (C3)
C270.3	Analyze different LTI systems with Frequency domain representation of continuous time and discrete time periodic and aperiodic signals.	Analyzing Level (C4)
C270.4	Determine Laplace Transform of continuous time signals and Z-Transform of discrete time signals. Introduction to SIMULINK and to realize systems described by differential and difference equations	Evaluating Level (C5)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Understanding of MATLAB and its use in signals and discrete time signals.	Introduction to MATLAB and its various applications.	C270.1
2.	Study and Classification of continuous time signals	Introduction to continuous time signals.	C270.1
3.	Study and Classification of Discrete time signals	Introduction to Discrete time signals.	C270.1
4.	Study of parts of signals	Introduction to even and odd parts of signal.	C270.1
5.	Study of plotting of different signals using MATLAB	Write MATLAB Codes for generating and plotting various combinations of the two signals and perform time scaling, time shifting, time reversal and multiple transformations.	C270.1

6.	Study and calculation of Power and energy of signals using MATLAB	Write MATLAB codes for finding the Signal Energy or power of signals.	C270.1
7.	Apply the concepts of MATLAB in finding the Convolution sum of signals	To calculate the convolution sum of two discrete time signals.	C270.2
8.	Apply the concepts of MATLAB in finding the Convolution integral of signals	To calculate the convolution integral of two continuous - time signals.	C270.2
9.	Analyze different LTI systems with Frequency domain representation	Realization of LTI system and verify it.	C270.3
10.	Analyze Frequency domain representation of continuous time and discrete time periodic signals.	Determine frequency domain representation of CT and DT periodic signals.	C270.3
11.	Analyze different LTI systems with Frequency domain representation of continuous time and aperiodic signals.	Determine frequency domain representation of CT and DT aperiodic signals.	C270.3
12.	Analyze and realize Discrete Fourier Transform and Inverse Discrete Fourier Transform	Write your own MATLAB function to compute DFT (Discrete Fourier Transform) and IDFT (Inverse Discrete Fourier Transform) for the spectral analysis of signals.	C270.3
13.	DetermineLaplace Transform of continuous time signals	Find out output y (t) of the system where input is x (t) and impulse response is h (t) using Laplace Transform. Also, find the ROC of the transform.	C270.4
14.	Determine Z-Transform of discrete time signals.	Find out output y [n] of the system where input is x[n] and impulse response is h[n] using Z-Transform. Also, find the ROC of the transform. Verify answer using MATLAB commands “ztrans” and “iztrans”. Check stability of the system using MATLAB	C270.4
15.	Introduction to SIMULINK	Introduction to SIMULINK and to realize systems described by differential and difference equations.	C270.4
16.	Understanding of MATLAB and its use in signals	Virtual Lab: 1. Signals and its properties	C270.1
17.	Understanding of MATLAB and its use in systems	Virtual Lab: 2. System and their properties	C270.2
18.	Understanding of MATLAB and its use in Frequency Domain Representation of	Virtual Lab: 3. Fourier analysis of signals	C270.3

	signals		

Evaluation Criteria

Components	**Maximum Marks**
Viva 1 (Mid Sem Viva)	20
Viva 2 (End Sem Viva)	20
Day to Day	30
Lab Record	15
Attendance	15
Total	**100**

Project Based Learning: Every Student will learn analyzing different LTI systems with frequency domainrepresentation of continuous time and discrete time periodic and aperiodic signals. Moreover, small groups ofstudents are required to develop one Simulink model to realize systems described by differential and differenceequations.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	J.G.Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms, and Applications, Third Edition, PrenticeHall, 1999.
2.	A.V.Oppenheim and R.W. Schafer, Discrete-Time Signal Processing, Second Edition, Prentice Hall, 1999.
3.	Sanjit K. Mitra, Digital Signal Processing: With DSP Laboratory Using MATLAB : A Computer-Based Approach, Second Revised Edition, TMH, 2001.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18B11EC215	**Semester** ODD	**Semester** III **Session** 2021-22 **Month from** September **to** December
Subject Name	Digital Circuit Design		
Credits	4	**Contact Hours**	3-1-0

Faculty Members	**Coordinator(s)**	Jasmine Saini, Bhartendu Chaturvedi
	Teacher(s)	Ankur Bhardwaj, Jitendra Mohan, Shamim Akhter

COURSE OUTCOMES- At the end of the course, students will be able to:		**COGNITIVE LEVELS**
C212.1	Understand the representation and conversion of various number systems and binary codes.	Applying Level (C3)
C212.2	Understand the fundamental concepts and techniques used in digital electronics which in turn form a digital logic.	Applying Level (C3)
C212.3	Analyze and construct combinational and sequential logic circuits. Develop skill to troubleshoot digital circuits using Finite state machines.	Analyzing Level (C4)
C212.4	Classify different semiconductor memories and analyze digital system design using PLDs. Classify and analyze wave shaping circuits and digital logic families.	Analyzing Level (C4)

Module No.	Subtitle of the Module	Topics in the Module	No. of Lectures
1	Introduction to Digital Systems, Binary Codes and Boolean Algebra	Digital systems, Importance, Analog vs. digital world; Conversion of bases, Representation of negative numbers, 9's and 1's complements, 10's and 2's complements, Arithmetic using 1's and 2's complements; Hexadecimal code, BCD, Excess-3 code, Gray code and Alphanumeric code; Basic theorems and properties of Boolean algebra; Digital logic gates.	4
2	Boolean Function Representation and Minimization Techniques	Canonical and standard forms; Prime implicants and essential prime implicants; Minimization of Boolean functions using Karnaugh map and Quine-McCluskey technique; Two-level gate implementation.	5
3	Combinational logic circuits	Binary adders and subtractors: Half adder, full adder, half subtractor, full subtractor, full adder using half adder, parallel adder, adder cum subtractor, look ahead carry adder; Circuit delay calculation; Magnitude comparator; Decoder and encoder; Multiplexer and demultiplexer; Binary multiplier; Code converters.	10
4	Sequential logic circuits	Latches and flip-flops: SR, JK, master-slave JK, T	10

		and D; Conversion of flip-flops; Synchronous and asynchronous counters; Registers and shift registers; Counters using shift registers; State diagram; Analysis of sequential circuits using flip-flops.	
5	State machines	Finite state machine of sequential circuits - Moore and Mealy machines.	5
6	Programmable logic devices	RAMs- DRAM, SRAM and ROM. PLDs: PLAs, PALs and PROMs.	3
7	Introduction to digital logic families	Parameters of logic families, Types- DTL, RTL, TTL, CMOS.	3
8	Wave shaping circuits	Linear wave shaping circuits, Schmitt trigger, Square wave generator, IC-555 based multivibrators.	2
Total Lectures			42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Project based learning: Digital Circuit Design is a fundamental course in Electronics and Communication Engineering. In this course, a description of the effective and innovative logic circuit design is presented, which can be utilized to design various logic circuits. The project-based exercises using Boolean logic functions, constructing a truth table, assembling the logic gates, counters design and FSM are also included.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	M. Morris Mano, “Digital logic and computer design,” 5th ed., Pearson Prentice Hall, 2013.
2.	M. Morris Mano and Michael D. Ciletti, “Digital Design with an Introduction to the Verilog HDL,” 5th Edition, Pearson Education, 2013.
3.	R. P. Jain, “Modern Digital Electronics,” 4th Edition, Tata McGraw-Hill Education, 2009.
4.	A. Anand Kumar, “Fundamentals of Digital Circuits,” PHI; 4th Revised edition, 2016.

Detailed Syllabus
Lab-wise Breakup

Course Code	18B15EC215	**Semester:** Odd **(specify Odd/Even)**	**Semester:** 3rd **Session** 2021-22 **Month from:** August to December 2021
Course Name	Digital Circuit Design Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Dr. Yogesh Kumar and Ms. Bhawna Gupta
	Teacher(s) (Alphabetically)	Abhishek Kashyap, Abhay Kumar. Ashish Goel, Akansha Bansal, Bhartendu Chaturvedi, Jitendra Mohan, Shruti kalra, Shradha Saxena, , Vimal Kumar Mishra,

COURSE OUTCOMES - At the end of the course, students will be able to:		**COGNITIVE LEVELS**
C271.1	Learn the nomenclature of digital ICs, familiarize and verify the truth tables of logic gates using ICs.	Applying Level (C3)
C271.2	Analyze, construct and verify various combinational circuits and their functionalities.	Analyzing Level (C4)
C271.3	Identify basic requirements to analyze, construct and verify sequential circuits.	Analyzing Level (C4)
C271.4	Analyze, construct and verifying wave shaping circuits.	Analyzing Level (C4)

Module No.	Title of the Module	List of Experiments	CO
1.	Nomenclature and specifications of digital ICs	Introduction to Digital Circuit Design Lab: Nomenclature of Digital ICs, specifications, study of the data sheet, concept of V_{CC} and ground, verification of the truth tables of logic gates using ICs.	C271.1
2.	Implementation of basic logic gates	(a) To implement basic logic gates AND, OR, NOT using NAND and NOR gates (b) To implement Ex-OR gate using NOR gates only (c) To implement the Boolean expression(s) using NAND gates	C271.1
3.	Combinational Logic circuits	To design 4-bit Binary to Gray and Gray to Binary Code Converters.	C271.2
4.	Combinational Logic circuits	To realize a Half Adder, Full Adder and Half Subtractor using logic gates.	C271.2
5.	Combinational Logic circuits	To design a 2-bit Multiplier using basic logic gates.	C271.2
6.	Combinational Logic circuits	To realize and implement 2-bit Magnitude Comparator using logic gates.	C271.2
7.	Combinational Logic circuits	To realize 4:1 Multiplexer using NAND gates.	C271.2
8.	Combinational Logic circuits	To realize 2:4 Decoder using basic logic gates and to realize Half Adder using 2:4 Decoder as a block.	C271.2
9.	Seven-segment display	Display decimal digit between 0-9 on seven segment using BCD Decoder IC-7447.	C271.2
10.	Sequential Logic circuits	To realize and verify the truth table of SR, Gated SR, Gated D Latch using logic gates and of JK flip flop using IC-74LS76.	C271.3

11.	Sequential Logic circuits	To design a Ripple Counter (Asynchronous) using JK flip flop IC-74LS76 and display the output on seven segment.	C271.3
12.	Sequential Logic circuits	To Design and implement counting sequence 0, 7, 1, 6, 2, 5, 0, 7…. (Repeating) using IC-74LS76.	C271.3
13.	Wave shaping circuits	Using IC-555 in Astable mode to generate a rectangular pulse of 1ms period with duty cycle 75%.	C271.4

Evaluation Criteria

Components	**Maximum Marks**
Mid Sem Viva	20
End Sem Viva	20
Day-to-day performance	30
Attendance	15
Lab Record	15
Total	**100**

Project Based Learning: The main learning objective of this Lab course is that students should be able to analyze and design simple combinational and sequential circuits by means of discrete components. Students' opinions have been obtained by means of course exit survey at the end of the course.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	M. Morris Mano, Digital logic and computer design, 5th ed., Pearson Prentice Hall, 2013.
2.	R. P. Jain, "Modern Digital Electronics," 4th Edition, Tata McGraw-Hill Education, 2009.
3.	A. Anand Kumar, "Fundamentals of Digital Circuits," PHI; 4th Revised edition, 2016.

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B11EC211	**Semester** Odd **(specify Odd/Even)**	**Semester** 3rd **Session** 2021 -2022 **Month from** August to December
Course Name	Electrical Science-2		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Madhu Jain, Megha Agarwal
	Teacher(s) (Alphabetically)	Archana Pandey, Atul Kumar, Atul Srivastava, Bajrang Bansal, Bhagirath Sahu, Garima Kapur, Jyoti Vyas, Kirmender Singh, Mandeep Narula, Satyendra Kumar, Shradha Saxena, Shruti Kalra, Vinay Kumar Tikkiwal, Vivek Dwivedi, Yogesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C203.1	Study and analyze the complete response of the first order and second order circuits with energy storage and/or non-storage elements.	Analyzing Level (C4)
C203.2	Understand two-port network parameters and study operational amplifier, first-order&second-orderfilters.	Understanding Level (C2)
C203.3	Study the properties of different types of semiconductors, PN junction diode, Zener diode and analyze diode applications.	Analyzing Level (C4)
C203.4	Study the characteristics, operation of bipolar junction transistor (BJT) and its biasing, stability aspects.	UnderstandingLevel (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Transient Analysis	First-order network analysis, sequential switching, Differential equation approach for DC and Non constant source, second order network analysis using differential equation approach for DC and non-constant source	10
2.	Two Port Network Parameters	Definition of Z, Y, h and Transmission parameters and their conversions.	5

3.	Introduction to Operational Amplifier and Filters	Introduction to Operational Amplifier and its applications, First-order and Second-order (Low Pass, High Pass, Band pass and Band Stop) RLC Filters.	5
4.	Introduction to Semiconductor	Semiconductor Physics-Energy Band Model, Carrier Statistics, Intrinsic Semiconductors, Extrinsic Semiconductors, Fermi Level, Charge densities in a semiconductor, Carrier Mobility and Drift Current, Hall Effect, Recombination of charges, diffusion and conductivity equation.	6
5.	Diodes &Applications	P-N Junction diode, Biasing the PN Junction diode, Current–Voltage Characteristics of a P-N Junction, Half Wave Rectifier &Full Wave Rectifier, Clipper&Clamping Circuits, Zener Diode and its application as voltage reference , Line and Load Regulations of reference circuits.	8
6.	Bipolar Junction Transistor	Transistor Construction and Basic Transistor Operation, Transistor Characteristics (CE,CB,CC). Transistor Biasing & Stability.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Project Based Learning: Students will learn about the transient responses of the first/second order circuits, which is the utmost requirement for electronic circuit design. Also, the students with the knowledge of OP-AMP and filters, can design and analyse the circuits for the signal processing applications.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	R. C. Dorfand James A. Svoboda, "Introduction to Electric Circuits", 9thed, John Wiley & Sons, 2013.
2.	Charles K. Alexander, Matthew N.O. Sadiku, "Fundamentals of Electric Circuits", 6th Edition, Tata McGraw Hill, 2019.
3.	Abhijit Chakrabarti, Circuit Theory Analysis and Synthesis, 7thed, Dhanpat Rai &Co. 2018.
4.	Robert L.Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 11thed, Prentice Hall of India, 2014.
5.	Jacob Millman, Millman's Electronic Devices and Circuits (SIE), 4thed, McGraw Hill Education, 2015.

Course Description

Course Code	15B17EC271	**Semester -:** Odd (specify Odd/Even)	**Semester-:** Odd, **Session** 2021 -2022 **Month- : September- December**
Course Name	Electrical Science Lab-2		
Credits	1	**Contact Hours**	0-0-2

Faculty (Names)	**Coordinator(s)**	Dr. Satyendra Kumar, Mr. Ankur Bhardwaj
	Teacher(s)	Dr. Ashish Gupta, Dr. Ajay Kumar, Dr. Alok Joshi, Dr. Amit Goyal, Dr. Archana Pandey, Mr. Atul Kumar Srivastava, Dr. Bajrang Bansal, Dr. Garima Kapoor, Dr. Hemant Kumar, Dr. Jasmine Saini, Dr. Juhi Gupta, Dr. Kapil Dev Tyagi, Dr. Kaushal Nigam, Dr. Kirmender Singh, Dr. Megha Agarwal, Dr. Parul Arora, Mr. Raghvendra Singh, Dr. Satyendra Kumar, Dr. Saurabh Chaturvedi, Mr. Shivaji Tyagi, Mrs. Shradhha Saxena, Dr. Shruti Kalra, Mrs. Smriti Bhatnagar, Dr. Varun Goel, Mr. Vinay Tikkiwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C204.1	Study and analyze time response of first order and second order passive circuits	Analyzing Level (C4)
C204.2	Understand two port resistive network parameters, operational amplifier applications and first order filter.	Understanding Level (C2)
C204.3	Understand the characteristics of pn junction diode and its applications	Understanding Level (C2)
C204.4	Understand the characteristics of Common emitter and common base configurations of BJT.	Understanding Level (C2)

Module No.	**Title of the Module**	**List of Experiments**	**COs**
1.	First and Second order passive circuits	Study the transient response of a series RC circuit and understand the time constant concept using pulse waveforms.	C204.1
		Study of Time Response of R-L-C Network	C204.1
2.	Two port resistive networks	To determine the Z-parameters of a 2- port resistive network.	C204.2
		To determine the h-parameters of a two-port resistive network.	C204.2
3.	Operational amplifier and	To realize inverting and non inverting configurations using Op- Amp IC 741 amplifier.	C204.2

	its applications	To realize an adder and substractor circuits using Op- Amp IC 741 amplifier.	C204.2
4.	PN junction and Zener diodes	To study the forward and reverse bias (volt-ampere) characteristics of a simple p-n junction diode. Also determine the forward resistance of the diode.	C204.3
		To study the forward and reverse bias volt-ampere characteristics of a zener diode. Also determine the breakdown voltage, static and dynamic resistances.	C204.3
5.	Diode applications	To observe the output waveform of half/full wave rectifier and calculate its ripple factor and efficiency.	C204.3
		Realization of desired wave shapes using clipper and clamper circuits.	C204.3
		To study Zener voltage regulator and calculate percentage regulation for line regulation and load regulation.	C204.3
6.	Bipolar Junction Transistor	To plot input characteristics of a common emitter npn BJT.	C204.4
		To plot output characteristics of a common emitter npn BJT.	C204.4
		To plot input characteristic of a BJT in Common Base Configuration.	C204.4
		To plot output characteristic of a BJT in Common Base Configuration.	C204.4
7.	First order filters	To plot frequency and phase response of First order low pass and high pass filter.	C204.2

Evaluation Criteria

Components	**Maximum Marks**
Viva1	20
Viva2	20
Attendance, and D2D	60 (15+45)
Total	**100**

Project Based Learning: Students will learn about the transient response of first and second order passive circuits. Also, student will learn about Op-amp and its applications like adder and substractor circuits. This course also gives the understanding of semiconductor diodes and Bipolar Junction Transistor. These concepts are the required for Electronic circuit design.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	R.C.Dorf, A. Svoboda, "Introduction to Electric Circuits",9th ed, John Wiley & Sons, 2013.
2.	D. Roy Choudhary and Shail B. Jain, " Linear Integrated Circuit," 2nd Edition, NAILP, 2003
3.	A.S .Sedra & K.C.Smith, Microelectronic Circuits Theory and Application, 6th Edition, Oxford University Press, 2015(Text Book)

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11HS211	**Semester : ODD (specify Odd/Even)**	**Semester** : III **Session 2021-22** Month from: Aug-December
Course Name	Economics		
Credits	03	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Manas Ranjan Behera (JIIT62) Dr. Anshu Banwari (J128)
	Teacher(s) (Alphabetically)	Dr. Mukta Mani Dr. Shirin Alavi Dr. Kanupriya Misra Bakhru Dr. Akarsh Arora Dr. Sakshi Varshney

COURSE OUTCOMES		**COGNITIVE LEVELS**
C206.1	*Explain* the basic micro and macro economics concepts.	Understanding Level (C2)
C206.2	*Analyze* the theories of demand, supply, elasticity and consumer choice in the market.	Analyzing Level (C4)
C206.3	*Analyze* the theories of production, cost, profit and break even analysis	Analyzing Level (C4)
C206.4	*Evaluate* the different market structures and their implications for the behavior of the firm.	Evaluating Level (C5)
C206.5	*Examine* the various business forecasting methods.	Analyzing Level (C4)
C206.6	*Apply* the basics of national income accounting and business cycles to Indian economy.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Economics Definition, Basic economic problems, Resource constraints and welfare maximization. Micro and Macro economics. Production Possibility Curve. Circular flow of economic activities.	2
2.	Basics of Demand, Supply and Equilibrium	Demand side and supply side of the market. Factors affecting demand & supply. Elasticity of demand & supply – price, income and cross-price elasticity. Market equilibrium price.	6
3.	Theory of Consumer Choice	Theory of Utility and consumer's equilibrium. Indifference Curve analysis, Budget Constraints, Consumer Equilibrium.	2
4.	Demand forecasting	Regression Technique Time-series Smoothing Techniques: Exponential, Moving Averages Method	4

5.	Production theory and analysis	Production function. Isoquants, Isocostlines, Optimal combination of inputs. Stages of production, Law of returns, Return to scale.	2
6.	Cost Theory and Analysis	Nature and types of cost. Cost functions- short run and long run Economies and diseconomies of scale	2
7.	Market Structure	Market structure and degree of competition Perfect competition Monopoly Monopolistic competition Oligopoly	6
8	National Income Accounting	Overview of Macroeconomics, Basic concepts of National Income Accounting,	2
9	Macro Economics Issues	Introduction to Business Cycle, Inflation-causes, consequences and remedies: Monetary and Fiscal policy.	2
		Total number of Lectures	28 (lectures)

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz+ Project+ Class Participation)
Total	**100**

Project based learning: Students have to form a group (maximum 5 students in each group) and have to do an economic analysis on the topic assigned. An economic impact analysis assesses the impact of an event on the economy in a particular area. It generally measures the effect on revenue, profits, wages and jobs. The knowledge gained in conducting economic analysis will enhance student's decision-making skills.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	H.C. Petersen, W.C. Lewis, *Managerial Economics*, 4th ed., Pearson Education 2001.
2.	D. Salvatore, Managerial Economics in a Global Economy, 8th ed., Oxford University Press, 2015.
3.	S. Damodaran, Managerial Economics, 2 nd ed., Oxford University Press, 2010.
4.	M. Hirschey, Managerial Economics, 12th ed., Cengage India, 2013.
5.	P.A. Samuelson, W.D. Nordhaus, S. Nordhaus,Economics,18th ed., Tata Mc-Graw Hill, 2006.
6.	S.K. Misra & V. K. Puri, Indian Economy, 38th ed., Himalaya Publishing House, 2020.

Course Description
Lecture wise Breakup

Course Code	15B11MA301	**Semester** Odd	**Semester** III **Session** 2021-2022 **Month from** Aug 2021- Dec 2021
Course Name	Probability and Random Processes		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Lakhveer Kaur, Dr. Himanshu Agarwal	
	Teacher(s) (Alphabetically)	Dr. Lakhveer Kaur, Dr. Himanshu Agarwal, Dr. Amit Srivastava, Dr. Yogesh Gupta, Dr. Neha Singhal	

COURSE OUTCOMES:		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C201.1	explain the basic concepts of probability, conditional probability and Bayes' theorem	Understanding Level (C2)
C201.2	identify and explain one and two dimensional random variables along with their distributions and statistical averages	Applying Level (C3)
C201.3	apply some probability distributions to various discrete and continuous problems.	Applying Level (C3)
C201.4	solve the problems related to the component and system reliabilities.	Applying Level (C3)
C201.5	identify the random processes and compute their averages.	Applying Level (C3)
C201.6	solve the problems on Ergodic process, Poisson process and Markov chain.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Probability	Three basic approaches to probability, conditional probability, total probability theorem, Bayes' theorem.	5
2.	Random Variables	One dimensional random variables (discrete and continuous), distribution of a random variable (density function and cdf). MGF and characteristic function of a random variable and its utility. Bivariate random variable, joint, marginal and conditional distributions, covariance and correlation.	8
3.	Probability Distributions	Bernoulli, binomial, Poisson, negative binomial, geometric distributions. Uniform, exponential, normal, gamma, Earlang and Weibull distributions.	8
4.	Reliability	Concept of reliability, reliability function, hazard rate function, mean time to failure (MTTF). Reliability of series, parallel, series-parallel, parallel-series systems.	6

5.	Random Processes I	Introduction, Statistical description of random processes, Markov processes, processes with independent increments. Average values of random processes. Strict sense and wide sense stationary processes, their averages. Random walk, Wiener process. Semi-random telegraph signal and random telegraph signal process. Properties of autocorrelation function.	7
6.	Random Processes II	Ergodic processes. Power spectral density function and its properties. Poisson processes. Markov chains and their transition probability matrix (TPM).	8
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	**Veerarajan, T.,** Probability, Statistics and Random Processes, 3rd Ed. Tata McGraw-Hill, 2008.
2.	**Papoulis, A. & Pillai, S.U.,** Probability, Random Variables and Stochastic Processes, Tata McGraw-Hill, 2002.
3.	**Ross, S. M.,** Introduction to Probability and Statistics for Engineers and Scientists, 4th Ed., Elsevier, 2004.
4.	**Palaniammal, S.,** Probability and Random Processes, PHI Learning Private Limited, 2012.
5.	**Prabha, B. and Sujata, R.,** Statistics, Random Processes and Queuing Theory, 3rd Ed., Scitech, 2009.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**19B13BT211**	**Semester: EVEN**	**Semester: III Session: 2021-2022 Month from: August to December**
Subject Name	**Environmental Studies**		
Credits	**0**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	1. Prof. Krishna Sundari S
	Teacher(s) (Alphabetically)	1. Ms. Ekta Bhat 2. Dr. Garima Mathur 3. Prof. Krishna Sundari S 4. Dr. Manisha Singh 5. Prof. Rachana 6. Dr. Susinjan Bhattacharya

COURSE OUTCOMES		**COGNITIVE LEVELS**
C205.1	Explain diversity of environment, ecosystem resources and conservation.	Understand Level (C2)
C205.2	Identify hazards related to environmental pollution and safe management practices	Apply Level(C3)
C205.3	Apply modern techniques for sustainable Urban planning and Disaster management	Apply Level(C3)
C205.4	Recall Government regulations, Environmental Policies, Laws & ethics	Understand Level (C2)
C205.5	Survey ground situation on specific environmental aspects, examine risks involved, make a field report and present the findings	Analyze Level(C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	The Multidisciplinary nature of environment, Biodiversity	Definition, scope and importance, Need for public awareness, Types of Ecosystems, World Biomes, Ecosystem functioning, Diversity of flora and fauna, species and wild life diversity, Biodiversity hotspots, threats to biodiversity, Case studies.	6
2.	Natural resources, Energy consumption & conservation	Water, Land, Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources, Global Conventions on Energy, Kyoto protocol, Case studies.	10
3.	Pollution, hazardous waste management	Air, Water & Land, chemical, noise pollution, sources & causes, effects, Electronic waste, nuclear hazards, Case studies.	8

4.	Urban planning, human communities, Disaster management	Sustainable building, Disaster Management and Contingency Planning, human population, resettlement, rehabilitation environmental movements, environmental ethics, Critical issues concerning Global environment Urbanization, population growth, global warming, climate change, acid rain, ozone depletion etc.. Case studies.	8
5.	Environmental Policies, Laws, Regulations & ethics	Regulation of technology and innovation, Policy and laws, Different Acts such as: Environmental Protection Act, Air and Water Acts, Wildlife and Forest Acts), US-EPA, National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities, Case studies.	4
6	Field Work/	Explore the current environment related occurrences at national and international level, Study of successful sustainable measures, a know-how of industries in local region and their possible effects, measure of water, air and land quality, Visit to a local polluted site-Urban/Rural /Industrial / Agricultural, Study of simple ecosystems.	6
Total number of Lectures			**42**

EVALUATION:

Mid Semester Examination - 30 marks (To be held along with T-2 Exam)
End Semester Examination - 40 marks
Teachers Assessment (TA) - 30 marks

PBL Component: Field work on environmental matters involving real-world learning associating issues to current or past environmental disturbances, involves constructive analytical thinking to suggest sustainable solutions for environmental crisis resolution. Students submit their field work report/e-poster/PowerPoint presentation.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Benny Joseph, Environmental Studies Simplified, 3rd Edition, McGraw Hill Education, India, Published 2nd August, 2017
2.	Erach Bharucha, Textbook of Environmental Studies for UG Courses, 3rd Edition, Orient Black Swan, Published 1st Jan 2013
3.	Issues of the Journal: Down to Earth, Published by Centre for Science and Environment (CSE), Delhi