Detailed Syllabus

Course Code	17M15EC114	Semester Summer	Semester Summer Session 2020 - 2021 Month from: June 2021 – July 2021
Course Name	ECE DESIGN AND SIMULATION LAB -2		
Credits	1	Contact Hours	
Faculty (Names)	Coordinator(s)	Dr Amit Kumar Goyal	
	Teacher(s) (Alphabetically)	Dr Amit Kumar Goyal	

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Understand and Analyze the path loss exponent for wireless communication.	Analyzing (IV)
CO2	Design an efficient communication system having adequate signal strength for base station.	Applying (Level III)
CO3	Analyze the frequency reuse and handover probability for a given wireless communication system.	Applying (Level III)
CO4	Simulate the various performance metrics of the wireless communication system.	Analyzing (IV)

Module No.	Title of the Module	List of Experiments	CO
1	Introduction to Modelling of Wireless Channel	1. To understand the path loss prediction formula and Calculation of received signal strength as a function of distance of separation, antenna height and carrier frequency. **To understand the impact of :-** a) Transmitter Power, b) Path loss exponent, c) Carrier frequency, d) Receiver antenna height, e) Transmitter antenna height.	CO1
		2. Calculation of path loss exponent and variance of shadow fading.	CO1

2	Wireless Communication System Optimization	3. To find the 3dB beam-width of a base station antenna. (a) To study the horizontal beam pattern of the Base Station antenna and calculate the beamwidth for horizontal beam pattern (b) To study the vertical beam pattern of the Base Station antenna and calculate the beamwidth for vertical beam pattern	CO2
		4. To calculate the probability that the received signal level crosses a certain sensitivity level.	CO2
		5. To understand the concept of co-channel interference and hence Signal to Interference and Noise Ratio. A. Downlink: To calculate & plot SINR vs. distance at the Mobile Station for adaptation of the following parameters, (a) Shadowing effect, (b) Vertical Beam Pattern, B. Uplink: To calculate & plot SINR vs. distance at the base stations for different distance of two mobile stations from the base stations and different separation between them for adaptation of the following parameters, (a) Shadowing effect, (b) Vertical Beam Pattern,	CO2
		6. Understanding the impact of many different parameters influence the downlink C/I ratio. (a) Cell radios, (b) Tx power of B.S, (c) Frequency reuse, (d) Sectoring, (e) Shadowing effect, (f) B.S. height, (g) Path loss exponent, (h) Vertical beam tilt	CO2
3	Capacity Improvement Techniques	7. To understand the cellular frequency reuse concept fulfilling the following objectives: (a) Finding the co-channel cells for a particular cell. **(b)** Finding the cell clusters within certain geographic area**.**	CO3
		8. To study the effect of handover threshold and margin on SINR and call drop probability and handover probability	CO3

4	Analysis of various performance metrics of the wireless communication systems.	9. To study the outage probability, LCR & ADF in SISO for Selection Combining and MRC.	CO4
		10. To study the effect of delay spread on frequency selectivity.	CO4

Project Based Learning: ECE DESIGN AND SIMULATION LAB -2 is a lab course designed for integrated students. The course provides a thorough knowledge about various aspects of wireless communications system (WCS). This includes understanding and analysing the impact of various performance parameters on a designed WCS. Thus, students are provided a wide scope to do their projects in different modules of the course. The projects can be taken towards designing an efficient WCS. This includes optimization of various parameters like receiving and transmitting antenna height, transmitting power, estimating handoff probability to avoid call drop and to study outage probability, LCR & ADF in SISO for Selection Combining and MRC.

Evaluation Criteria

Components	Maximum Marks
Mid Viva	20
End Viva	20
TA	60
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	T. Rappaport, "Wireless Communication" prentice-hall, 2002.
2.	Gerd Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill International edition, 2000.
3	John M. Senior, Optical Fiber Communications, 2nd Edition, PHI, 2002.
4.	D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Fiber Optic Communications, Pearson Education, 2005.
5.	Journal articles i.e. IEEE, Springer, IOPscience, Elsevier and Video lectures from nanohub, NPTEL, MIT video lectures
6.	http://fcmcvlab.iitkgp.ac.in/ http://vlabs.iitkgp.ernet.in/fcmc/#

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC417	**Semester** Odd **(specify Odd/Even)**	**Semester** 9th **Session** 2020 -2021 **Month from**June to July
Course Name	Satellite Communication		
Credits	4	**Contact Hours**	6-2-0

Faculty (Names)	**Coordinator(s)**	Dr. Ajay Kumar
	Teacher(s) (Alphabetically)	Dr. Ajay Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-4.1	Define Satellite and its historical background, outline the basic concepts of Satellite communications, recall the Kepler's laws of planetary motion.	RememberingLevel (C1)
C433-4.2	Develop the equations of the orbit, explain the satellite launching and launch vehicles and outline terminology of earth-orbiting Satellites.	AnalyzingLevel(C4)
C433-4.3	Demonstrate the space segment, antenna subsystem, estimate different parameters and design uplink and downlink.	Creating Level (C6)
C433-4.4	Apply various multiple access techniques for satellite communication and analyze Noise and Bandwidth. Also Interpret applications of various types of satellites established in different earth orbits.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction to the Subject and its Importance. Contents. Books and Reading References. Evaluation. Space Environment. Artificial Satellites. Communication Satellites.	4
2.	Satellite Orbits and Frequency Bands	Orbital Mechanics. Orbits Employed for Satellite Communication like LEO, MEO & GEO, their Merits and Demerits. Satellite Launching. Launch Vehicles. Radio Wave Propagation Effects. Communication Window.	8
3.	Communication Satellites and Link Design	Geostationary Communication Satellite-Transponder. Ground Station System. Communication Link-Consideration, Calculation and Design. Power and Bandwidth Limitations and Budget.	8
4.	Modulation Techniques	Modulation and Demodulation Techniques. Performance Analysis- Noise and Bandwidth.	6
5.	Multiple Access	Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA)	7

6.	Different Communication Satellite Systems	VSAT. Navigational Satellites. Broadcasting Satellites. Remote Sensing Satellites. Low and Medium Earth Orbit Satellites. INSAT. INTELSAT.	5
7.	Some Communication Satellite Applications	DBS TV. Multimedia Transmission Related Issues, Advantages& Bit Rates for Digital TV, HDTV, Bandwidth Considerations, and Introduction to Compression Standards. Convergence of Communication, Introduction to IPTV.	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
Mid-Term	30
End Semester Examination	40
TA	30
Total	**100**

Project based learning: Each student in a group of 3 studentsselect a topic related to latest development in the technology of satellite communication. This method of learning will help students to understand latest development in the industry like ISRO, once they land into entry it will be a simple task to design and implement any given task. Knowledge acquired during this course will boost their confidence and clarity while attending any Interview related to placement activities and establishment of their own application-based startup company related with latest and cutting-edge technologies

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.	T. Pratt, C.W. Bostian and J.E. Allnut, Satellite Communications, 2 Ed, John Wiley & Sons (Asia), 2003
2.	Dennis Roddy, Satellite Communications, 4 Ed, Tata Mcgraw Hill, 2006
3.	G. Maral & M. Bousquet, Satellite Communications Systems- Systems, Techniques and Technology, 4 Ed, John Wiley and Sons, 2002.
4.	Richard Brice, Newness Guide to Digital TV, 2Ed, 2003.
5.	Gerard O' Driscoll, Next Generation IPTV Services and Technologies, John Wiley & Sons, 2008

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC413	**Semester** Int. Sem	**Semester IX Session** 2020 -2021 **Month from** June-July
Course Name	Digital Control System		
Credits	4	**Contact Hours**	6L+2T

Faculty (Names)	**Coordinator(s)**	Ritesh Kumar Sharma
	Teacher(s) (Alphabetically)	Ritesh Kumar Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-2.1	To represent the systems in the Z domain and in state space representation.	Remembering Level(C1)
C433-2.2	To analyze transient and steady state behaviors of linear discrete time control systems with modified transfer function.	Analyzing Level (C4)
C433-2.3	To understand and gain knowledge in stability analysis of digital control systems.	Understanding Level (C2)
C433-2.4	To Design Digital Control Systems	Designing Level (C6)

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
1.	Review of Z transform	z transform and inverse z transform . Relationship between s- plane and z- plane- Difference equation . Solution by recursion and z-transform.	3
2.	Review of state space techniques	Review of state space techniques to continuous data systems, state space representation of discrete time systems- Transfer function from state space model-various canonical forms- conversion of transfer function model to state space model-characteristics equation-solution to discrete state equations.	5
3.	Introduction to Digital Control System	Basic Elements of discrete data control systems, advantages of discrete data control systems, examples. Signal conversion & processing: Digital signals & coding, data conversion & quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold.	8

4.	Analysis of Digital Control Systems	Digital control systems- Pulse transfer function . z transform analysis of closed loop and open loop systems- Modified z- transfer function- Stability of linear digital control systems and Jury's stability test	8
5.	Stability tests	Stability tests- Steady state error analysis- Root loci - Frequency domain analysis- Bode plots- Gain margin and phase margin.	8
6.	State feedback concept	Controllability and Observability - Response between sampling instants using state variable approach-Pole placement using state feedback .	5
7.	Digital System Design	Observer Design for digital control, Pole placement design based on input-output models.	5
		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 analysis and Design of Digital controllers with the help of assignments/simulations based projects. Additionally, students in group sizes of two-three are required to prepare a review of any one application of the Digital Control System using one or more research publications.

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.	B. C. Kuo , "Digital control systems" (Second Edition) , Oxford University Press,2007.
2.	K. Ogatta, "Discrete Time control systems ", 2nd ed. PHI),1995
3.	M. Gopal, "Digital Control and State Variable Methods", 3rd Edition, TMH, Sep-2008.
4.	G. F. Franklin, J. D. Powell, M. Workman, Digital Control of Dynamic Systems, 3rd Edition, Longman, 1998.

Detailed
SyllabusLecture-wise
Breakup

Course Code	15B11HS112	**Semester**: Odd	**Semester**:I **Session** 2020-2021 **Month** from July 20 to Dec 20
Course Name	English		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr Monali Bhattacharya (Sect 62) Dr NiluChaudhary(Sect128)
	Teacher(s) (Alphabetically)	Dr AnshuBanwari, Dr EktaSrivastava, Dr Monali Bhattacharya, Dr NiluChaudhary, Ms PuneetPannu , Ms Rashmi Jacob, Dr Santosh Dev

COURSE OUTCOMES		**COGNITIVE LEVELS**
C114.1	Develop an understanding and appreciate the basic aspects of English as a communication tool.	Understand (C2)
C114.2	Apply the acquired skills in delivering effective presentations	Apply (C3)
C114.3	Demonstrate an understanding of different forms of literature and rhetorical devices	Understand (C2)
C114.4	Examine literature as reflection of individual and society	Analyse (C4)
C114.5	Compose different forms of professional writing	Create (C6)
C114.6	Apply Phonetics through theory and practice for better pronunciation	Apply (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	English as a Communication Tool	Basic aspects of English ·LSRW: Listening, Speaking, Reading,Writing Non Verbal Communication: Body Language, Voice Modulation, Posture Gambits Phonetics: Pronunciation, Stress, Rhythm, Intonation	10

2.	Language through Literature	**Short Stories** ·Too Bad by IsaacAsimov ·The Castaway by RabindranathTagore **Poems** ·The Highwayman by AlfredNoyes ·Where the mind is without fear by RabindranathTagore ·"If" by RudyardKipling ·Ode to Clothes by PabloNerruda **One act Play** Refund by FritzKarinthy **Famous Speech** ·Swami Vivekanand's ChicagoSpeech	10
3.	Professional Application/Writing	Textual Organization ·LetterWriting ·Circulars ·Notices ·Agenda ·Minutes ·ReportWriting	8
		Total number of Lectures	**28**

Evaluation Criteria

Components	**MaximumMarks**
T1	20
T2	20
EndSemesterExamination	35
TA	25 (Project, Assignment)
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.	**C.L.Bovee, J.V.Thill, M.Chaturvedi**, *Business Communication Today*,9th Ed, Pearson Education, copyright@ Dorling Kinderslay (India) Pvt Ltd,2009
2.	**Kelly M. Quintanilla and S.T.Wahl**, *Business and Professional Communication*, Sage Publications Pvt India Ltd,2011
3.	**S. Kumar and PushpLata,** *Communication Skills*, Oxford University Press,1st, Ed. 2011
4.	**R.K Bansal, and J.B Harrison**, *Spoken English for India*, Orient Longman, 2018
5	**Alfred Noyes,** *"The Highwayman",* Oxford University Press, USA, Sep 1999
6	**Rabindranath Tagore,** *"Where the Mind is without Fear"***,** BK Classics

7	**Rudyard Kipling**, *"If",* If Handbook, Creative Editions, 2014
8	**Pablo Neruda,** *"Ode To Clothes"* Late & Posthumous Poems, 1968-74
9	**Isaac Asimov,** *"Too Bad"***,** Robot Visions, ROC Books, New York, NY, USA, 1991
10	**RabindraNath Tagore, "***The Castaway***",** Selected Short Stories, Introduction & translated by William Radice", Penguin Classics, 2005
11	**Fritz Karinthy,** "*The Refund*", A Play in One Act adapted by Percival Wilde, French's Acting Edition, London, 1958
12	**Swami Vivekananda &SankarSrinivasan, "** Sisters & Brothers of America: Speech at World Parliament of Religions, Chicago, 1893", Creative Space Independent Publishing Platform, 2015

Detailed Syllabus

Lab-wise Breakup

Course Code	**15B17CI171**	**Semester** ODD	**Semester: 1st Session:** 2020 -2021 **Month from:** Aug –Dec
Course Name	Software Development Fundamentals Lab-1		
Credits	1	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Dharmveer Singh Rajpoot (J62), Ms. Kritika Rani (J128)
	Teacher(s) (Alphabetically)	Akanksha Mehndiratta, Alka, Amanpreet Kaur, Amarjeet, Ambalika Sarkar, Amrit Pal Singh, Anita Sahoo, Ankita, Anubhuti Mohindra, Anuja Arora, Aparajita Nanda, Archana Purwar, Arpita Jadhav Bhatt, Arti Jain, Avinash Pandey, Bansidhar Joshi, Bharat Gupta, Bindu Verma, Charu, Chetna Dabas, Chetna Gupta, Deepti, Dhanalakshmi G, Gagandeep Kaur, Gaurav Kumar Nigam, Himani Bansal, Himanshu Agrawal, Himanshu Mittal, Indu Chawla, K Vimal Kumar, Kashav Ajmera, Kavita Pandey, Kirti Aggarwal, Manju, Mradula Sharma, Mukta Goyal, Neeraj Jain, Nitin Shukla, Niyati Aggrawal, Parmeet Kaur, Parul Agarwal , Pawan Kumar Upadhyay, Pawan Mehra, Payal Khurana Batra, Potukuchi Raghu Vamsi, Prantik Biswas, Pulkit Mehndiratta, Raju Pal, Rashmi Kushwah, Rupesh Kr. Koshariya, Sakshi Agarwal, Sangeeta Mittal, Sarishty Gupta, Shailesh Kumar, Shardha Porwal, Shariq Murtuza, Sherry Garg, Shikha Mehta, Shikha Jain, Shilpa Budhkar, Shruti Jaiswal, Shulabh, Somya Jain, Sonal, Suma Dawn, Swati Gupta, Taj Alam, Varsha Garg, Vartika Puri, Vivek K. Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C172.1	Develop programs/logic for data types, expressions and conditional structure.	Apply (level 3)
C172.2	Perform programs for array and functions.	Apply (level 3)
C172.3	Implement programs for structure and union.	Apply (level 3)
C172.4	Perform programs of pointers and recursive functions.	Apply (level 3)
C172.5	Implement menu driven programs to perform basic file operations.	Apply (level 3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Weeks (2 Labs/Week)**
1	Flow chart and Logic Building	Developing logic/flow-chart/pseudo code to solve problems, simple/logical games, puzzles	2 Weeks

2	Data Type, Statements, Expressions, Operators	Data, variables and constants, data types, operators – binary, unary, ternary, operator precedence, associativity	1 Week
3	Control Flow	Develop C programs using conditional structure (if, if-else, nested if), and iterative control structure (do-while, while, for). Implement switch case statement.	2 Weeks
4	Array and String	Array initialization, reading and writing operations with array, one dimensional, two-dimensional array, strings, and related operations like addition, multiplication, traversal, transpose etc.	2 Weeks
5	Functions	User defined functions and inbuilt functions, Functions definition, declaration, calling, Pass by value, functions with array	1 Week
6	Structures and Union	Struct keyword, Structure and Union, Structure variable, dot operator, arrow operator, Array of Structures, structure using functions.	2 Weeks
7	Pointers	Pointers in C, Dynamic memory allocation for 1D/2D array and structures, Arithmetical operations on pointers, functions using pass by reference, recursive functions like palindrome, factorial, fibonacci series, number system etc	2 Weeks
8	File Handling	File creation, Modes of File Handling like read, write, update; different types of files like binary file and text file and respective operations like, opening, closing, reading, writing, end of file, traversing the file for structured and unstructured data	2 Weeks
Total Number of Weeks			14 Weeks

Evaluation Criteria

Components	**Maximum Marks**
Lab Test -1	20
Lab Test -2	20
Day to Day	60
Evaluation 1	15
Evaluation 2	15
Project	15
Attendance	15
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	H. Cooper and H. Mullish, Jaico Publishing House. “Spirit of C”, 4th Edition, Jaico Publishing House, 2006
2	Herbert Schildt. “The Complete Reference C ”, 4th Edition, TMH, 2000

3	Brian W. Kernighan and Dennis M. Ritchie ,"The C Programming Language", 2nd Edition, Prentice-Hall India, New Delhi, 2002
4	Peter Norton, "Introduction to Computers", 5th edition, Tata McGraw-Hill, Delhi., 2005.
5	Balaguruswamy, Programming in ANCI C", 2nd Edition, TMH, 2001.
6	Ashok N. Kamthane , "Programming with ANSI and Turbo C", Pearson Education, Delhi, 2003
7	Rajaraman V., "Fundamentals of Computer", 3rd Edition, Prentice-Hall India, New Delhi, 2005.
8	B. A. Forouzan, R. F. Gilberg "Computer Science: A Structured Programming Approach Using C", 2nd Edition, Thomson Press, New Delhi, 2006.
9	Avi Silberschatz, Henry F. Korth, and S. Sudarshan, "Database System Concepts", 6th edition, McGraw-Hill, 2010.

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11PH111	**Semester: Odd Semester**	**Semester: 1st Session:** 2020 -2021 **Month fromJune21 to July 21 (Deferred)**
Course Name	PHYSICS-1		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Anshu D. Varshney & Ashish Bhatnagar
	Teacher(s) (Alphabetically)	AlokPratap Singh Chauhan, Anuj Kumar, AnurajPanwar, AnshuD. Varshney, Ashish Bhatnagar, ManojTripathi,Papia Chowdhury, R.K. Dwivedi.S. C. Katyal, Suneet Awasthi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C101.1	Recall the basic principles of physics related to optics, relativity, quantum mechanics, atomic physics and thermodynamics.	Remembering (C1)
C101.2	Illustrate the various physical phenomena with interpretation based on the mathematical expressions involved.	Understanding (C2)
C101.3	Apply the concepts/principles to solve the problems related to wave nature of light, relativity, quantum mechanics and atomicphysics.	Applying (C3)
C101.4	Analyze and examine the solution of the problems using physical and mathematical concepts involved.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Physical Optics	Analytical treatment of interference, Intensity distribution of fringe system, Fresnel's Biprism, Newton's rings, Michelson interferometer, Diffraction (limited to Fraunhoffer class) from Single slit, double slit and Diffraction grating, Polarization, Phenomenological understanding of Birefringence, Principles of use of uni-axial crystals in practical polarizers, compensators and wave plates, Production and analysis of completely polarized light. Optical activity, Polarimeter	15
2.	Relativity	Michelson-Morley experiment, Lorentz transformations, Addition of velocities, Mass variation with velocity, Mass-energy relation.	5
3.	Radiation	Black body radiation, Wein's law, Rayleigh Jeans law, Planck's law of radiation.	3
4.	Quantum Mechanics	Wave-particle duality, Compton scattering, Matter waves, Heisenberg's uncertainty principle, Schrödinger wave equation and its applications to the free particle in a box, potential barrier and Harmonic oscillator.	9
5.	Atomic Structure	Origin of spectral lines, spin and orbital angular momentum, Quantum numbers, Atoms in magnetic field, Zeeman effect.	4
6.	Thermodynamics	Review of the basic laws of thermodynamics, Entropy and Clausius-Cleyperon equation.	4
		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (7M), Attendance (7M), PBL(6M)and Class performance (5M)]
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. K. Ghatak, *Optics*, Tata McGraw Hill.
2.	E. Hecht, *Optics*, Pearson Education.
3.	F. A. Jenkins and H. E. White, *Fundamentals of optics*, Tata McGraw Hill.
4.	R. S. Sirohi, *Wave Optics*, Orient and Longman.
5.	Reshnick, *Relativity*, New Age.
6.	A. Beiser, *Concepts of Modern Physics*, Mc Graw Hill International.
7.	Mark W. Zemansky, *Thermodynamics,*Tata McGraw Hill.

Detailed Syllabus
Lab-wise Breakup

Course Code	**15B17PH171**	**Semester:ODD**	**Semester: 1st Session:**2020 -2021 **Month fromJune21 toJuly 21 (deferred)**
Course Name	Physics Lab-1		
Credits	01	**Contact Hours**	02

Faculty (Names)	**Coordinator(s)**	Anuraj Panwar and S K Awasthi
	Teacher(s) (Alphabetically)	Alok Pratap Singh Chauhan, Amit Verma, Anuj Kumar, Ashish Bhatnagar, Manoj Tripathi, N. K. Sharma, Papia Chowdhury, Prashant Chauhan, R. K. Dwivedi, S. P. Purohit, Sandeep Chhoker, Vikas Malik

COURSE OUTCOMES		**COGNITIVE LEVELS**
C170.1	Recall optics and modern physics principles behind the experiments.	Remembering (C1)
C170.2	Explainthe experimental setup and the principles involved behind the experiments performed.	Understanding (C2)
C170.3	Plan the experiment and set the apparatus and take measurements.	Applying (C3)
C170.4	Analyze the data obtained and calculate the error.	Analyzing (C4)
C170.5	Interpret and justify the results.	Evaluating (C5)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Optics	**1.**To determine the wavelength of sodium light with the help of Newton's rings setup **2.**To determine the wavelength of sodium light with the help of Fresnel's Bi-prism **3.** To find the specific rotation of cane- sugar solution by a polarimeter at room temperature, using half-shade / Bi-quartz device. **4.** To determine the dispersive power of the material of a prism with the help of a spectrometer. **5.** To determine the wavelength of prominent spectral lines of mercury light by a plane transmission grating using normal incidence method	1-5
2.	Modern Physics	**6.** To study the Photoelectric effect and determine the value of Planck's constant. **7.** Determination of Planck's constant by measuring radiation in a fixed spectral range.	1-5
3.	Electricity and Magnetism	**8.** To verify Stefan's law by electrical method. **9.**To determine the resistance per unit length of Carey Foster's bridge wire and specific resistance of the material of the given wire using Carey Foster's bridge. **10.** To study the variation of magnetic field with distance, along the axis of Helmholtz galvanometer, and to estimate the radius of the coil.	1-5
Evaluation Criteria			

Components	Maximum Marks
Mid Term Viva (V1)	20
End Term Viva (V2)	20
D2D	60
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.	Dey and Dutta, *Practical Physics*, Kalyani Publication.
2.	Experiment hand-outs.

Course Description

Course Code	15B11MA111	**Semester** Odd	**Semester** I **Session** 2020-21 **Month from Aug 2020- Dec 2020**
Course Name	Mathematics-1		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C105.1	Explain the concepts of limits, continuity and differentiability of functions of several variables.	Understanding Level (C2)
C105.2	Explain the Taylor's series expansion of functions of several variables and apply it in finding maxima and minima of functions.	Applying Level (C3)
C105.3	Make use of double and triple integrals to find area and volume of curves and surfaces.	Applying Level (C3)
C105.4	Explain the concepts of vector calculus and apply Green's, Stoke's and Gauss divergence theorems in engineering problems.	Applying Level (C3)
C105.5	Solve the ordinary differential equations and explain the concepts of Laplace transform for solving engineering problems.	Applying Level (C3)
C105.6	Utilize matrix algebra for solving a system of linear equations and explain eigenvalues, eigenvectors, diagonalization and quadratic form.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Partial differentiation	Chain rule, change of variables, Taylor's series for function of two or more variables, maxima and minima of function of two variables, Jacobians.	7
2.	Double integrals	Change of order and change of variables, Gamma and Beta functions, Applications to areas and volumes, Equations to curves and surfaces, Plots of some well known curves and surfaces.	7
3.	Vector Differentiation	Gradient, divergence and curl, Normal and tangent to a plane surface.	3
4.	Vector Integration	Line integrals, Green's Theorem in a plane, surface integrals, Gauss and Stokes theorems.	7
5.	Differential Equations	Differential Equations with constant coefficients, Cauchy-Euler equations, Equations of the form y''=f(y), simple applications.	6
6.	Laplace Transform	Laplace Transform, inverse Laplace transform, Dirac delta and unit step function, Solution of IVPs.	6
7.	Matrices	Linear dependence and independence of rows, row echelon form, Rank, Gauss elimination method, Eigen values and vectors, symmetric matrices,	6

		Reduction to diagonal form Quadratic forms.	
		Total number of lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials, PBL)
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.	**Jain, R. K. &Iyenger, S. R. K.,** Advanced Engineering Mathematics, 4th Ed., Alpha Science International, 2013.
2.	**Prasad, C.,** (a) Mathematics for Engineers (b) Advanced Mathematics for Engineers, Prasad Mudranalaya, 1982.
3.	**Lipschutz, S., Lipsom, M.,** Linear Algebra, 3rd Ed, Schaum Outline Series, 2001.
4.	**Thomas, G. B and Finney, R. L**., Calculus and Analytical Geometry, 9th Ed., Pearson Education Asia (Adisson Wesley), New Delhi, 2000.

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11CI111	**Semester** Odd **(specify Odd/Even)**	**Semester** I **Session-2020-21** **Month from:** July to December
Course Name	Software Development Fundamentals – I		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Manish Kumar Thakur, Ms. Mradula Sharma (J62) / Dr. Avinash Pandey (J128)
	Teacher(s) (Alphabetically)	Dr. Manish Kumar Thakur, Ms. Mradula Sharma ,Dr. Arpita Jadhav Bhatt, Ms. Deepti, Dr. Dharmveer Singh Rajpoot, Ms. Sakshi Agarwal, Ms. Sonal, Dr. Suma Dawn Dr Avinash Pandey, Akanksha Bhardwaj, Nitin Shukla, Bindu Verma, Payal Khurana Batra, Rashmi Kushwah, Shailesh Kumar, Swati Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C109.1	Explain various phases of software development life cycle and	Understand Level (Level 2)
C109.2	Explain various data types, memory allocation schemes. precedence of arithmetical and logical operations, and need of array, and structures	Understand Level (Level 2)
C109.3	Draw the flow chart and write the high level code for different problems	Understand Level (Level 2)
C109.4	Apply and implement functions with or without pointers for different Problems	Apply Level (Level 3)
C109.5	Demonstrate and implement various operations like traverse, insertion, deletion, *etc.* on files	Apply Level (Level 3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction to Software Development Life Cycle, Step by step solution to simple problems, developing logic/flow-chart/pseudo code to solve problems like 2D screen saver, simple/logical games, puzzles	9
2.	Data types, operators, and Control Flow	Data, variables and constants, data types, operators – binary, unary, ternary, operator precedence, operations using different operators, if, if-else, while, do-while, for, switch-case in C Programming	9
3.	Array	Fundamentals of Array, Implementation of 1D/2D Array and related operations like insertion, traversal, updating, etc. in C programming using different problems	6
4.	Functions	Introduction to Functions and its implementation in C programming language, Functions using Pass by value, recursive functions	4
5.	Structures and Union	Introduction and implementation of Structures and Union in C programming, Array of Structures and related operations like insertion, traversal, updating, etc. in C programming using different problems, Structures using function	4
6.	Pointers	Pointers in C, Dynamic memory allocation for 1D/2D array and structures, Arithmetical operations on pointers, functions using pass by reference	6

7.	File Handling	Introduction to File, creation of files in C programming language, Modes of File Handling like read, write, update; different types of files like binary file and text file and respective operations like, opening, closing, reading, writing, end of file, traversing the file, for structured and unstructured data	4
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz and Assignment (15), Attendance (10)
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	Herbert Schildt. "The Complete Reference C ", 4th Edition, TMH, 2017
2	Brian W. Kernighan and Dennis M. Ritchie ,"The C Programming Language", 2nd Edition, Pearson Education India, 2015
3	H. Cooper and H. Mullish, Jaico Publishing House. "Spirit of C", 4th Edition, Jaico Publishing House, 2006
4	B. A. Forouzan, R. F. Gilberg "Computer Science: A Structured Programming Approach Using C", 1st Edition, Cengage, New Delhi, 2012
5	Ashok N. Kamthane , "Programming with ANSI and Turbo C", 3rd Edition, Pearson Education, Delhi, 2013
6	Balagurusamy, Programming in ANSI C", Eighth edition, TMH, 2019

Detailed Syllabus
Lecture-wise Breakup

Course Code	**19M12HS211**	Semester: Odd (specify Odd/Even)	Semester: III Session: 2020 -2021 Month from: July-December
Course Name	**Cost Accounting for Engineering Projects**		
Credits	03	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Dr. Praveen Kumar Sharma
	Teacher(s) (Alphabetically)	Dr. Praveen Kumar Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C201.1	Understand basic concepts of Cost Accounting	Understand (C2)
C201.2	Apply concepts of cost in project management	Apply (C3)
C201.3	Analyze cost behaviour for decision making	Analyze (C4)
C201.4	Construct different budgets for controlling the cost	Create (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction & Overview of Cost Management Process	3
2.	Cost Concepts	Relevant Cost, Differential Cost, Incremental Cost, Opportunity Cost, Objectives of a costing system, Inventory Valuation, Provision of data for decision making	4
3.	Project execution	Meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities.	5
4.	Project Execution	Pre project execution main clearances and documents Project team: Role of each member. Importance Project site Data required with significance, Project contracts, Types and contents, Project execution, Project cost control, bar charts & network diagrams, Project commissioning	6
5.	Cost Behavior	Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.	6
6.	Profit Planning Marginal Costing	Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach,	6
7.	Material Planning	Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card& value chain analysis.	6
8.	Budgetary Control	Flexible budgets, Performance budgets, zero based budgets, Measurements of divisional profitability pricing decisions including transfer pricing.	6
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35

TA	25 (Quiz+ Assignment)
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.	B. M. L. Nigam and I. C. Jain, *Cost Accounting: Principles And Practice, PHI Learning Pvt. Ltd*. PHI Learning Pvt. Ltd., 2010.
2.	C. T. Horngren, *Cost accounting: A managerial emphasis, 13/e Pearson Education India*. Pearson Education India, 2009.
3.	R. S. Kaplan and A. A. Atkinson, *Advanced management accounting*. PHI Learning, 2015.
4.	A. K. Bhattacharyya, *Principles and practice of cost accounting*. PHI Learning Pvt. Ltd., 2004.
5.	N. D. Vohra, *Quantitative Techniques in Management, 3e*. Tata McGraw-Hill Education, 2006.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**19M13HS211**	Semester: Odd	Semester: M.TechIII and M.Tech Integrated X Session: 2020 -2021 Month from: July-December 2020
Course Name	**Constitution of India**		
Credits	2	Contact Hours	(2-0-0)

Faculty (Names)	Coordinator(s)	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	Dr. Chandrima Chaudhuri

COURSE OUTCOMES		**COGNITIVE LEVELS**
C202.1	Demonstrate an understanding of the conflict between the Fundamental Rights and Directive Principlesas given in the Indian Constitution	Understand (C2)
C202.2	Assess the nature of the Indian constitution and its applicability in the study of politics in India.	Evaluate (C5)
C202.3	Assess the devolution of powers and authority of governance of the Union government and the local government	Evaluate (C5)
C202.4	Demonstrate an understanding ofthe powers and functions of the Indian executive, legislature and judiciary	Understand (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	History of Making of the Indian Constitution	• History • Drafting Committee-Composition & Working	3
2.	Philosophy of the India Constitution	• Preamble • Salient Features	1
3.	Fundamental Rights and Directive Principles	• Right to Equality • Right to Freedom • Right against Exploitation • Right to Freedom of Religion • Cultural and Educational Rights • Right to Constitutional Remedies • Directive Principles of State Policy	5

4.	Organs of Governance	• Parliament-Composition, Qualifications & and Disqualification ,Powers and Functions • Executive- President , Governor , Council of Ministers • Judiciary-Appointment and Transfer of Judges, Qualifications, Power and Functions	8
5.	Local Administration	• District's Administration head: Role and Importance • Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation • Panchayati raj: Introduction, PRI: ZilaPanchayat. • Elected officials and their roles, CEO ZilaPanchayat: Position and role • Block level: Organizational Hierarchy(Different departments) • Village level: Role of Elected and Appointed officials • Importance of Grass root democracy	8
6.	Election Commission	• Election Commission: Role and Functioning	3
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Examination:	30
End Semester Examination	40
TA	30 (Attendance, Quiz, Project)
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.	Austin, G. (1996). *The Indian Constitution: Corner Stone of a Nation*. Oxford: Oxford University Press
2.	Bakshi, P.M.(2015). *The Constitution of India*. Delhi: Universal Law Pub. Co. Pvt. Ltd
3.	Bhuyan, D. (2016). *Constitutional Government and Democracy in India*. Cuttack:KitabMahal..
4.	Busi, S.N. (2016). *Dr. B. R. Ambedkar framing of Indian Constitution*. Hyderabad*:*Ava Publishers
5.	Basu, D.D. (2018). *Introduction to the Constitution of India*. Nagpur: Lexis Nexis
6.	Jayal, N.G. & Mehta, P.B. (eds.)(2010). *The Oxford Companion to Politics inIndia*. New Delhi: Oxford University Press.

Course Description

Course Code	17M17EC218	**Semester** Odd **(specify Odd/Even)**	**Semester** 10th **Session** 2020-2021 **Month from** July to December
Course Name	*Seminar &Term Paper*		
Credits		**Contact Hours**	

Faculty (Names)	**Coordinator(s)**	Dr. Saurabh Chaturvedi
	Teacher(s) (Alphabetically)	Dr. Saurabh Chaturvedi

S. N.	**COURSE OUTCOMES:** After the completion of this course, students will be able to	**COGNITIVE LEVELS**
C212.1	Understand relevant theories, methods and research design relating to the seminar topic selected by a student.	Understanding Level (C2)
C212.2	Analyze the work of other authors/researchers and contribute to the field of knowledge with the cooperation of the supervisor.	Analyzing Level (C4)
C212.3	Evaluate the previously published research works, findings and conclusions.	Evaluating Level (C5)
C212.4	Develop and refine the master's dissertation topic and proposal. Develop the effective technical writing, communication and presentation skills.	Creating Level (C6)

Evaluation Criteria

Components	**Maximum Marks**
Mid-sem. viva	20
End-sem. viva	20
Day-to-day evaluation	40
Report	20
Total	**100**

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17M22EC116**	**Semester (Odd)**	**Semester I** **Session –** 2020-21 **Month** Aug 2020 to Dec 2020
Subject Name	**DSP Architecture**		
Credits	3	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Madhu Jain
	Teacher(s) (Alphabetically)	Dr. Madhu Jain

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
CO1	Recall the concepts of Digital Signal Processing and study the computational building blocks of DSP Processor	Understanding Level (C2)
CO2	Understand the various addressing modes, peripherals, interrupts and pipelining structure of DSP processor	Understanding Level (C2)
CO3	Implementation and applications of DSP Processor	Applying Level (C3)

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
1.	Introduction to digital signal processing	Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.	5
2.	Architectures for programmable digital signal-processors	Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.	8
3.	Programmable digital signal processors	Introduction, Commercial digital Signal-processing Devices, Data Addressing Modes of TMS32OC54xx., Memory Space of TMS32OC54xx Processors, Program Control.	6
4.	Detail Study of TMS320C54X & 54xx	Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor.	6
5.	Implementation of basic DSP algorithms	Introduction, The Q-notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters	6
6.	Implementation of FFT algorithms	Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation &	6

		Implementation on the TMS32OC54xx.	
7.	Interfacing and applications of DSP processor	Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.	5
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
Total	**100**

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	Digital Signal Processing, Avatar Singh and S. Srinivasan, Thomson Learning, 2004.
2.	Digital Signal Processing: A practical approach, Ifeachor E. C., Jervis B. W Pearson-Education, PHI/ 2002
3.	Digital Signal Processors, B Venkataramani and M Bhaskar TMH, 2002
4.	Architectures for Digital Signal Processing, Peter Pirsch John Weily, 2007

Detailed Syllabus
Lecture-wise Breakup

Subject Code	20M11EC111	**Semester: ODD**	**Semester: ISession: 2020-2021** **Month from** July **to** December
Subject Name	Advanced RF and Microwave Engineering		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Dr. Jasmine Saini	
	Teacher(s) (Alphabetically)	Dr. Jasmine Saini	

COURSE OUTCOMES-At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C141.1	Develop an understanding of concepts of microwave circuits and ISM applications.	Understanding (Level II)
C141.2	Explain the concepts of microwave circuits and scattering parameters.	Evaluating (Level V)
C141.3	Design and analyze impedance transformers.	Analyzing (Level IV)
C141.4	Design and apply microwave components like dividers, filters,resonators etc. in Microwave systems.	Applying (Level III)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Transmission Lines and Waveguides	Review of Microwave Engineering; Advantages, disadvantages and ISM applications of microwaves; TEM mode transmission lines: lossless line, line with small losses; Quasi TEM mode lines: Fields in micro striplines and striplines, losses in microstrips, microstrip discontinuities, coupled lines, slot lines and coplanar waveguides; Wave velocities.	8
2.	Microwave Circuit Theory Principles	Equivalent voltages and currents; Z, Y, S, and ABCD parameters; Equivalent circuit representation of microwave junctions; Scattering parameter analysis of microwave junctions.	10
3.	Impedance Transformers	Review of single-, double- and triple-stub tuners; waveguide reactive elements; quarter-wave transformers; design of maximally flat and Chebyshev transformers; Introduction to tapered transmission lines.	6

4.	Power Dividers and Couplers	Scattering matrix of 3- and 4-port junctions; Design of T-junction and Wilkinson power dividers; Design of 90□ and 180□ hybrids.	6
5.	Filters	Analysis of periodic structures; Floquet's theorem; filter design by insertion loss method; maximally flat and Chebyshev designs.	6
	Resonators	Principles of microwave resonators; loaded, unloaded and external Q, open and shorted TEM lines as resonators; microstrip resonators; dielectric resonators.	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
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.	Collin, R.E., "Foundations for Microwave Engineering", 2nd Ed., John Wiley & Sons,2000.
2.	Pozar, D.M., "Microwave Engineering", 3rd Ed., John Wiley & Sons,2004.
3.	Edwards, T.C. and Steer M.B., "Foundations for Interconnects and Microstrip Design", 3rd Ed., John Wiley & Sons.,2001.
4.	Ludwig, R. and Bretchko, P., "RF Circuit Design", Pearson Education,2000.
5.	Hunter, I., "Theory and Design of Microwave Filters", IEE Press,2001.
6.	Misra, D.K., "Radio-frequency and Microwave Communication Circuits", John Wiley & Sons,2001.
9.	https://nptel.ac.in/courses/108/101/108101112/

Subject Code	20M11EC112	**Semester: ODD**	**Semester: I Session: 2020-2021** **Month from** July **to** December
Subject Name	Photonics Materials & Devices for Communications		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		Dr. Amit Kumar Goyal
	Teacher(s) (Alphabetically)		Dr. Amit Kumar Goyal

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
CO1	Develop an understanding of photonic components and optical fiber technology.	Understanding (Level II)
CO2	Design and analyze different types of Photonic/Nano-photonic devices and components.	Applying (Level III)
CO3	Classify the material system/technologies along with their fabrication processes to design efficient photonic devices for communication.	Analyzing (Level IV)
CO4	Analytically evaluate the various photonic devices.	Evaluating (Level V)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Basics of Photonics, and Optical fibers	Photonics, integrated photonics and their brief history, Basic photonic technologies and components, Brief introduction to Maxwell's equations, wave equation, Electromagnetic waves at different dielectric intserfaces. Overview of Optical fibers, types (step-index and graded index), single-mode and multi-mode along with their condition, birefringent fiber, numerical aperture, Optical fiber communications, Dispersion and scattering	10
		losses in fiber, budget analysis.	

2.	Optical waveguides and Photonic Devices	Optical waveguides classification, Guided modes in optical waveguides, Dispersion of guided modes, Single-mode 3-D optical waveguides. Basic integrated-optic devices: Optical power splitter, Directional coupler, thermo-optic switches, Mach-Zehnder interferometer, Arrayed Waveguide Grating (AWG)-based MUX/DEMUX, Add-drop multiplexer, Design of photonic devices: Beam Propagation Method and Marcatili's Method.	10
3.	Fundamental of Nano-Photonic Devices and Components	Nano-photonics: Photonic crystal (PhC) technology, PhC waveguide, PhC resonator, PhC MUX/DEMUX, PhC Filters, PhC fibers, Nano-wires, Packaging of photonic devices. Recent studies on PhC based devices for communication applications.	6
4.	Photonic Materials and Fabrication Technologies	Photonic materials, selection of materials like silicon, silica, Lithium Niobate, Compound Semiconductor and Polymers. Fabrication and process techniques like Lithography, Deposition, and Diffusion etc. Parameter measurement and techniques, recent studies on photonic materials.	10
5.	Coupled-mode Theory and Devices	Basic concepts of coupled mode theory, Mode coupling: co-directional and contra-directional, Mode coupling in corrugated waveguides, Short-period and long-period gratings in optical fibers and optical waveguides, Properties of short-period and long-period gratings, Application of gratings in communication, and Recent trends.	8
		Total number of Lectures	**44**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
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.	Gerd Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill International edition, 2000.
2.	John M. Senior, Optical Fiber Communications, 2nd Edition, PHI, 2002.
3.	H Nishihara, M Haruna and T Suhara, Optical integrated Circuits, McGraw-hill, 1989.
4.	D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Fiber Optic Communications, Pearson Education, 2005.
5.	C. R. Pollock and M. Lip Son, Integrated Photonics, Kluwer Pub., 2003.
6.	T. Tamir, (ed), Guided-wave optoelectronics, (2nd edition), Springer-Verlag, 1990.
7.	Clifford Pollock, Fundamentals of Optoelectronics, Richard Irwin Inc., Chicago, 1995.
8.	Journal articles i.e. IEEE, Springer, IOPscience, Elsevier and Video lectures from nanohub, NPTEL, MIT video lectures
9.	https://nptel.ac.in/courses/117/108/117108142/

Detailed
Syllabus Lab-
wise Breakup

Course Code	17M15EC113	**Semester: Odd 2020 (specify Odd/Even)**	**Semester** 10th **Session** 2020 -2021 **Month from** July to December
Course Name	ECE Design and Simulation Lab -I		
Credits	3	**Contact Hours**	5

Faculty (Names)	**Coordinator(s)**	Ashish Goel
	Teacher(s) (Alphabetically)	Juhi Gupta, Shweta Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
C171.1	At the end of the module the student will be able to explain relative merits and demerits of wireless communication technologies.	Remember Level (I)
C171.2	At the end of the lab the students will be able to simulate the radio propagation model	Understand Level (II)
C171.3	Plan a communications system for a given environment in which it is to be deployed.	Apply Level (III)
C171.4	Select a wireless technology or a combination of technologies to suit a given application.	Analyze Level (IV)
C171.5	Use of MIMO technology in 5G communication	Evaluate Level (V)
C171.6	Perform measurements with commercial equipment and understand the effects of radio channel on the OFDM signal as well as strategies to compensate them	Create Level (VI)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Exp.1	Introduction to MATLAB and its various applications.	**C171.**1
2.	Exp.2	To study and simulate Rayleigh and Rician distribution using two signals that follow normal distribution	**C171.**2
3.	Exp.3	To study and simulate Propagation Path loss Models: Free Space Propagation, log distance and log normal.	**C171.**2
4.	Exp.4	To study atmospheric turbulence models in Free Space Optical Communication system and implement them using MATLAB	**C171.**3
5.	Exp.5	To determine the channel capacity for AWGN and faded wireless channels	**C171.**3
6.	Exp.6	To study Pulse code modulation and demodulation using Matlab	**C171.**4
7.	Exp.7	Write Matlab program to perform Delta modulation and Adaptive Delta modulation for a sinusoidal signal. Also study the effect of step size and sampling rate on delta modulated signal.	**C171.**4
8.	Exp.8	To study and simulate the following systems using BPSK modulation: a) wired or AWGN (Additive White Gaussian Noise); b) wireless or faded channel system.	**C171.**4
9.	Exp.9	Write Matlab program to evaluate the SER of 16-QAM modulated signal over AWGN channel and also verify it with the theoretical	**C171.**4

		results.	
10.	Exp.10	To simulate the channel capacity for MIMO system	**C171.**5
11.	Exp.11	To analyze the performance of MIMO systems by using space time code technique.	**C171.**5
12.	Exp. 12	OFDM systems implementation using MATLAB	**C171.**6
13.	Exp. 13	To obtain the PAPR analysis of multi-carrier signal and the performance of PAPR & BER with clipping and filtering Scheme	**C171.**6

Evaluation Criteria Components	**Maximum Marks**
Viva -1	20
Viva -2	20
D2D	60
Total	**100**

Project based learning: Here, students will learn latest communication technologies, starting from the basics process of modulation, demodulation and its impairment. These schemes are of utmost importance to understand the concepts of current and future generations of communication system and to design the same. Student will be able to design the physical layer of 4G communication and to analyze its implementations issues. Students can perform the some simulation on Matlab to analyze the same. Understating of these techniques will further help to work in any core communication industry.

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.	Aditya K Jagannatham, Principles of Modern Wireless Communication Systems Theory and Practice, TMH, 2/e, 2017
2.	Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung-Gu Kang , MIMO-OFDM Wireless Communications with MATLAB, Wiley, 2013
3.	

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M22EC113	**Semester: (specify Odd/Even)**	**Semester: I Session: 2020-21 Month: Aug-Dec**
Course Name	HDL Based Digital Design		
Credits	3	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Shruti Kalra	
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
CO1	Recall the basics combinational and sequential circuits	Remembering Level (C1)
CO2	Understand the concepts of Verilog hardware description language and distinguish between good and bad coding practices	Understanding Level (C2)
CO3	Learn to model synchronous and Asynchronous digital circuits	Applying Level (C3)
CO4	Fault analysis and case studies on complex digital circuits	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Verilog	Overview of Digital Design with Verilog HDL, Hierarchical Modeling Concepts, Modules and Ports, Gate-Level Modeling, Dataflow Modeling, Behavioral Modeling, Tasks and Functions, Useful Modeling Techniques	9
2.	Advanced topics in Verilog	Timing and Delays, Switch-Level Modeling, User-Defined Primitives, Programming Language Interface, Logic Synthesis with Verilog HDL, modeling memory and register banks, introduction to the concept of pipelining.	9
3.	Synchronous Finite State Machine	Flip-Flops, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Flip-Flops Excitation Tables, Design Procedure	9
4.	Asynchronous Finite State Machines	Asynchronous Analysis, Design of Asynchronous Machines, Flow table realization, reduction, state assignments and design, Cycle and race analysis. Hazards, Essential Hazards, and its removal	10
5.	Fault Analysis	s-a-0, s-a-1 fault analysis using path sensitization method, Boolean Difference Method	5
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
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.	Monk S. Programming FPGAs: Getting Started with Verilog. McGraw Hill Professional; 2016.
2.	Li Y. Computer principles and design in Verilog HDL. John Wiley & Sons; 2015.
3.	Ciletti M. Advanced digital design with the Verilog HDL. Prentice hall; 2009.
4.	Sutherland S. The Verilog PLI Handbook: a user's guide and comprehensive reference on the Verilog programming language interface. Springer Science & Business Media; 2013.

Detailed Syllabus
Course Outcomes

Course Code	17I17EC512/17M27EC216/17M17EC220	**Semester ODD& EVEN**	**Semester** 3rd& 4thfor M.Tech / 11th for Dual Degree **Session** 2020 -2021 **Month from** July to Dec/Jan to May
Course Name	Industrial Project		
Credits	M.Tech –4 &16 DD - 22	**Contact Hours**	8 & 32

Faculty (Names)	**Coordinator(s)**	Ms. Bhawna Gupta, Dr. Rachna Singh
	Teacher(s) (Alphabetically)	All faculty of ECE Deptt.

COURSE OUTCOMES		**COGNITIVE LEVELS**
C214.1	Summarize the contemporary scholarly literature, activities, and explored tools/ techniques/software/hardware for hands-on in the respective project area in various domain of Electronics Engineering.	Understanding (Level II)
C214.2	Gain knowledge of the State-of-Art in the chosen field of study. Analyze various feasible methods of solving a problem to slot a suitable solution methodology	Analyzing and Designing (Level IV)
C214.3	Use latest techniques and software tools for achieving the defined objectives. Evaluate /Validate sound conclusions based on evidence and analysis	Evaluating (Level V)
C214.4	Demonstrate the oral and written communication skills. Describe the importance of possible future developments in the selected domain	Create Level (Level VI)

Evaluation Criteria

(Industrial Project at the end of final semester for M.Tech/DD)

Components	**Maximum Marks**
End Term Viva	30
Day To Day	20 (Awarded by Internal Supervisor)
Day To Day	50 (Awarded by Supervisor from Industry)
Total	**100**

Detailed Syllabus
Course Outcomes

Course Code	**17I17EC511/17M17EC219/ 17M27EC215/**17M17EC222 /17I17EC511	**Semester ODD& EVEN**	**Semester** 3rd& 4thfor M.Tech / 11th for Dual Degree **Session** 2020 - 2021 **Month from** July to Dec/Jan to May
Course Name	Dissertation		
Credits	M.Tech–4 &16 DD - 22	**Contact Hours**	8 & 32

Faculty (Names)	**Coordinator(s)**	Ms. Bhawna Gupta, Dr. Rachna Singh
	Teacher(s) (Alphabetically)	All faculty of ECE Deptt.

COURSE OUTCOMES		**COGNITIVE LEVELS**
C213.1	Summarize the contemporary scholarly literature, activities, and explored tools/ techniques/software/hardware for hands-on in the respective project area in various domain of Electronics Engineering.	Understanding (Level II)
C213.2	Gain knowledge of the State-of-Art in the chosen field of study. Analyze various feasible methods of solving a problem to slot a suitable solution methodology	Analyzing and Designing (Level IV)
C213.3	Use latest techniques and software tools for achieving the defined objectives. Evaluate /Validate sound conclusions based on evidence and analysis	Evaluating (Level V)

C213.4	Demonstrate the oral and written communication skills. Describe the importance of possible future developments in the selected domain	Create Level (Level VI)

Evaluation Criteria

(Dissertation at the end of third semester for M.Tech only)

Components	**Maximum Marks**
End Term Viva	60
Day to Day	40
Total	**100**

(Dissertation at the end of final semester for M.Tech/DD)

Components	**Maximum Marks**
End Term Viva	50
Special Contribution	10
Day to Day	40
Total	**100**

Software Development Lab - II

Detailed Syllabus
Lab-wise Breakup

Course Code	15B17CI271	**Semester:** Even **(specify Odd/Even)**	**Semester: II Session: 2020-21** **Month from:** Jan to June
Course Name	Software Development Lab - II		
Credits	1	**Contact Hours**	2 hrs

Faculty (Names)	**Coordinator(s)**	Anita Sahoo, Niyati Aggrawal, Himani Bansal (J128)
	Teacher(s) (Alphabetically)	(J62) Adwitiya Sinha, Anita Sahoo, Ankita Verma, Arpita Yadav, Bhawna Saxena, Chetna Dabas, Deepti, Hema N., K Vimal Kumar, K.Rajalakshmi, Manju, Megha Rathi, Mradula Sharma, Neetu Sardana, Niyati Aggrawal, Prantik Biswas, Shardha Porwal (J128) Ambalika Sarkar, Anubhuti Mohindra, Arti Jain, Avinash Pandey, Devpriya Soni, Himani Bansal, Kritika Rani, Mukesh Saraswat, Nitin Shukla, Rashmi Kushwah, Shailesh Kumar, Shariq Murtuza, Shilpa Budhkar, Swati Gupta.

COURSE OUTCOMES		**COGNITIVE LEVELS**
C173.1	Write programs in C++ to implement OOPs concepts related to objects, classes, constructor, destructor, and friend function.	Apply Level (Level 3)
C173.2	Write programs in C++ using OOPs concept like encapsulation, inheritance, polymorphism and abstraction.	Apply Level (Level 3)
C173.3	Write programs in C++ using Standard Template Library.	Apply Level (Level 3)
C173.4	Perform exception handling in C++ programs.	Apply Level (Level 3)
C173.5	Write MySQL queries to perform operations like ADD, DELETE, UPDATE, SELECT on relational databases.	Apply Level (Level 3)

Module No.	**Title of the Module**	**List of Experiments**	**No. of Labs for the module**
1.	OO Concepts using C++	Write output based C++ programs to implement the concepts of Objects, Classes, Internal representations of Objects, encapsulation, Constructors, Destructors, Function and Operator Overloading, Static and Friend Functions.	3
2.	Inheritance using C++	Write programs in C++ to implement concepts of Base Class, Derived class, Method Overriding, Private and Public Inheritance, Multiple Inheritance.	2
3.	Polymorphism using C++	Write programs in C++ using Virtual Functions, Pure Virtual Functions, Abstract Classes, Dynamic Dispatch, Internal representations of method tables, RTTI, operator overriding.	2

4.	UML/Relationship Implementation in C++	Write programs in C++ using based on Class diagram, Relationships of Association, Aggregation, Composition, and Inheritance	1
5.	Exceptions, Templates, and STL in C++	Write programs in C++ using Exceptions, Try, Catch and Throw, Re-throwing exceptions, Exception and Inheritance, Function Templates, Overloading Functions Template, Class Templates, Collection classes and iteration protocols (STL)	2
6.	Introduction to Database	Design simple SQL queries using MYSQL to apply various operations on single table like create, insert, delete, update, alter, etc., Queries on single table using select statement with or without where/ group by clause, etc.	2
		Total number of Labs	**12**

Evaluation Criteria

Components	**Maximum Marks**
Evaluation 1	15
Lab Test1	20
Evaluation 2	15
Lab Test 2	20
Mini Project	15
Attendance	15
Total	**100**

Project based leaning: Groups of 3-4 students will choose a project topic. They will use the concepts of OOP and/or database to execute their project. In a team, they will learn how to apply the concepts for problem solving in a meaningful way.

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	Herbert Schildt, C++: The Complete Reference, McGraw-Hill Osborne Media, 4th Edition, 2017
2	Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson, 7th Edition, 2016
3	Stroustrup B., The C++ Programming Language, Addison Wesley, 4th Edition, 2013
4	Avi Silberschatz, Henry F. Korth, and S. Sudarshan, “Database System Concepts”, 6th edition, McGraw-Hill, 2010.
5	Robert Lafore, Object Oriented Programming in C++, SAMS, 4th Edition, 2002
6	John Hubbard, Schaum's Outline of Programming with C++, McGraw-Hill, 2nd Edition, 2000

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11PH211	**Semester: Even**	**Semester: II Session** 2020-21 **Month from: January to June**
Course Name	PHYSICS-2		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	**Prof. R.K. Dwivedi& Dr.Suneet Kumar Awasthi**
	Teacher(s) (Alphabetically)	Alok Pratap Singh Chauhan (ALC) Anshu D. Varshney (ADV) Anuj Kumar (AK) Ashish Bhatnagar (ABH) Dinesh Tripathi (DT) Himanshu Pandey (HP) Manoj Kumar (MKC) Navendu Goswami (NG) R. K. Dwivedi (RKD) S C Katyal (SCK) Suneet Kumar Awasthi (SKA) Vikas Malik (VM)

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Recall the basic concepts relating to electromagnetic theory, statistical physics, lasers, fiber optics and solid state physics.	Remembering (C1)
CO2	Illustrate the various physical phenomena with interpretation based on the mathematical expressions involved.	Understanding (C2)
CO3	Apply the basic principles in solving variety of problems related to lasers, electromagnet theory, fiber and solid state physics.	Applying (C3)
CO4	Analyze and examine the solution of the problems using physical and mathematical concepts involved in the course.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Electromagnetism and Optical Fiber	Coulomb's law, Gauss law and its applications,Treatment of electrostatic problems by solutionof Laplace and Poisson's equations, Biot-Savartlaw, Ampere's law, Maxwell's equations in freespace and dielectric media. Electromagneticwaves, Derivations of expressions for energydensity and energy flux (Poynting vector) in anelectromagnetic field, Radiation pressure.Propagation of EM waves through boundary-Reflection, Refraction, Absorption and TotalInternal Reflection. Light propagation in fibersand	18

		Graded Index fibers, Numerical Apertureand Attenuation, Single and Multimode.	
2.	Statistical Distributions and Lasers	Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distributions and their applications.Principle and working of laser, Einstein A and Bcoefficients, Ruby Laser.	08
3.	Solid State Physics	Basic ideas of bonding in solids, Crystalstructure, Bragg's law X-ray diffraction, Bandtheory of solids, Distinction between metals,semiconductors and insulators. Electronicconduction in metals, Intrinsic and extrinsic (nandp-type) semiconductors and their electricalconductivity. p-njunction and Hall effect insemiconductors.	14
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	**20**
T2	**20**
End Semester Examination	**35**
TA	**25**
(a) Quizes /class tests (07M), (b) Attendance (07M)	
(c) Internal Assessment (05) (d) Assignments in PBL mode (06M)	
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.	D. J. Griffiths, Introduction to electrodynamics, Pearson India.
2.	G. Keiser, Optical Fiber Communications, Tata Mc Graw Hill Education.
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	S. O. Pillai, Solid State physics, New Age International (P) Limited.
5.	B. G. Streetman & S. Banerjee, Solid State Electronic Devices, Prentice-Hall India.

Detailed Syllabus
Lab-wise Breakup

Course Code	**15B17PH271**	**Semester:**Even	**Semester:**II **Session** 2020 -2021 **Month: from** January -July
Course Name	Physics Lab-2		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Prof. Navendu Goswamiand Dr. Vikas Malik.
	Teacher(s) (Alphabetically)	Ashish Bhatnagar, B.C. Joshi, Dinesh Tripathi, Manoj Kumar, Manoj Tripathi, Navendu Goswami, Sandeep Chhoker, Suneet Kumar Awasthi, Vikas Malik,

COURSE OUTCOMES		**COGNITIVE LEVELS**
C171.1	Recall laser, fibre optics, semiconductor and solid state physics principles behind the experiments.	Remembering (C1)
C171.2	Explainthe experimental setup and the principles involved behind the experiments performed.	Understanding (C2)
C171.3	Plan the experiment and set the apparatus and take measurements.	Applying (C3)
C171.4	Analyze the data obtained and calculate the error.	Analyzing (C4)
C171.5	Interpret and justify the results.	Evaluating (C5)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Semiconductor Physics	**1(a).** To determine the band gap in a semiconductor using its p-n junction diode. **1(b).** To draw the I-V characteristic of Solar cell and find maximum power and fill factor. **2(a).** To measure resistivity of semiconductor at different temperatures by Four Probe Method. **2(b).**To determine Band Gap of the semiconductor. **3.**To study the Hall effect in semiconductor and to determine its allied coefficients.	1-5
2.	Solid State Physics	**4.** To study the Magnetostriction in metallic rod with the help of Michelson interferometer arrangement. **5.** To find the susceptibility of a paramagnetic substance ($FeCl_3$) in the form of liquid or a solution. **6.**Study of dielectric (constant) behavior and determination of Curie's temperature of ferroelectric ceramics.	1-5
3.	Modern Physics	**7.**To study the magneto resistance of given semiconductor material. **8(a).** To determine the value of specific charge (e/m) of an electron by Magnetron method. **8(b).** To determine the velocity of ultrasonic wave in the	1-5

		medium of liquid using ultrasonic interferometer and to determine the compressibility of the given liquid. **9(a).** To determine Planck‟s Constant using LEDs of known wavelength. **9(b).** To study the photovoltaic cell and hence verify the inverse square law.	
4.	Optical Fiber	**10(a).** To determine the numerical aperture of a given multimode optical fiber. **10(b).** To measure the power loss at a splice between two multimode fibers and tostudy the variation of splice loss with Longitudinal and Transverse misalignments of thegiven fibers.	1-5

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Viva (V1)	20
End Term Viva (V2)	20
D2D	60
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.	Dey and Dutta, Practical Physics
2.	Lab Manuals

Course Description

Course Code	15B11MA211	**Semester** Even	**Semester** II **Session** 2020-2021 **Month from** Jan 2021- June 2021		
Course Name	Mathematics 2				
Credits	4		**Contact Hours**	3-1-0	
Faculty (Names)	**Coordinator(s)**				
	Teacher(s) (Alphabetically)				

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C106.1	apply different methods for solving ordinary differential equations of second order.	Applying Level (C3)
C106.2	explain different tests/methods of convergence for infinite series.	Understanding Level (C2)
C106.3	find the series solution of differential equations and use it to construct Legendre's polynomials and Bessel's functions.	Applying Level (C3)
C106.4	classify the partial differential equations and apply Fourier series to find their solution.	Applying Level (C3)
C106.5	explain Taylor's & Laurent's series expansion, singularities, residues and transformations.	Understanding Level (C2)
C106.6	apply the concept of complex variables to solve the problems of complex differentiation and integrations.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Second Order Linear Differential Equations	Linear Differential Equations of Second Order with constant coefficients and with variable coefficients, Change of Variable, Variation of Parameters.	5
2.	Convergence of Series	Convergence of series, Tests of convergence, Alternating Series, Absolute & Conditional Convergence, Uniform Convergence.	7
3.	Series Solution and Special Functions	Series Solutions, Bessel Function, Recurrence Relations and Orthogonality. Legendre functions, Recurrence relations and Orthogonality.	7
4.	Fourier Series andPartial Differential Equations	Fourier Series. Classification and Solution of PDE, Equation of vibrating string, Solution of one dimensional wave & heat equations.	5

5.	Complex Variables	Limit, Continuity and Differentiability of Functions of Complex Variables, Analytic Functions, Cauchy's Riemann Equations.	3
6.	Complex Integration	Cauchy Integral Theorem, Cauchy Integral Formula and Applications.	4
7.	Series Expansion	Taylor and Laurent Series Expansion, Poles and Singularities.	4
8.	Contour Integration	Residues, Cauchy's residue theorem and its applications.	5
9.	Conformal Mapping	Bilinear transformation	2
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:

1.	**Jain, R. K. &Iyenger, S. R. K.,** Advanced Engineering Mathematics, 5th Ed., Narosa Publishing House, New Delhi, 2016.
2.	**Brown, J.W. & Churchill, R.V.,** Complex Variables and Applications, 6th Ed., McGrawHill, 1996.
3.	**Prasad, C.,** (a) Mathematics for Engineers (b) Advanced Mathematics for Engineers, Prasad Mudranalaya, 1982.
4.	**Kreysizg, E.,** Advanced Engineering Mathematics, 10th Edition, John Willey & Sons, Inc., 2015.
5.	**Simmons, G. F.,** Differential Equations with Applications and Historical Notes, 2nd Ed. McGraw Hill, 1991.
6.	**Spiegel, M.R.,** Complex Variables, Schaum's outline series, Mac Graw-Hill, 2009.
7.	Grewal,B.S., "Higher Engineering Mathematics" 44thEdition, Khanna Publisher, New Delhi, 2018.

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11EC111	**Semester** Even **(specify Odd/Even)**	**Semester** 2nd **Session** 2020 -2021 **Month from** Jan-June
Course Name	**Electrical Science -1**		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Vimal Kumar Mishra, Neetu Joshi
	Teacher(s) (Alphabetically)	Archana Pandey, Bhagirath Sahu, Jyoti Vyas, Mandeep Narula, Megha Agarwal, Nisha, Rachna Singh, Sajaivir Singh, Shraddha Saxena.

COURSE OUTCOMES		**COGNITIVE LEVELS**
C113.1	Recall the concepts of voltage, current, power and energy for different circuit elements. Apply the Kirchhoff laws and different analyzing techniques to identify the different circuit parameters.	Apply Level (C3)
C113.2	Define and apply the networks theorems in the complex AC and DC circuits, networks. Demonstrate the physical model for given Sinusoidal AC signal and construct the phasor diagrams.	Applying Level (C3)
C113.3	Demonstrate the concept of resonance and operate different instrumental and measurement equipments.	Understanding Level (C2)
C113.4	Demonstrate the construction and working of single phase transformer.	Understanding Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic Concepts	Voltage, Current, Power and Energy analysis for Circuit elements (R, L, C), Independent and Dependent Sources, Kirchhoff's Laws, Voltage Divider rule, Current Divider rule	6
2.	DC Circuit Analysis	Star-Delta Transformation, Source transformation, Mesh and Supermesh Analysis, Nodal and super nodal Analysis	6
3.	Network Theorems	Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem	6
4.	Sinusoidal Steady State Analysis	Physical Model for a Sinusoid, Average Value, Effective Value, Phasor presentation, Addition of Phasor using Complex Numbers, Concepts of impedance and admittance.	4

5.	AC Network Analysis and Theorems	Mesh and Nodal analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem	6
6.	Resonant Circuits	Series and Parallel resonance, frequency response of Series and Parallel resonance, Q-Factor, Bandwidth	4
7.	Electrical Instruments	Essentials of an Instrument, Permanent Magnet Moving Coil (PMMC) Instruments, voltmeter, ammeter, Ohmmeter, Meter Sensitivity (Ohms-Per-Volt Rating); Loading Effect; Multimeter; Cathode Ray Oscilloscope: Construction,	6
		Working and Applications. Function Generators	
8.	Single Phase Transformer	Principle of operation, construction, e.m.f. equation, equivalent circuit, power losses, efficiency (simple numerical problems), introduction to auto transformer.	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, quiz, attendance)
Total	**100**

Project based learning component: Students will learn fundamental concepts, working and applications of Permanent Magnet Moving Coil (PMMC) Instruments, voltmeter, ammeter, Ohmmeter, Cathode Ray Oscilloscope and Function Generators that develop aptitude among students to design minor and major projects. They will also develop knowledge about step-up and step-down transformer which can be further used to design advanced circuits in communication and robotics. It will also help develop concepts about instrumentation in electrical/electronics/biotech/communication based industries.

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 and James A. Svoboda, "Introduction to Electric Circuits", 9th ed, John Wiley & Sons, 2013.
2.	Charles K. Alexander (Author), Matthew N.O Sadiku, " Fundamentals of Electric Circuits", 6th ed, Tata Mc Graw Hill, 2019.
3.	Robert L. Boylestad, Louis Nashelsky, " Electronic Devices and Circuit Theory ", 11th ed, Prentice Hall of India, 2014.
4.	D.C. Kulshreshtha, Basic Electrical Engineering,Revised 1st ed, Tata Mc Graw Hill, 2017 .

Course Description

Course Code	15B17EC171	**Semester -:** Even (specify Odd/Even)	**Semester** II **Session:** 2020 -21 **Month- :** January - May
Course Name	Electrical Science Lab-1		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Bhagirath Sahu & Shradha Saxena
	Teacher(s)	Archana Pandey, Ashish Gupta, Atul kumar Srivastav, Bhagirath Sahu, Garima Kapur, Gaurav Verma, Juhi Gupta, Kaushal Nigam, Kirmender Singh, Mandeep Singh Narula, Neetu Singh, Pankaj Kumar Yadav, Parul Arora, Raghvenda Kumar Singh, Sajai Vir Singh, Shivaji Tyagi, Shradha Saxena, Vijay Khare, Vivek kumar Dwivedi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C176.1	Understand various active and passive components and instruments (Multimeter, Bread board, Regulated D.C. power supply).	Understanding (Level II)
C176.2	Acquire the knowledge of electrical network and circuit such as branch, node, loop and mesh in networks and circuits.	Analyzing (Level IV)
C176.3	Study and verification of reduction technique using different network theorem.	Remembering (Level I)
C176.4	Study and verification of series and parallel AC circuits as well as Open & Short Circuit Test in single phase transformer.	Applying (Level III)

Module No.	**Title of the Module**	**List of Experiments**	**COs**
1.	Introduction of active and passive components	Introduction to various components (Resistor, Capacitor, inductor, and IC) and instruments Multimeter, Bread board, Regulated D.C. power supply and CRO.	C176.1
2.	Analysis and verifications of Mesh and Node	Verification of KVL and KCL using a given circuit.	C176.2
3.	Analysis and verification of Transform Network	Realization of Equivalent Resistance of Star to Delta and Delta to Star Transformation.	C176.2

4.	Analysis and verification of of Super Node	Verification of Super Node using Voltage Source.	C176.2
5.	Analysis and verification of Divider rules for Current and Voltage	To verify the voltage divider rule (VDR) and the current divider rule (CDR).	C176.2
6.	Study and Analysis of Superposition Theorem	Verification of Superposition Theorem.	C176.3
7.	Analysis and verification of Thevenin's/ Norton Theorem	Verification of Thevenin's Theorm and Norton Theorm.	C176.3
8.	Analysis and verification of Maximum Power Transfer Theorem	Verification of Maximum Power Transfer Theorem.	C176.3
9.	Study and Verification of AC Signal in term of RMS and PP Value	To study the Root-Mean-Square(RMS), Peak, and Peak-to-Peak Values, Measurements with Oscilloscope.	C176.4
10.	Study and Analysis of Resonance Circuit	To study the behavior of Series-Parallel RLC Circuit at Resonance.	C176.4
11.	Study of open Circuit Test	Open Circuit Test in Single Phase Transformer using Vlab.	C176.4
12.	Study of Short Circuit test	Short Circuit Test in Single Phase Transformer using Vlab.	C176.4

Evaluation Criteria

Components	**Maximum Marks**
Viva1	20
Viva2	20
Report file, Attendance, and D2D (15+15+30)	60
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.	Nilsson Riedel, Electric Circuits," Pearson, 11th Edition, 2019
2.	Abhijit Chakrabarti, "Circuit Theory Analysis and Synthesis," Dhanpat Rai & Co.; 7th Edition , 2018
3.	U. S. Bkashi A.U. Bakshi S. Ilaiyaraja,, "Circuit Theory Technical Publications; 3rd Edition, 2019
4.	Roman Malaric, "Instrumention and Measurement in Electrical Engineering, "Universal Publisher, 3rd Edition, 2011.
5.	DP Kothar and I J Nagrath, " Electric Machine," TMH; 4 th Edition, 2010

Detailed Syllabus
Lab-wise Breakup

Course Code	18B15GE111	**Semester :** Even **(specify Odd/Even)**	**Semester:** II[nd] **Session** 2020-2021 **Month from:** Jan to June
Course Name	Engineering Drawing and Design		
Credits	1.5	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Mr. Chandan Kumar,Mr. Rahul Kumar
	Teacher(s) (Alphabetically)	Mr. DeepakKumar, Mrs. MadhuJhariya,Mr. Nitesh Kumar, Dr. PrabhakarJha,Mr. VimalSaini

COURSE OUTCOMES		**COGNITIVE LEVELS**
C178.1	Recall the use of different instruments used in Engineering Drawing and Importance of BIS and ISO codes.	Remembering (Level I)
C178.2	Illustrate various types of mathematical curves and scale.	Understanding (Level II)
C178.3	Classify different types of projection and Construct Orthographic projection of Point, Line, Plane and Solid.	Applying (Level III)
C178.4	Construct Isometric Projection and Conversion of Orthographic view to Isometric view and vice-versa.	Applying (Level III)
C178.5	Construct Engineering model in Drawing software (AutoCAD) and Compare it with conventional drawing.	Analyzing (Level IV)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Engineering Drawing	• Principles of engineering graphics and their significance, usage of drawing instruments. • Technical vertical capital letters which includes English alphabets and numeric.	C178.1
2.	Engineering Curves	• Constructing a pentagon and hexagon; engineering curves: Parabola, Ellipse, Hyperbola, Cycloids and Involutes.	C178.2
3.	Orthographic Projections	• **Projection of points:** Point on VP, HP, in space. • **Projection of straight lines:** Lines inclined or parallel to any one of the planes; lines inclined to both HP and VP with traces. • **Projection of planes:** Plane on VP, HP, inclined to any one of the planes; plane inclined to both HP and VP.	C178.3
4.	Projections of	• Projections of solids in simple position inclined to	C178.3

	Regular Solids	one/both the planes.	
5.	Sections and Sectional Views of Right Angular Solids	• **Sections of solids:** Section of standard solids and true shape section of standard machine elements for the section planes perpendicular to one plane and parallel or inclined to other plane.	C178.3
6.	Isometric Projections	• Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.	C178.4
7.	Overview of Computer Graphics	• Demonstrating knowledge of the theory of CAD software; Dialog boxes and windows; Shortcut menus; the Command Line; the Status Bar; Isometric Views of lines, Planes, Simple and compound Solids.	C178.5
8.	Customization & CAD Drawing	• CAD Drawing along with customization tools, Annotations, layering & other functions. Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Surface Modeling; Solid Modeling.	C178.5
9.	Demonstration of a simple team design project	• Technical 2D/3D orthographic and Isometric projections; Demonstration of a simple team design project.	C178.5

Evaluation CriteriaComponents	**Maximum Marks**
Mid Viva	20
End Viva	20
TA	60
Total	**100**

Project based learning: AutoCAD is a computer-aided software used for creating blueprints for bridges, buildings, interior & exterior designs etc. The software is widely used by designers and drafters for creating 2D and 3D computer drawings. Each student will opt an Automobile or Manufacturing Industry of India and learn more about their projects and latest designs.

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.	Bhatt N.D., Panchal V.M. & Ingle P.R., Engineering Drawing, Charotar Publishing House, 2014.
2.	Shah, M.B. &Rana B.C., Engineering Drawing and Computer Graphics, Pearson Education, 2008.
3.	Agrawal B. &Agrawal C. M., Engineering Graphics, TMH Publication, 2012.
4.	Narayana, K.L. & P Kannaiah , Text book on Engineering Drawing, Scitech Publishers, 2008

Software Development Fundamentals – II

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11CI211	**Semester:**Even **(specify Odd/Even)**	**Semester: II Session: 2020-21** **Month from:** Jan to June
Course Name	Software Development Fundamentals – II		**NBA Code:** C110
Credits	4	**Contact Hours**	4 (3 Hrs. Theory, 1 Hr. Tutorial)

Faculty (Names)	**Coordinator(s)**	Mukesh Saraswat, Manish Kumar Thakur, Ashish Mishra
	Teacher(s) (Alphabetically)	Anuradha Gupta, Arti Jain (T), Avinash Pandey, Himani Bansal, Kritika Rani, Shailesh Kumar, Swati (T)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C110.1	Explain various object-oriented concepts like class and objects, friend function, function and operator overloading, etc.	Understand Level(Level 2)
C110.2	Apply and implement the relationships of association, aggregation, composition, and inheritance	Apply Level (Level 3)
C110.3	Analyze the output of the source code and able to debug the errors	Analyze Level (Level 4)
C110.4	Design the class diagram for real life problems and implement it using virtual functions, abstract classes, templates, and exception handling	Create Level (Level 6)
C110.5	Apply SQL commands to create tables and perform various operations like insert, delete, select, *etc.*	Apply Level (Level 3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Object Oriented Programming	Comparison of Procedural and Object-Oriented Approach, Characteristics of Object-Oriented Languages, Separation of behavior and implementation	2
2.	OO Concepts using C++	Objects, Classes, Internal representations of Objects, Constructors, Destructors Functionand Operator Overloading, Static and Friend Functions	8
3.	Inheritance using C++	Base Class, Derived class, Method Overriding, Private and Public Inheritance, Multiple Inheritance.	3
4.	Polymorphism using C++	Virtual Functions, Pure Virtual Functions, Abstract Classes, Dynamic Dispatch, Internal representations of method tables, RTTI	3
5.	UML/Relationship Implementation in C++	Models, Views and Model Elements, Class Diagram, Relationships of Association, Aggregation, Composition, and Inheritance, *etc.* and their implementing	8
6.	Exceptions, Templates, and	Exceptions, Try, Catch and Throw, Re-throwing exceptions, Exception and Inheritance, Function Templates, Overloading	8

	STL in C++	Functions Template, Class Templates, Collection classes and iteration protocols (STL)	
7.	Introduction to Database	Fundamentals of Database and Database Management System, Introduction to Relational Database, Table, Attributes, Records, Introduction to SQL, Data types in SQL, Various operations on single table like create, insert, delete, update, alter, etc. using SQL, SQL queries on single table using select statement with or without where/ group by clause, etc.	10
		Total number of Lectures	**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Mini Project (10), Attendance (10), Tutorial Assignments (5))
Total	**100**

Project based learning: Each student in a group of 3-4 will have to develop a mini project based on Object Oriented Programming and database. The students can opt any real-world application where these concepts can be applied. The students have to implement the mini project using C++ language. Project development and its presentation will enhance the knowledge and employability of the students in IT sector.

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	Herbert Schildt, C++: The Complete Reference, McGraw-Hill Osborne Media, 4th Edition, 2017
2	Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson, 7th Edition, 2016
3	Stroustrup B., The C++ Programming Language, Addison Wesley, 4th Edition, 2013
4	Avi Silberschatz, Henry F. Korth, and S. Sudarshan, “Database System Concepts”, 6th edition, McGraw-Hill, 2010.
5	Robert Lafore, Object Oriented Programming in C++, SAMS, 4th Edition, 2002
6	John Hubbard, Schaum's Outline of Programming with C++, McGraw-Hill, 2nd Edition, 2000

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**19B13BT211**	**Semester: ODD**	**Semester:** III **Session: 2020-2021** **Month from:** July to December
Subject Name	**Environmental Studies**		
Credits	**0**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	1. Dr. Krishna Sundari S
	Teacher(s) (Alphabetically)	1. Dr. Krishna Sundari S 2. Manisha Singh 3. Dr. Rachana 4. Ms. Ekta Bhat

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO205.1	Explain diversity of environment, ecosystem resources and conservation.	Understand Level (C2)
CO205.2	Identify hazards related to environmental pollution and safe management practices	Apply Level(C3)
CO205.3	Apply modern techniques for sustainable Urban planning and Disaster management	Apply Level(C3)
CO205.4	Recall Government regulations, Environmental Policies, Laws & ethics	Understand Level (C2)
CO205.5	Survey ground situation on specific environmental aspects, examine risks involved, make a field report and present the findings	Analyzing 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,	Sustainable building, Disaster Management and	8

	human communities, Disaster management	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.	
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**

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

EVALUATION:

Mid Semester Examination - 30 marks (To be held along with T-2 Exam)

End Semester Examination - 40 marks

Teachers Assessment (TA) - 30 marks

Structure of Grading Academic Performance: Mandatory to Pass, grade will be awarded

Course Description

Course Code	15B11MA301	**Semester** Even	**Semester** III **Session** 2020-21 **Month from** Jan - Jun 2021	
Course Name	Probability and Random Processes			
Credits	4	**Contact Hours**	3-1-0	
Faculty (Names)	**Coordinator(s)**			
	Teacher(s) (Alphabetically)			

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

Course Code	15B11EC411	**Semester Odd (specify Odd/Even)**	**Semester** 3rd **Session** 2020 -2021 **Month from** August to December
Course Name	ANALOGUE ELECTRONICS		
Credits	4	**Contact Hours**	6-2-0

Faculty (Names)	**Coordinator(s)**	Dr. Archana Pandey, Dr. Hemant Kumar
	Teacher(s) (Alphabetically)	Dr. Archana Pandey, Dr. Garima Kapur, Dr. Hemant Kumar, Dr. Kirmender Singh, Mr. Shivaji Tyagi, Mr. Varun Goel

COURSE OUTCOMES		**COGNITIVE LEVELS**
C213.1	Classify the different modes of operation of a transistor and stability analysis of a transistor.	Understanding Level (C2)
C213.2	Explain and analyze the various BJT and MOS amplifier circuits for different frequency ranges.	Analyzing Level (C4)
C213.3	List and explain the building blocks of an Op-Amp and its characteristics.	Understanding Level (C2)
C213.4	Explain the effect of feedback on amplifier characteristics and design of various types of oscillators.	Evaluating Level (C5)
C213.5	Apply basic understanding of Op-Amp to design various electronics circuits for specified gain and waveform.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module** **(yellow highlighted part shows the content covered in PBL CO3, CO4, CO5)**	**No. of Lectures for the module**
1.	BJT Amplifier	Single stage (CE, CB, CC), Small-Signal Model, Multistage: CE-CE, Cascode, Darlington-pair and Frequency Response of CE Amplifier	9
2.	Introduction of MOSFET and analysis of MOS amplifier	Introduction of MOSFET, characteristics and basing (voltage and current), small signal models: common source, common gate and common Drain, Frequency Response of CS amplifier	9
3.	Building Blocks of Op-Amp	Basic building block of Op-Amp, Differential amplifiers, Analysis of Differential Amplifiers,Current Mirrors	8
4.	Feedback	Four basic feedback topologies: series-shunt, series-series, shunt-shunt, shunt-series, Introduction and Criterion for oscillations	5
5.	Measurement of Op-Amp Parameters	Output Offset Voltage, Input offset voltage, Input Bias Current, Input Offset current, CMRR, Slew rate, Open loop and closed loop gain, PSRR.	3
6.	Application of Op-Amp	Comparators, Zero Crossing Detector, Peak Detector, Schmitt trigger, Waveform generator (square wave, triangular wave), Instrumentation amplifier.	4

Total number of Lectures	**38**

Evaluation Criteria

Components	**Maximum Marks**
T1	20 (JIIT 128) , Course coverage-Lecture 1 to Lecture 12
T2	20 (JIIT 128), Course coverage-Lecture 13 to Lecture 24
End Semester Examination	35 (JIIT 62)- Whole syllabus
TA	25 (Attendance 10 marks, Assignment 1 (JIIT 128) 10 marks, to be assigned on 18th june, submitted by 26th june Assignment 2/PBL (JIIT 62) 5 marks, to be assigned on 10th july, submitted by 17th july
Total	**100**

Project Based Learning: Students will learn about the building blocks of an Op-Amp and its characteristics, the effect of feedback on amplifier characteristics, design of various types of oscillators, and use of Op-Amp to design various electronics circuits for specified gain and waveform. Students will be given an analytical and simulation based problem/project, which will help them to develop circuit analysis skills and expertise of circuit simulation tools.

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.S .Sedra & K.C.Smith, Microelectronic CIRCUITS Theory and Application, 6th Edition, Oxford University Press, 2011
2.	J.Milman & Halkias : Integrated Electronics, 2nd Edition, Tata McGraw Hill, 1991.
3.	R.A. Gayakwad: Op Amp and Linear Integrated Circuit Technology, 3rd Edition, Prentice-Hall India, 1999.

Course Description

Course Code	15B17EC271	**Semester -:** Odd (specify Odd/Even)	**Semester-:** III, **Session** 2020 -2021 **Month- :** July - December
Course Name	Electrical Science-2 Lab		
Credits	2	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Mr. Ankur Bhardwaj, Dr. Yogesh Kumar, Dr. Abhishek Kashyap
	Teacher(s)	Shamim Akhter, Jasmine Saini, Ruby Beniwal, Nisha Venkatesh, Ankur Bhardwaj, Rachna Singh, Atul Kumar, Alok Joshi, B. Suresh, Kuldeep Baderia, Vinay Tikkiwal, Vishal Narain Saxena, Vimal Mishra, Priyanka Gandhi, Abhay Kumar, Monika, Yogesh Kumar, Abhishek Kashyap

COURSE OUTCOMES		**COGNITIVE LEVELS**
C204.1	Understand Transient analysis and steady state response of series RC circuit.	Understanding (Level II)
C204.2	Acquire the knowledge of circuits like Adder, Subtractor, Integrator, differentiator; inverting and non inverting amplifier circuits realized using Op-amp IC-741.	Analyzing (Level IV)
C204.3	Study and Implementation of the different logic gates.	Remembering (Level I)
C204.4	Construct Adder, Subtractor and Multiplexer circuits using logic gates.	Applying (Level III)

Module No.	**Title of the Module**	**List of Experiments**	**COs**
1.	Study of Transient Analysis in the Network Circuit	Transient analysis of a series RC circuit for a given time constant.	C204.1
2.	Study and Analysis of Parallel Resonance Circuits	Analysis of Parallel Resonance circuits	C204.1
3.	Study and Analysis of Series Resonance Circuits	Analysis of Series Resonance circuits.	C204.1
4.	Study and Analysis of	To realize inverting and non inverting amplifier configuration using Op-Amp IC-	C204.2

	Inverting and Non-inverting by Op-Amp	741.	
5.	Study and Analysis of Adder and Substractor by Op-Amp	To realize adder and substractor circuits using Op-Amp IC-741	C204.2
6.	Study and Analysis of Differentiator and Integrator by Op-Amp	To realize differentiator and integrator circuits using Op-Amp IC-741.	C204.2
7.	Study of Logic Gates and Verification of Boolean Laws	Verification of the truth tables of logic gates using ICs	C204.3
8.	Study and Implement of Basics Logics Gates using Universal Logic Gates	To implement basic logic gates AND, OR, NOT using NAND and NOR gates.	C204.3
9.	Perform the Boolean Expression using Universal Gates	To implement the Boolean expressions using NAND gates only: $(i)X = \overline{A + \bar{B}}$ $(ii)Y = \bar{A}B + C\bar{D}$ $(iii)Z = \overline{(A + \bar{B})(C + \bar{A})}$	C204.3
10.	Design and Implementation of Adders	To realize a Half Adder, Full Adder using logic gates.	C204.4
11.	Design and Implementation of Subtractors	To realize a Half Subtractor , Full Subtractor using logic gates.	C204.4
12.	Design and Implementation of Multiplexer	To realize 4:1 Multiplexer using NAND gates.	C204.4
13.	Study and Implement of Voltage Comparator using Op-Amp	To implement a Voltage Comparator circuit using Op-Amp	C204.2
14.	Study of Square Waveform using Op-Amp	To generate a Square Waveform using Op-Amp	C204.2

15.	Study and Analysis of Filter in Op-Amp	To design a First Order Low Pass Filter	C204.2

Evaluation Criteria

Components	**Maximum Marks**
Viva1	20
Viva2	20
Report file, Attendance, and D2D	60 (15+15+30)
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.	Richard C. Dorf, James A. Svoboda, "Introduction to Electric Circuits," Wiley; 7 Edition, 2006
2.	M. Morris Mano, "Digital Design," 3rd Edition, PHI, 2002
3.	A. A. Kumar, "Fundamentals of Digital Circuits," 3rd Edition, PHI Learning Pvt. Limited, 2014
4.	D. Roy Choudhary and Shail B. Jain, " Linear Integrated Circuit," 2nd Edition, NAILP, 20 03

Detailed Syllabus
Lab-wise Breakup

Course Code	15B17EC471	**Semester : ODD (specify Odd/Even)**	**Semester 3rd** **Session** 2020-21 **Month from** **Aug to Dec**
Course Name	Analogue Electronics Lab		
Credits	1	**Contact Hours**	0-0-2

Faculty (Names)	**Coordinator(s)**	Shivaji Tyagi, Dr. Bharatendu Chaturvedi
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES	DESCRIPTION	COGNITIVE LEVELS
C275.1	Plot the transient, frequency response of second-order RC circuit using SPICE/MULTISIM and utilize the plot to compare 3-dB cut-off frequency with theoretical calculation.	Applying Level (C3)
C275.2	Analyze the bias point and plot frequency response of single-stage amplifiers and they will be able to build an amplifier of given specifications.	Analyzing Level (C4)
C275.3	Build a common-source amplifier for a specified gain using N-channel MOSFET.	Applying Level (C3)
C275.4	Analyze BJT based simple constant current biasing circuit and subsequently improves its specification by using modified current mirror.	Analyzing Level (C4)
C275.5	Determine differential gain, common mode gain and CMRR of BJT based differential amplifier.	Applying Level (C3)
C275.6	Simulate an operational amplifier and use it in different applications.	Analyzing Level (C4)

Module No.	Title of the Module	List of Experiments	CO
1.	Introduction and demonstration of Simulation tool with suitable example	Installation of PSPICE Light version on GPL with operating instructions. Simulate transient and frequency response of first-order RC circuit for input of sine and square waveform.	**C275.1**
2.	Study and Analyzing Biasing Techniques	Use PSPICE to simulate dependence of β_{dc} on collector bias current for discrete BJT transistor (BC547B/ 2N2222A/3904).	**C275.2**
3	Study and Analyzing Biasing Techniques	Use PSPICE to compare the biasing techniques such as voltage divider, collector to base bias and fixed bias for DC "Q- point" stability of a BJT (BC547B/2N2222A/3904) on PSPICE	**C275.2**
4.	Large signal and small signal analysis of CE amplifier	Use PSPICE to determine instantaneous node voltages and branch currents of single stage CE amplifier for triangular input V_i = 1.6V (p-p) using discrete transistor (BC547B/2N2222A/3904). Also determine the maximum amplitude of V_i which is allowed to be used in the amplifier.	**C275.2**
5.	Design of BJT based	Use PSPICE to design a single stage BJT amplifier for given specifications.	**C275.2**

	amplifier		
6.	Frequency Response of Amplifier	Use PSPICE to simulate frequency response of the Common source amplifier using N- channel MOSFET BS170. Determine a) Upper, lower 3-dB frequency b) Bandwidth	**C275.3**
7.	Current Mirror	Use PSPICE to design a basic BJT current mirror using discrete transistor (BC547B/2N2222A/3904) for reference current of 1mA. Determine the output resistance, current gain error.	**C275.4**
8.	Current Mirror	Use PSPICE to design Wilson current mirror of 1mA and determine the output resistance, current gain error.	**C275.4**
9.*	Differential Amplifier	Use PSPICE to simulate the single stage differential amplifier and determine the following: a) Frequency response of differential gain A_d. b) Frequency response of common mode gain $A_{CM.}$ c) Common Mode Rejection Ratio (CMRR).	**C275.5**
10.*	Applications of OP-AMP	Use PSPICE to simulate the closed–loop non inverting amplifier, inverting amplifier, adder, subtractor for given specifications and determine: a) Transient Response b) Its 3-dB bandwidth c) Input resistance R_i	**C275.**6

Evaluation Criteria

Components	**Maximum Marks**
Mid Viva	20
End Viva	20
Day to Day	60
Total	**100**

*** These are advanced level experiments.**

Students are advised to register and download the student version of PSPICE software from the following link: https://www.orcad.com/orcad-academic-program.

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.S .Sedra & K.C.Smith, Microelectronic Circuits Theory and Application, 6th Edition, Oxford University Press, 2015(Text Book)
2.	Marc Thompson, Intuitive Analog Circuit Design, 2nd Edition, Elsevier Publication, 2013

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B11EC214	**Semester** Odd **(specify Odd/Even)**	**Semester IIIrd Session** 2020 -2021 **Month from August to December**
Course Name	Signals and Systems		
Credits	**4**	**Contact Hours**	**3+1**

Faculty (Names)	**Coordinator(s)**	Ajay Kumar, PriyankaKwatra
	Teacher(s) (Alphabetically)	Ajay Kumar, JyotiVyas,PriyankaKwatra,SajaiVir Singh, SaurabhChaturvedi,

COURSE OUTCOMES		**COGNITIVE LEVELS**
C210.1	Understand the mathematical representation, classification, applications and analyze both continuous and discrete time signals and systems.	Understanding (Level II)
C210.2	Analyze and interpret the response of continuous and discrete time LTI system in time domain	Evaluating (Level V)
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 V)
C210.4	Apply Laplace and Z transform to analyze and examine the response and behavior of the CT and DT system.	Analyzing (Level IV)

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.	System 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 function, Laplace approach to analysis the LTI system, stability analysis	7
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.	TarunRawat, Signals and Systems, Oxford University Press , 2010
7.	J. G. Proakis& D. G. Manolakis, Digital Signal Processing, Principles, Algorithmsand Applications, Fourth edition, PHI, 2007.

Detailed Syllabus Signals and Systems Lab (18B15EC214)
Lab-wise Breakup

Course Code	(18B15EC214)	**Semester** Odd **(specify Odd/Even)**	**Semester-:**III, **Session** 2020 -2021 **Month- :** January-May
Course Name	Signal and Systems Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	**Kuldeep Baderia, Rahul Kaushik**
	Teacher(s) (Alphabetically)	**Jyoti Vyas, Kuldeep Baderia, Madhu Jain, Rahul Kaushik**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C270.1	Understanding of MATLAB and its various applications, Classification of continuous time signals and discrete time signals.	Understanding (Level II)
C270.2	Apply the coding skills of MATLAB for Convolution of continuous time signals and discrete time signals, for DFT and IDFT.	Applying (Level III)
C270.3	Analyze different LTI systems with Frequency domain representation of continuous time and discrete time periodic and aperiodic signals.	Analyzing (Level IV)
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 V)

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 sum 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
Assessment Components 20	
Attendance	15
Lab Record	15
Virtual Lab Exps.	10
Total	**100**

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

#Due to Pandemic situation of COVID-19, All the MATLAB programs will be performed using open source SCILAB and OCTAVE, due to unavailability of licensed MATLAB software to the students.

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

Course Code	15B11EC211	**Semester** Odd **(specify Odd/Even)**	**Semester** 3rd **Session** 2020 -2021 **Month from** August to December
Course Name	Electrical Science-2		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr.SatyendraKumar, Dr.Kirmender Singh
	Teacher(s) (Alphabetically)	Dr.Akanksha Bansal, Mr.Ankur Bhardwaj, Dr.Archana Pandey, Dr.AtulKumar,Dr.BhagirathSahu,Dr.BhartenduChaturvedi,Mr.Chandan Singh,Mr.Deepak Kumar, Dr.GarimaKapur, Dr.Hemant Kumar,Dr.Jitendra Mohan, Dr.Kaushal Nigam, Ms. MadhuJharia, Mr.MandeepNarula, Mr.Nitesh Kumar, Dr.Pankaj Kumar Yadav, Mr. Prabhakar, Dr.Rachna Singh, Mr.RahulKumar,Dr.RubiBeniwal, Mr.ShivajiTyagi, Ms.ShradhaSaxena, Dr.Vimal Kumar Mishra, Mr.Vimal Saini, Dr.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.	Analysing 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**

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",9th ed, John Wiley & Sons, 2013.
2.	Charles K. Alexander,Matthew N.O. Sadiku,"FundamentalsofElectricCircuits", 6th Edition,Tata McGrawHill,2019.
3.	AbhijitChakrabarti,CircuitTheoryAnalysisand Synthesis,7th ed,DhanpatRai&Co.2018.
4.	RobertL.Boylestad,LouisNashelsky, "Electronic DevicesandCircuitTheory",11th ed,PrenticeHall of India, 2014.
5.	JacobMillman,Millman'sElectronicDevicesandCircuits (SIE),4thed,McGrawHillEducation,2015.

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11HS211	**Semester : ODD (specify Odd/Even)**	**Semester** : III **Session 2020-21** Month from:Aug-December
Course Name	Economics		
Credits	03	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	ManasRanjanBehera, Dr.AnshuBanwari
	Teacher(s) (Alphabetically)	Dr.Akarsh Arora, Dr.Amandeep Kaur, Dr.AnsuBanwari, Dr. KanupriyaMisraBakhru,ManasRanjanBehera, Dr. Mukta Mani Dr.SakshiVarshney, Dr.ShirinAlavi

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

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.	3
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	6
5.	Production theory and analysis	Production function. Isoquants, Isocostlines, Optimal combination of inputs. Stages of production, Law of returns, Return to scale.	3
6.	Cost Theory and Analysis	Nature and types of cost. Cost functions- short run and long run Economies and diseconomies of scale	3
7.	Market Structure	Market structure and degree of competition	5

		Perfect competition, Monopoly, Monopolistic competition, Oligopoly	
8	National Income Accounting	Overview of Macroeconomics, Basic concepts of National Income Accounting,	3
9	Macro Economics Issues	Introduction to Business Cycle, Inflation-causes, consequences and remedies: Monetary and Fiscal policy.	3
		Total number of Lectures	30

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project+ClassTest+Attendance and Discipline)
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.	H.C. Petersen, W.C. Lewis, *Managerial Economics*, 4th ed., Pearson Education 2001.
2.	D. Salvatore, Managerial Economics in a Global Economy, 8th ed., Thomson Asia, 2015.
3.	S. Damodaran, Managerial Economics, 2nd ed., Oxford University Press, 2010.
4.	M. Hirschey, Managerial Economics, 15th ed., Thomson Asia, 2019.
5.	P.A. Samuelson, W.D. Nordhaus, Economics, 19th ed., Tata Mc-Graw Hill, 2010.
6.	S.K. Misra& V. K. Puri, Indian Economy, 37th ed., Himalaya Publishing House, 2019.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**15B1NHS433**	**Semester** EVEN **(specify Odd/Even)**	**Semester** IV **Session** 2020 -2021 MonthJan2021- June2021
Course Name	**INTRODUCTION TO SOCIOLOGY**		
Credits	**3(2-1-0)**	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Prof Alka Sharma
	Teacher(s) (Alphabetically)	Prof Alka Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C206-7.1	Demonstrate an understanding of sociological perspectives and concepts.	Remembering (C1)
C206-7.2	Explain the concept of social stratification and types of stratification as class, caste and gender.	Understanding (C2)
C206-7.3	Apply the major sociological perspectives, social concepts and methods in the systematic study of society	Applying(C3)
C206-7.4	Analyze the relevance of various social Institutionsand how it shapes and influences social interactions.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Emergence of Sociology- forces and historical background, nature and scope, relationship with other social sciences, difference between common sense and sociology, Major sociological perspective and methods, the sociological imagination	5
2.	Basic Concepts of Sociology	Society, Culture, Groups, sub-groups, Communities, Association, Organization, social interaction and social structure: status and role	4
3.	Social stratification	Stratification-concept, theories and type. Basis of stratification caste, class, gender and race, status and Roles	4
4.	Sociology of Institutions	Kinship, Family ,Religion, Education &Economy in Society	5
5.	Process of Change and Mobility	Concept, theories and Agents of Social Change, Process of Social Change in Indian Society: Sanskritization, Westernization, Modernization, Urbanization	6
6.	Politics and Society	Power, Elite, Bureaucracy, Pressure groups, Political parties, nation, state and civil society, protest, agitation and Social Movements	4
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20 (Project based)
End Semester Examination	35
TA	25 (Presentation, assignment, quiz and tutorial participation)
Total	**100**

Each student will be assigned a project based on primary data collection through in-depth interviews with their parents, grandparents and other relatives

Topic of the project- the students will conduct a multidimensional analysis of their class with the Occupation, Education, Income, and Wealth variable, using their parents, grandparents, and themselves as examples to find out how do these variables relate to Social Class and social mobility? How has the Social Class of their family changed (or not) over the past three generations?

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	Johnson, Harry M. *Sociology: a systematic introduction*. Routledge, 2013.
2	Rawat, H. K. *Sociology: basic concepts*. Rawat Publications, 2007.
3	Macionis, John J. *Society: the basics*. Pearson/Prentice Hall, 2009.
4	C. Wright. And Mills, *The Sociological Imagination*, Oxford: Oxford University Press, 1959.
5	Peter L Berger, *The Social Construction of Reality: a Treatise in the Sociology of Knowledge. Garden City,* New York: Anchor, 1966.
6	Conley and Dalton, *You May Ask Yourself: An Introduction to Thinking Like a Sociologist*, 2nd Ed, W. W. Norton & Company New York, 2011. ISBN: 0393935175 or 978-0393935172
7	Ballentine and Roberts, *Our Social World: Introduction to Sociology*, 4th Edition, Sage. 2013.
8	Robert Parkinand Linda Stone, (ed.). *Kinship and Family: An Anthropological Reader*, U.S.A.: Blackwell, 2000, selected chapters

Detailed Syllabus
Lecture-wise Breakup

Course Code	**15B1NHS435**	**Semester: Even**	**Semester** IV **Session:**2020-21 **Month from: Jan-June**
Course Name	Financial Accounting		
Credits	3	**Contact Hours**	3 (2,1,0)

Faculty (Names)	**Coordinator(s)**	Dr. Mukta Mani (Sec-62), Dr. Sakshi Varshney (Sec-128)
	Teacher(s) (Alphabetically)	Dr. Mukta Mani, Dr. Sakshi Varshney

COURSE OUTCOMES		**COGNITIVE LEVELS**
C206-8.1	Understand the basic concepts of Accounting.	Understanding level (C2)
C206-8.2	Apply accounting concepts for recording of business transactions.	Applying level (C3)
C206-8.3	Compare and reconcile the accounting records with other sources of information	Analyzing level (C4)
C206-8.4	Evaluate the accounting records to identify and rectify the errors made during accounting process.	Evaluating level (C5)
C206-8.5	Construct the final accounts and cash flow statement of a business	Creating (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Accounting	Meaning of Accounting, Objectives of Accounting, Understanding Company Management, Stakeholders versus Shareholders, Financial Reporting Standards, Financial Reporting	2
2.	Understanding Accounting Elements	Elements of Financial Statements- Assets, Current assets, Liabilities, Current liabilities, Equity, Income, Expenses, Accounting Equation	2
3.	Accounting Concepts	Business entity concept, Money measurement concept, Going concern, Consistency, Matching concept, Cost concept, Dual aspect concept, Materiality,Full disclosure,Generally Accepted Accounting Principles (GAAP)	2
4.	Journal Transactions	Journal, Rules of Debit and Credit, Compound Journal entry, Opening entry	2
5.	Ledger Posting and Trial Balance	Ledger, Posting, relationship between Journal and Ledger, Rules regarding Posting, Trial balance	3
6.	Rectification of Errors	Different types of errors, their effect on trial balance, rectification and preparation of suspense account	5

7.	Bank Reconciliation Statement	Meaning of Bank Reconciliation Statement, technique of preparing BRS, Causes of difference	2
8.	Final Accounts	Trading account, Profit and Loss account, Balance sheet, Adjustment entries	6
9.	Cash Flow Statement	Introduction of Cash Flow Statement,Classification of Cash inflows and Cash Outflows Activities,prepare the statement of cash flows using direct and Indirect method	4
		Total number of Lectures	**28**

Evaluation Criteria

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

Project Based learning: Students form a group of 4-5 students. Each group is required to choose a company listed in Indian stock exchange and download its latest annual report. Students are required to describe the company,composition of board of directors, number of company's executives,independent directors,background of independent directors. They are required to find outfinancing, investing and operating activities and examines the change in total assets, sales and net profit of the company. As per auditor's report, company's position and future plans for growth of the company is also analyzed.

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.	Maheshwari S. N., Financial and Management Accounting, 5th Ed., S. Chand & Sons Publication, 2014. ISBN No.: 978-81-8054-529-0
2.	Ghosh, T.P., Financial Accounting for Managers, 4th Ed., Taxmann Publications, 2009
3.	Tulsian,P., Financial Accounting,1st Ed., Pearson Education India,2002
4.	Bhattacharya, A., Financial Accounting for Business Managers, 4th Ed., Prentice Hall of India,2012
5.	Weygandt.J., Kimmel, P., Kieso,D., Accounting Principles, 12th Edition, John Wiley & Sons,2015
6.	Barton,M., Bhutta, P.,S. O'Rourke,J.,Satyam Computer Services Ltd: Accounting fraud in India,London,SAGE Publications Ltd, 2017,

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**15B11HS111**	**Semester: EVEN**	**Semester IV Session 2020-2021 Month from Jan to June**
Subject Name	**LIFE SKILLS**		
Credits	**2**	**Contact Hours**	**2 (1 1 0)**
Faculty (Names)	**Coordinator(s)**	Dr. Praveen Sharma & Dr. Deepak Verma	
	Teacher(s) (Alphabetically)	Dr.Akarsh Arora,Dr. Amandeep Kaur, Dr. Badri Bajaj, Dr. Kanupriya Bakhru, Dr Praveen Sharma, Dr. Anshu Banwari, Dr. Deepak Verma, Dr. Ekta Shrivastava, Dr. Nilu Choudhary	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C209.1	Understand Life Skill required to manage self and one's environment	Understand (C2)
C209.2	Apply comprehensive set of skills for life success for self and others	Apply (C3)
C209.3	Analyze group dynamics for its effective functioning	Analysing (C4)
C209.4	Evaluate the role of women leadership and gender issues	Evaluate (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Introduction to Life Skills; basic Concepts and Relevance for Engineers	1
2.	Individual-1	Emotional Intelligence, Stress Management, Goal Setting	4
3.	Individual-II	Dimensions of Personality, Values and Attitudes, Assertiveness, Well being,	3
4.	Group Dynamics	Group, Group types, Group Relationship, Social Loafing, Social Facilitation	3
5.	Women Leadership	Gender Sensitization, Women Leadership.	3
Total number of Hours			14

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment & Project)
Total	**100**

Project Based Learning: Students are supposed to form a group (Maximum 5 students in each group) and identify a Women leader of their choice. They are supposed to do the in-depth study on the leadership style of their identified leader and explain it. They are also supposed to explain identified women leader's personality traits by referring the Big five personality traits model. The project provides understanding to students on Women leadership and personality traits.

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.	Stephen P. Robbins, Organizational Behaviour, 9th Edition, Prentice-Hall India 2001
2.	Smith, E., Hoeksema, S., Fredrickson, B., & Loftus, G. Introduction to Psychology. Thompsons and Wadsworth Co, 2003
3.	Daniel Goleman, Working With Emotional Intelligence, Bantom Books 1998
4.	Sue Bishop, Assertiveness Skills Training, Viva Books, New Delhi, 2004
5.	Adele B. Lynn 50 Activities for Developing Emotional Intelligence, Ane Books, 2003
6.	Sivasailam Thiagarajan, Glenn M. Parker; Teamwork and Teamplay, Games and Activities for Building and Training Teams., Jossey-Bass, 1999
7.	Kaul A.& Singh M., *"New Paradigms for Gender Inclusivity*", PHI Pvt Ltd 2012

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11EC413	**Semester** Even	**Semester** IV **Session** 2020 –2021 **Month from** Jan to June
Course Name	DIGITAL SIGNAL PROCESSING		
Credits	4	**Contact Hours**	**4**

Faculty (Names)	**Coordinator(s)**	Madhu Jain, Hemant Kumar
	Teacher(s) (Alphabetically)	Parul Arora, Smriti Bhatnagar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C215.1	Recall the principles of z-transforms, explain the DFTs (Discrete Fourier Transform) and develop FFT (Fast Fourier Transform) algorithms for DFT.	Applying (C3)
C215.2	Construct and Analyze the digital FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) filters.	Analyzing (C4)
C215.3	Demonstrate multi-rate signal processing and relate DSP (Digital Signal Processing) in various applications.	Understanding (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Review of Discrete time Signals and Systems**	Review of discrete–time sequences and systems, discrete time system analysis using Z transform.	**3**
2.	**Discrete Fourier Transform and FFT**	Discrete Fourier Transform (DFT) and its properties, Linear filtering methods based on DFT, Frequency analysis of signals using the DFT, Fast Fourier Transform (FFT) algorithms using decimation in time and decimation in frequency techniques.	11
3.	**FIR Filter design**	Basic structures of digital filters; Significance of Linear phase response, FIR filters design - Frequency sampling and Windowing techniques, Computer aided design.	8
4.	**IIR Filter design**	Approximation of filter functions: Butterworth, Chebyshev, Elliptic; IIR filter design based on analog filter functions- Impulse Invariant and modified invariant response techniques, Bilinear transformation method.	10
5.	**Multi-rate Digital Signal Processing**	Decimation & Interpolation, Filter design with sampling rate conversion by a rational factor I/D	5
6.	**DSP Applications**	Applications in speech and image processing, and power	7

		spectrum estimation.	
		Total number of Lectures	44

Evaluation Criteria

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

Project based learning: Students will learn different techniques used for the generation, transformation, extraction and interpretation of information via discrete signals which is essential for smart phones, home appliances, healthcare devices, cameras and in general for many digital systems. Student shall be given various practical situation based design exercises to be implemented in MATLAB or OCTAVE. This would enable them to recall and apply various techniques and algorithms taught in course to design and analyse the required system that meets the given technical specification.

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.	L. Tan and Jean Jiang , Digital Signal Processing Fundamentals and Applications, Third Edition, Academic Press, 2013
2.	J. G. Proakis & D. G. Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, Fourth edition, PHI, 2007.
3.	S. K. Mitra, Digital Signal Processing: A Computer Based Approach, Fourth Edition, McGraw Hill, 2013.
4.	L. R. Rabiner, B. Gold, Theory and application of digital signal processing, Third Edition, PHI, 2012
5.	A. Antoniou, Digital Signal Processing: Signals, Systems, and Filters, TMH, 2006

Detailed Syllabus
Lab-wise Breakup

Course Code	**15B17EC473**	**Semester Even**	**Semester** IV **Session** 2020 -2021 **Month from** Jan – Jun
Course Name	**Digital Signal Processing (DSP) Laboratory**		
Credits	1	**Contact Hours**	0-0-2

Faculty (Names)	**Coordinator(s)**	Dr. Bajrang Bansal, Dr. Madhu Jain
	Teacher(s) (Alphabetically)	Dr. Bajrang Bansal, Dr. Kuldeep Baderia, Dr. Sajai Vir Singh, Dr. Madhu Jain, Dr. Vineet Khandelwal, Dr. Abhinav Gupta, Dr. Rahul Kaushik, Mr. Ritesh Sharma, Ms. Smriti Bhatnagar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C277.1	Recall and interpret discrete time signals and systems in time domain and in frequency domain	Understanding Level (C2)
C277.2	Develop and demonstrate coding skills from basic mathematical operations to complex operations like DFT and FFT.	Applying Level (C3)
C277.3	Identify and examine different digital filter structures.	Analyzing Level (C4)
C277.4	Determine and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters and digital FIR filters using window techniques for various applications of DSP.	Evaluating Level (C5)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to MATLAB	Introduction to the MATLAB and its features.	C277.1
2.	Introduction to applications of MATLAB	Introduction to the different applications of MATLAB.	C277.1
3.	Discrete-Time Signals	Generation of discrete time signals with different operation on independent and dependent variable.	C277.1
4.	LTI Systems	Write your own MATLAB function to implement linear convolution as an operation to analyze discrete time LTI system.	C277.1
5.	Z-transform	Compute z- transform and inverse z-transform of a discrete time signals and systems. Plot pole-zero map of the same using symbolic tool box.	C277.1
6.	Discrete Fourier Transform (DFT)	Write your own MATLAB function to compute DFT (Discrete Fourier Transform) and IDFT (Inverse Discrete Fourier Transform) for the spectral analysis of signals.	C277.2
7.	Spectral Analysis	To determine magnitude and power spectrum of given signal.	C277.2
8.	Circular Convolution	Write your own MATLAB function 'mycirconv' to compute circular convolution of two sequences.	C277.2

9.	FFT	Develop radix-2 butterfly FFT (Decimation in Time) algorithm for the computation of N-point dft.	C277.2
10.	FIR Filter	Write MATLAB program to design digital FIR filter employing windowing technique.	C277.4
11.	IIR Filter	Write MATLAB program to design IIR digital filter for a given specification using bilinear transformation and impulse invariant method.	C277.4
12.	IIR Structures	Write MATLAB program for realization of digital IIR filter using direct form-I & II, cascade and parallel method.	C277.3
13.	DFT Properties	Virtual Lab: Study of Transform domain properties and its use.	C277.2
14.	FIR Filter Study	Virtual Lab: Study of FIR filter design using window method.	C277.4
15.	IIR Filter Study	Virtual Lab: Study of Infinite Impulse Response (IIR) filter.	C277.4

Evaluation Criteria

Components	**Maximum Marks**
V1	20
V2	20
AC	25
Attendance	15
Report	15
Virtual Lab Exp	5
Total	**100**

Project based learning: Students will design Digital filters (FIR and IIR) for the given design specifications using MATLAB programming as well Filter Design Analysis tool. Additionally, students in group sizes of two-three will realize various applications of DSP employing digital filters.

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.	Sanjit K. Mitra, Digital Signal Processing: With DSP Laboratory Using MATLAB: A Computer-Based Approach*, 4th Edition, TMH,* 2013.
2.	Vinay K. Ingle, John G. Proakis, Digital Signal Processing Using MATLAB, *3rd Edition, Cengage Learning,* 2012.

Detailed Syllabii
Lecture-wise Breakup

Subject Code	18B11EC212	**Semester** **EVEN**	**Semester 4th Session** 2020-21 **Month from Jan to June**
Subject Name	ANALOG AND DIGITAL COMMUNICATION		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	ReemaBudhiraja, , Yogesh Kumar
	Teacher(s) (Alphabetically)	Bhawna Gupta, Raghvendra Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C211.1	Understand need of modulation and differentiate among various amplitude modulation schemes and design simple systems for generating and demodulating amplitude modulated signals.	ApplyingLevel (C1)
C211.2	Analyze the generation and detection of FM signal and design basic systems for the indirect and direct generation of FM signals.	Analyzing Level (C4)
C211.3	Understand the concepts of transmitters and receivers for analog modulations, Sampling process, time division multiplexing and GSOP.	Understanding Level (C2)
C211.4	Understand the concepts of waveform coding techniques, Line coding schemes and analysis of ISI Mitigation Techniques	Analyzing Level (C4)
C211.5	Understand the concepts of digital modulation techniques and evaluate their probability of error and bandwidth efficiency.	Evaluating Level (C5)

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
1.	Introduction	Elements of a communication system;Analog and digital signals, bandlimited signals and systems, bandwidth	2
2.	Amplitude modulation	Introduction to modulation; AMSC,DSB, SSB, VSB Communication. Detection of AM signals: Coherent detection, Envelope detection,Costas receiver.	7
3.	Angle modulation	Concepts of FM and PM,Narrowband and wideband FM, Direct and indirect methods of FM generation, Detection of FM signals	6
4.	Transmitters , Receivers and Multiplexing Techniques	AM and FM Transmitters, Superheterodyne AM and FM Receivers. FDM,TDM, Interchannel crosstalk and bandwidth effects	3
5.	Sampling and Quantization techniques	Time and frequency domain sampling with aperture effects, Reconstruction of signals, Quantization process and mean square quantization error, GSOP.	5

6.	Speech Coding ,Line Coding and Baseband Digital Transmission	Pulse Code modulation,Line Codes: Unipolar-NRZ, polar-NRZ, Unipolar-RZ, Bipolar-RZ, Manchester Code, DPCM, DM, Bit rate and bandwidth of digital signals, ISI Mitigation Techniques	11
7.	Digital Modulation Techniques	ASK, FSK ,PSK, QPSK Modulation, 16-QAM, Demodulation, Constellation diagrams, BER and their BW calculation,	9
		Total number of Lectures	43

Evaluation Criteria

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

Project based learning: Here, students will learn the process of analog and digital modulation schemes as it is of the utmost importance to understand the process of communication system and to design the same. Student will be able to design the communicationsystem as per requirements and some simulation on Matlab can also be performed to analyze the same . Understating of these techniques will further help to work in any communication based industry.

Recommended Reading(Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)	
1.	LathiB.P, Modern Digital and Analog CommunicationSystems, 5th /ed ,Oxford University Press,2018
2.	H. Taub, D. L. Schilling and GautamSaha, Principles of Communication Systems, 4th/ed,TMH, 2017
3.	S.Haykin, Digital Communication Systems,John Wiley & Sons, 2013

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18B11EC215	**Semester** Even	**Semester** IV **Session** 2020-21 **Month from** January **to** June
Subject Name	Digital Circuit Design		
Credits	4	**Contact Hours**	3-1-0

Faculty Members	**Coordinator(s)**	Bhartendu Chaturvedi, Jasmine Saini
	Teacher(s)	Akansha Bansal, Jitendra Mohan

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. Study and Implement combinational and sequential circuits using VHDL.	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 .	9
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.	3
6	Programmable logic devices	RAMs- DRAM, SRAM and ROM. PLDs: PLAs, PALs and PROMs.	3
7	Wave shaping circuits	Linear wave shaping circuits, Schmitt trigger, Square wave generator, IC-555 based multivibrators.	2
8	Introduction to digital logic families	Parameters of logic families, Types- DTL, RTL, TTL, CMOS.	3
9	Introduction to VHDL	Basic language elements, Different modeling styles: Dataflow, structural and behavioral.	3
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. In addition to understand digital era, this course also delivers VHDL based basic learning methods that bring knowledge to drive state of art projects.

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.	J. Bhasker, "A VHDL Primer," 3rd ed., Pearson Education, 2015.
4.	R. P. Jain, "Modern Digital Electronics," 4th Edition, Tata McGraw-Hill Education, 2009.
5.	A. Anand Kumar, "Fundamentals of Digital Circuits," PHI; 4th Revised edition, 2016.

ADC LAB PROPOSAL FOR SPECIAL SEM 2021

Course Code	18B15EC212	**Semester (special sem)**	**Semester IV Session2020-2021** Month from**Jan** to **June**
Course Name	***Analog and Digital Communication Lab***		
Credits	**1**	**Contact Hours**	2 Hrs per week

Faculty (Names)	**Coordinator(s)**	Bhawna Gupta, Atul Kumar	
	Faculty involved in deciding mode of conduction	Ashish Goel, Neetu Joshi, Reema Budhiraja, Richa Gupta, Bajrang Bansal, Kapil Dev Tyagi	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Analyse and construct various analogue modulation/ demodulation techniques	Analyzing (Level IV)
CO2	Understand the concepts of sampling process and time division multiplexing.	Applying (Level III)
CO3	Analyze and verify various digital modulation techniques.	Analyzing (Level IV)
CO4	Utilize Scilab/Octave to implement and understand the concept of Pulse code modulation and Delta modulation.	Analyzing (Level IV)

Module No.	**List of Experiments**	**COs**
1.	Study and simulation of amplitude modulation with full carrier for all three cases of modulation indices.	CO1
2.	Study and simulation of double side band suppressed carrier (DSB SC) modulation.	CO1
3.	Study and simulation of frequency modulation schemes NBFM and WBFM.	CO1
4.	Study and simulation of Sampling and signal reconstruction.	CO2
5.	Study and simulation of time division multiplexing (TDM).	CO2
6.	Study and simulation of binary amplitude shift keying (BASK) modulation scheme.	CO3
7.	Study and simulation of the binary phase shift keying (BPSK) modulation scheme.	CO3
8.	Study and Simulation of binary frequency shift keying (BFSK) modulation scheme.	CO3
9.	Study and simulation of generation and demodulation of pulse code modulation	CO4

	(PCM).	
10.	Study and simulation of generation of delta modulation.	CO4

Evaluation CriteriaComponents Maximum Marks Viva 1(Mid Sem Viva) 20 Viva 2(End Sem Viva) 20 Day to day 60 **Total 100**	**Day to day breakup** Assessment Components 45 Attendance 15 **Total 60**	**Assessment Components** AC 1- Lab record AC 2- Day to day work AC 3- Teacher Assessment AC 4- Execution of experiment	

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.	LATHI,B.P, Modern Digital and Analog Communication Systems, Oxford University Press,3rd edition,2005.
2.	S.Haykin, Communication Systems, John Wiley & Sons, Intl. Ed, 2004.
3.	**Online platform: GNU Octave or SciLab**
4.	**Octave tutorials:**https://www.youtube.com/watch?v=8gczfvuwnf8 https://www.youtube.com/watch?v=mvvmJLmfwNw **Scilab tutorials:**https://youtu.be/AzElVPaS71U Scilab software download: https://www.scilab.org/download/6.1.0
5	**Supporting links:** **sampling and reconstruction: https://youtu.be/sC1cLeme6fU**

Detailed Syllabus
Lab-wise Breakup

Course Code	18B15EC215	**Semester:** Even **(specify Odd/Even)**	**Semester:** 4th **Session** 2020-21 **Month from:** January to June
Course Name	Digital Circuit Design Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Dr. Jitendra Mohan, Dr. Richa Gupta
	Teacher(s) (Alphabetically)	Dr. Abhishek Kashyap, Dr. Ashish Goel, Dr. Bajrang Bansal, Dr. Bhartendu Chaturvedi, Dr. Vimal Kumar Mishra, Mr. B.suresh, Ms. Bhawna Gupta

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	Utilize VHDL to implement and simulate the combinational and sequential logic circuits.	Applying Level (C3)

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%.	C271.3
14.*	Combinational and Sequential Logic Circuits using VHDL	(a) Write the VHDL program for the following logic circuits: Half Adder, Full Adder, 2X1 Multiplexers, 2:4 Decoder. (b) Write VHDL program for D, JK, T and RS flip flops.	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 and hardware description language. Students' opinions have been obtained by means of course exit survey at the end of the course.

*** These are advanced level experiments.**

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.	J. Bhasker, A VHDL Primer, 3rd ed., Pearson Education, 2015.
4.	R. P. Jain, "Modern Digital Electronics," 4th Edition, Tata McGraw-Hill Education, 2009.
5.	A. Anand Kumar, "Fundamentals of Digital Circuits," PHI; 4th Revised edition, 2016.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**15B1NHS431**	**Semester : EVEN**	**Semester IV Session** 2020-2021 **Month: January 2021 to June 2021**
Course Name	**Introduction to Literature**		
Credits	**3**	**Contact Hours**	**3 (2-1-0)**

Faculty (Names)	**Coordinator(s)**	Dr. Monali Bhattacharya (Sector 62) & Dr. Ekta Srivastava (Sector 128)
	Teacher(s) (Alphabetically)	Dr. Ekta Srivastava , Dr. Monali Bhattacharya

COURSE OUTCOMES		**COGNITIVE LEVELS**
C206-5.1	Understand figurative language to demonstrate communication skills individually and in a group.	CL-2 Understanding
C206-5.2	Develop a critical appreciation of life and society through a close reading of select texts.	CL-3 Applying
C206-5.3	Analyse a literary text thematically and stylistically and examine it as representing different spectrum of life, human behavior and moral consciousness of society.	CL-4 Analysing
C206-5.4	To interpret Literature as reflection of cultural and moral values of life and society.	CL-5 Evaluating

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Literature & Genres	Introduction Literary Genres Literary Devices Learning Communication Skills through Literature	5
2.	Poems	On His Blindness: John Milton My Last Duchess: Robert Browning "Hope" is the thing with feathers: Emily Dickinson A Prayer before Birth: Louis MacNeice Goodbye Party for Miss Pushpa T.S.: Nissim Ezekiel	6
3.	Prose & Short Stories	The Spectator Club: Richard Steele Evidence: Isaac Asimov Toba Tek Singh: Saadat Hasan Manto	6
4.	Plays & Drama	Andher Nagari Chaupat Raja: Bhartendu Harishchandra The Characters of Macbeth & Lady Macbeth as Universal Characters. Arms & The Man: G B Shaw	7
5.	Novel	To Sir With Love: E.R. Braithwaite	4

Total number of Lectures	28

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Project, Class participation)
Total	**100**

Recommended Reading material:

1	M.H. Abrams, *'A Glossary of Literary Terms'*, 7th Edition, Hienle & Hienle: Thomson Learning, USA, 1999
2	Mark William Roche, *'Why Literature matters in the 21st Century'*, First Edition, Yale University Press, 2004.
3	E.R. Braithwaite, *'To Sir With Live'*, First Edition, Bodley Head, UK, 1959. Susie Thomas(Ed), "E. R. Braithwaite: 'To Sir, with Love' – 1959", Available at http://www.londonfictions.com
4	Khalid Hasan (Translator), *'Saadat Hasan Maanto : Toba Tek Singh'* Reprint, Penguin Books, India, 2008.
5	G.B Shaw, 'Arms & The Man', Paperback, 2013 https://onemorelibrary.com/index.php/en/?option=com_djclassifieds&format=raw&view=download&task=download&fid=10428
6	Anon, (n.d.). *The Spectator Club. Sir Richard Steele. 1909-14. English....* [online] Available at: http://www.bartleby.com/27/7.html [Accessed 2018].
7	*All poems online: http://www.poetryfoundation .org*
8	Wolfgang Clemen, '*Shakespeare's Soliloquies'*, First Edition, Routledge, London, 1987.

Detailed Syllabus
Lecture-wise Breakup

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Course Code	**16B1NHS433**	**Semester: Odd**	**Semester:** 5th Sem **Session** 2020-2021 **Month from August to Dec 2020**
Course Name	Financial Management		
Credits	3	**Contact Hours**	3 (3-0-0)

Faculty (Names)	**Coordinator(s)**	Dr. Mukta Mani (Sec-62) Dr. SakshiVarshney (Sec-128)
	Teacher(s) (Alphabetically)	Dr. Mukta Mani (Sec-62) Dr. SakshiVarshney (Sec-128) Dr. ShirinAlavi (Sec-62)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C303-3.1	Analyze the time value of money in taking investment decisions.	Analyze (Level 4)
C303-3.2	Contrast the various forms of business organizations and evaluate their financialperformance.	Evaluate (Level5)
C303-3.3	Evaluate investment projects using capital budgeting techniques	Evaluate (Level5)
C303-3.4	Apply the concept of cost of capital into evaluation of investment projects	Apply (Level 3)
C303-3.5	Evaluate the leverage capacity of a business and its application in selection of long term sources of finance.	Evaluate (Level5)
C303-3.6	Understand the practical considerations for managing working capital requirement in a firm.	Understand (Level 2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Basic financial concepts-Meaning of Accounting, Accounting Concepts and Conventions, Introduction to Double Entry system and Accounting equation, Definitionand Objectives of Financial management, Finance functions and Role of Finance manager	4
2.	Time value of Money	Compounding, Discounting, Annuity, Perpetuity, Loan Amortization	6
3.	Analysis of Financial Statements	Understanding of Balance Sheet and Income Statements, Ratio Analysis, Interpretation, Importance and limitations	7

4.	Capital Budgeting: Principle Techniques	Nature of Capital Budgeting, Evaluation Techniques: Discounting (NPV, IRR etc.) and Non-discounting Techniques (payback, ARR etc)	5
5.	Long Term Sources of Finance	Definition, types, advantages and disadvantages	3
6.	Concept and measurement of cost of capital	Definition, measurement of specific costs, computation of Overall Cost of Capital,	4
7.	Cash Flows for Capital Budgeting	Identification and determination of relevant cash flows	5
8.	Leverages and Capital structure decision and Working Capital Management	Break Even Analysis, Operating, Financial and combined leverage, Capital structure EBIT- EPS analysis, Concept ofworkingcapitalmanagement,PracticalConsiderations in Working capital management	5
9.	Project presentations		3
		Total	42

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Term	35
TA	25 (Project, Class Participation)
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.	Khan, M.Y. and Jain, P.K., *Financial Management: Text, Problems and Cases*, 5th ed, Tata McGraw Hill, 2007.
2.	Chandra, P., *Financial Management Theory and Practice*, 6th ed., Tata McGraw Hill, 2004.
3.	Pandey, I.M., *Financial management*, 9th ed, Vikas Publishing House Pvt Ltd, 2006
4.	Van Horne, J.C. and Wachowicz, J.M., *Fundamentals of Financial Management*, 11th ed, Pearson Education, 2001
5.	Kishore, R.M., *Financial Management*, 6th ed, Taxmann, 2007.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	16B1NHS434	**Semester : ODD**	**Semester V Session 2020-21** **July - December**
Subject Name	**Introduction to Contemporary Forms of Literature**		
Credits	**3**	**Contact Hours**	**3 (3-0-0)**

Faculty (Names)	**Coordinator(s)**	**Dr. Monali Bhattacharya (Sector 62)**
	Teacher(s) (Alphabetically)	**Dr. Monali Bhattacharya**

Course Outcomes:

	Course Outcome	**COGNITIVE LEVELS**
C303-6.1	Interpret & relate with the genres, periods, and conventional as well as experimental forms of literature as current ethical, technological and cultural reflections of society.	CL-2 Understand
C303-6.2	Apply literary and linguistic theories on the texts to identify them as cultural constructs inculcating human values in the society.	CL-3 Apply
C303-6.3	Analyze social, cultural, moral and linguistic changes in contemporary world through cloze study of select representative texts of different cultures thematically and stylistically.	CL-4 Analyse
C303-6.4	Determine the reciprocal relationship between the individual and culture individually and/or through a research based paper/poster presentation with an aim to analyze social, cultural and moral fibre of youth in multidisciplinary environment, giving holistic solutions for sustainable development of society.	CL-5 Evaluate
C303-6.5	Create literary, non-literary write-up with proper applied grammar usage, having moral and cultural significance for today's world	CL-6 Create

	individually and in a team.	

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Module No.	Subtitle of the Module	Topics in the module	No. of Hours for the module
1.	**Introducing Literary Theories**	• From Formalism to Reader Response Theory: Major Terms & Concepts • Narrative Art & Narratology • Language & Style: An Introduction	12
2.	**Introducing New Forms & Sub Genres Today: Features & Portions**	• New Fiction: Graphic Novels, Cyberpunk • Non Fiction: Memoirs & Autobiographies, Biographies & Personal Narrative	6
3.	**Spiritual Literature**	*Siddhartha*- Hermen Hesse (novella)	4
4.	**Travel Literature**	*Eat, Pray & Love (Travelogue& cinematic adaptation)*	4
5.	**Written Communication Through Non-Fiction**	*Diary, Blog, Travelogue*	4
6.	**Commonwealth / Post Colonial Literature**	*Hayavadana(Short Play)*- Girish Karnad	4
7.	**European Literature**	*Brave New World – Aldous Huxley (Science Fiction)*	4
8	**Canadian Literature**	*The Penelopiad- Margaret Atwood*	4
		Total number of Hours	**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Project, Class Interaction)
Total	**100**

Recommended Reading material:

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.	Margaret Atwood, 'The Penelopiad', 1st Edition, Canongate Series, Knopf, Canada, 2005.
2.	M.H. Abrams, 'A Glossary of Literary Terms'.7th Edition, Hienle & Hienle: Thomson Learning, USA, 1999.
3	Mark William Roche, 'Why Literature matters in the 21st Century', 1st Edition, Yale University Press, 2004.
4	Girish Karnad, 'Hayavadana', 1st Edition, Oxford University Press, Delhi, 1975 (30th Impression, 2012).
5	Aldous Huxley, 'Brave New World', 1st Edition, Harper Collins, 2004.
6	Hermen Hesse, 'Siddhartha', 1st Edition. New Directions, US, 1951. For online version: https://www.gutenberg.org
7	Elizabeth Gilbert, 'Eat, Pray & Love. 1st Edition, Penguin,US, 2006.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**16B1NHS435**	**Semester : ODD**	**Semester: V Session: 2020-21** **Month: August to December**
Subject Name	**SOCIOLOGY OF MEDIA**		
Credits	**3 (2-1-0)**	**Contact Hours**	**42**

Faculty (Names)	**Coordinator(s)**	**Prof. Alka Sharma**
	Teacher(s) (Alphabetically)	**Prof. Alka Sharma**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-1.1	Demonstrate a basic understanding of different concepts used in the systematic study of Sociology of Media	Understanding(C 2)
C304-1.2	Examine various sociological theoretical orientation towards media and society.	Analyzing(C 4)
C304-1.3	Analyze the key issues related to the processes of Production of Media, Popular Culture and consumer culture.	Analyzing(C 4)
C304-1.4	Critically evaluate the major methods of Cultural Consumption ,Social Class & the process of construction of subjectivities and audience reception in new Media	Evaluating(C 5)
C304-1.5	Create positive and critical attitude towards the use of new media and understanding of threats of Digital Age	Creating(C 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**

1.	Introduction	Introduction to the Course	1
2.	Concepts and Theoretical Orientation of Sociology of Media	• Different concepts related to Sociology of media • Functionalist Approach to the Sociology of Media • Critical Approach to the Sociology of Media • Symbolic Interactionist Approach to the Sociology of Media • Different theories of Media	8
3.	Concept of Popular Culture and its critical analysis	• What is popular culture? • Difference between 'pop' culture and 'high' culture • What distinguishes popular culture from other kinds of culture (art, folk culture)? Is there a distinction at all anymore? • Visualizing Society through 'pop' culture/ media • Risks and rituals that come with Popular Culture	8
4.	New media	• Difference between tradition media and new media • New media as technology • New Information Technology (brief history in case of India)	5
5.	Media & State	• Mediatization of Society • Free-speech Media	5
6.	Consumption of Media and Media reception	• Social Actors as Audience/ Audience as market– Theory • Media effects: Media and representations (gender, ethnic)- the under-representation and misrepresentation of subordinate groups. • Media and the construction of reality: media logic and cultivation analysis theory • Information Society vs Informed Society • Cultural Consumption and Social Class	9
7.	Media in Global	• Rise of Network Society- Manuel Castells • Global Media: impact of market & state • Global Perspectives: The world on our doorstep • Marketing and aesthetics in everyday life	6

	Age		
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Presentation and attendance)
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.	Ritzer, George, and Steven Miles. "*The changing nature of consumption and the intensification of McDonaldization in the digital age.*" Journal of Consumer Culture 19, no. 1, pp 3-20, 2019.
2.	Turow, Joseph. *Media today: An introduction to mass communication*. Taylor & Francis, 2011.
3.	Curran, James. *Media and society*. Bloomsbury Publishing, 2010.
4	JA Fisher 'High Art v/s Low Art*,* in Berys Nigel Gaut& Dominic Lopes (eds.), *The Routledge Companion to Aesthetics*. Routledge 2001

DETAILED SYLLABUS
Lecture-wise Breakup

CourseCode	16B1NHS532	**Semester:ODD (specifyOdd/Even)**	**Semester: 5th Monthfrom: Aug to Dec2020**
CourseName	Planning and Economic Development		
Credits	03	ContactHours	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Akarsh Arora
	Teacher(s) (Alphabetically)	1. Dr. Akarsh Arora(akarsh.arora@mail.jiit.ac.in) 2. Dr. Amandeep Kaur(amandeep.kaur@mail.jiit.ac.in)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C303-4.1	Understand the issues and approaches to economic development.	C2
C303-4.2	Evaluate National income accounting, human development index and sustainable development.	C5
C303-4.3	Apply an analytical framework to understand the structural characteristics of development.	C3
C303-4.4	Analyze the role of Macroeconomic stability & policies and Inflation in the development process.	C4
C303-4.5	Evaluate the importance of federal development and decentralization.	C5

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Economic Development and its Determinants	Economic growth and development. Indicators of development. Approaches to economic development. Rostows Stages of Growth.	5
2.	National Income Accounting	National Income Accounting, Green GNP and Sustainable development	5
3.	Indicators of development	PQLI, Human Development Index (HDI) and gender development indices.	4
4.	Demographic Features, Poverty and Inequality	Demographic features of Indian population; Rural-urban migration; Growth of Primary, Secondary and Tertiary Sector.	5
5.	Inflation and Business Cycles	Inflation. Business cycle. Multiplier and Accelerator Interaction.	6
6.	Macro-Economic Stability &	Monetary Policy. Fiscal Policy. Role of Central Bank & Commercial banks in the development of the	6

	Policies	country. Balance of payments; currency convertibility and Issues in export-import policy.	
7.	Federal Development	The Federal Set-up - The Financial Issues in a Federal Set-up, Principles for Efficient Division of Financial Resources between Governments. Financial Federalism under Constitution. Finance Commissions in India, Terms of References and its Recommendations	6
8.	Planning and Development	Need for planning, Decentralisation, Rural and Urban local bodies.	5
		Total number of Lectures	**42**

Evaluation Criteria

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

Recommended Reading material:

1. **Todaro, M.P**., **Stephen C. Smith,** Economic Development, Pearson Education, 2017
2. **Thirwal, A.P**., Economics of Development, Palgrave, 2011
3. **Ahuja, H. L.**, Development Economics, S Chand publishing, 2016
4. **Ray, Debraj,** Development Economics, Oxford University Press, 2016

Detailed Syllabus

Lecture-wise Breakup

Course Code	17B1NHS531	**Semester ODD**	**Semester V Session** 2020 -2021 **Month from July- Dec**
Course Name	Technology and Culture		
Credits	3	**Contact Hours**	**(3-0-0)**

Faculty (Names)	**Coordinator(s)**	Dr Swati Sharma
	Teacher(s) (Alphabetically)	Dr Swati Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C303-5.1	Understand the main theories in cultural management,	Applying (C 2)
C303-5.2	Appraise technological convergence and cultural divergence, relate the differences to the literature and suggest solutions	Evaluating(C 5)
C303-5.3	Interpret and communicate effectively in physical and virtual teams by evaluating appropriate concepts, logic and selecting the apt IT tools.	Evaluating (C5)
C303-5.4	Evaluation of the theoretical knowledge to adapt to cultural differences in global work environment.	Evaluating(C 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	▪ Genealogy of the concept ▪ The Information Technology Revolution ▪ The concept of Network societies	7
2.	Dimensions of Culture	▪ Evolution of Culture ▪ Principal theories of Culture: Kluckholn and Strodtbeck, Hofstede, Trompenaars and Schwartz	12

		▪ Cultural Diversity and cross cultural literacy	
3.	Cross cultural communication in physical and virtual teams	▪ The Communication Process ▪ Language and Culture ▪ Non Verbal Communication ▪ Barriers to Cross Cultural Understanding	7
4.	Negotiation and Decision Making	▪ Theories of Negotiation ▪ Negotiation and Intercultural Communication ▪ Decision making in cross cultural environment	8
5.	Cross Culture and Leadership	▪ Leadership and Culture ▪ Theories of Culture centric leadership and their Global Relevance ▪ Developing Competencies for Global citizens ▪ Women as International Leaders ▪ Cross Cultural Training ▪ Ethical Guidelines for Global Citizens	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Projectand Oral Viva)
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.	Cateora, P. R., Meyer, R. B. M. F., Gilly, M. C., & Graham, J. L. (2020). *International marketing*. McGraw-Hill Education.
2.	Coyle,D., The Culture Code: The Secrets of Highly Successful Groups, Bantam, 2018
3.	Fletcher, R., & Crawford, H. (2013). *International marketing: an Asia-Pacific perspective*. Pearson Higher Education AU.

4.	Gerard Bannon, J. (red.). Mattock, Cross-cultural Communication: The Essential Guide to International Business.2003
5.	Maidenhead.Riding the Waves of Culture: Understanding Cultural Diversity in Business (2012).3rd edition. McGraw Hill.
6.	Madhavan,S., Cross Cultural Management: Concepts and Cases(2nd Ed),Oxfor University Press 2016.
7.	Robertson, Ronald. Globalization: Social theory and global culture, London: Sage, 1992.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	19B12HS311	**Semester: ODD**	**Semester V Session 2020-21** **Month from Aug 2020 to Dec 2020**
Subject Name	**ENTREPRENEURIAL DEVELOPMENT**		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	**Dr Badri Bajaj**
	Teacher(s) (Alphabetically)	**Dr Badri Bajaj**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C303-8.1	Understand basic aspects of establishing a business in a competitive environment	Understand Level (C2)
C303-8.2	Apply the basic understanding to examine the existing business ventures	Apply Level (C3)
C303-8.3	Examine various business considerations such as marketing, financial and teaming etc.	Analyze Level (C4)
C303-8.4	Assessing strategies for planning a business venture	Evaluate Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Entrepreneurial perspective	Foundation, Nature and development of entrepreneurship, importance of entrepreneurs, Entrepreneurial Mind, Individual entrepreneur Types of entrepreneurs	6

2.	Beginning Considerations	Creativity and developing business ideas; Legal issues; Creating and starting the venture; Building a competitive advantage	10
3.	Developing Marketing Plans	Developing a powerful Marketing Plan, E-commerce, Integrated Marketing Communications	8
4.	Developing Financial Plans	Sources of Funds, Managing Cash Flow, Creating a successful Financial Plan Developing a business plan	10
5.	Leading Considerations	Developing Team, Leading the growing company, Resources for growth	8
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Quiz , Oral Questions)
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.	Robert D Hisrich, Michael P Peters & Dean A Shepherd, "Entrepreneurship" 10th Edition, McGraw Hill Education, 2018
2.	Norman M. Scarborough and Jeffery R. cornwell, "Essentials of entrepreneurship and small business management" 8th Edition, Pearson, 2016
3.	Rajiv Roy, "Entrepreneurship", 2nd Edition, Oxford University Press, 2011
4.	Sangeeta Sharma, "Entrepreneurship Development", 1st Edition, Prentice-Hall India, 2016

Detailed Syllabus

Lecture-wise Breakup

Course Code	**20B13HS311**	**Semester: Odd**	**Semester: V Session: 2020-21** **Month: JULY-DECEMBER**
Course Name	**Indian Constitution and Traditional Knowledge**		
Credits	**3**	**Contact Hours**	**3**(3-0-0)

Faculty (Names)	**Coordinator(s)**	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	• Dr. Chandrima Chaudhuri • Dr. Praveen Sharma • Dr. Santosh Dev • Ms. Shikha Kumari • Dr. Swati Sharma

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C305.1	Demonstrate an understanding about the early Indian traditional political thought and the current Indian political scenario by knowing about the structure of government in place	Understand(C2)
C305.2	Demonstrate an understanding of the role of Indian President, Prime Minister, Governor, other members of the legislature and local governments as representatives of the common masses	Understand (C2)
C305.3	Analyze the working of Indian federalism with reference to centre-state relations	Analyze(C4)
C305.4	Analyze the impact of the contemporary challenges such as caste and gender to the working of Indian democracy	Analyze(C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	The Indian Constitution	• Historical Background to the Indian Constitution • Salient features of the Indian Constitution • Fundamental Rights (Part III of the Indian Constitution) • Fundamental Duties (Part IVA of the Indian Constitution) • Directive Principles of the State Policy (Part IV of the Indian Constitution)	8
2.	Organs of the Government	• The Executive: President, Prime Minister and Governor- appointment, powers and functions • The Legislature: Parliament and its components- Lok Sabha and Rajya Sabha (composition and functions) • The Judiciary: Supreme Court-composition, functions, appointment and jurisdiction	8
3.	Nature of Federalism in India	• Centre-State Legislative Relations • Centre-State Administrative Relations • Centre-State Financial Relations • Special Provisions of some state and the 5^{th} and 6^{th} schedule	8
4.	Local Governance in India	• Urban local governance: Municipality- Structure & Functions • Rural Local governance: Panchayat- Organization and Powers • Civil Society: the participation of the	8

		people in local governance	
5.	Traditional knowledge	• Kautilya- Theory of state • Mandala theory • Saptanga theory	6
6.	Challenges to Indian Democracy	• Caste as a critical factor in the Indian Constitution • Gender as critical to the process of Constutionalization	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Quiz, Project)
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.A. George, *Important Judgements that transformed India*, New Delhi: McGraw Hill, 2020
2.	B. Chakraborty, *Indian Constitution: Text, Context and Interpretation,* New Delhi: Sage Publications, 2017
3.	B.K.Sharma, *Introduction to the Constitution of India*, New Delhi: Prentice Hall of India, 2002
4.	M.Laxmikanth, *Indian Polity*, 6th edition, Noida: McGraw Hill, 2019
5.	M.P.Singh and R. Saxena, R, *Indian Politics: Contemporary Issues and Concerns*, New Delhi: PHI Learning, 2008
6.	R. Kangle, *Arthashashtra of Kautilya*, New Delhi: Motilal Publishers, 1997

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH531	**Semester : ODD**	**Semester: 5th Session:** 2020 -2021 **Month from July to December**
Course Name	**Quantum Mechanics for Engineers**		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Anuraj Panwar
	Teacher(s) (Alphabetically)	Anuraj Panwar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C301-10.1	Remember basics of Quantum Mechanics and its applications.	Remembering (C1)
C301-10.2	Explain postulates of quantum mechanics, Dirac notation, Schrödinger Equation, Perturbation theory and Qubits.	Understanding (C2)
C301-10.3	Solve various problems related to different quantum systems and construct quantum circuits using quantum gates.	Applying (C3)
C301-10.4	Analyse the results obtained for various physical systems and to establish the advantages of some simple protocols of quantum information processing.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Wave particle duality, quantum physics (Planck and Einstein's ideas of quantized light), postulates of quantum mechanics, time dependent and time independent Schrodinger equation, operators, probability theory, expectation values, and uncertainty principle and its implications, no cloning applications	8

2.	Measurement Theory with Applications	Matrix and linear algebra, Eigen values and eigenfunctions Hilbert space, Kets, Bras and Operators, Bras Kets and Matrix representations, Measurements, Stern Gerlach Experiment, Observables and Uncertainity Relations, No-cloning theorem, Pauli Spin Matrices.	10
3.	Potential problems	1-D, 2-D, and 3-D potential problems (including infinite and finite square well). Tunneling, harmonic oscillator, separation in spherical polar coordinates, hydrogen atom, etc.),	08
4.	Approximation methods	Time independent perturbation theory for nondegenerate and degenerate energy levels.	4
5.	Advanced Applications	Kronig Penny model, Basic ideas of quantum computing, Qubit, Gate model of quantum computing : H, CNOT, Pauli Gates, BB84 protocol, Advantages of quantum computing, Quantum wire, Quantum dot and realization of CNOT using Quantum dot.	10
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
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.	The new quantum universe by Toney Hey and Patrick Walters, Cambridge University Press.
2.	Quantum mechanics a new introduction by Kenichi Konishi and G Paffuti, OUP., 2009
3.	Quantum physics by Eyvind H Wichman (Berley Physics course Vol 4) Tata McGraw Hill 2008
4.	Elements of quantum computation and quantum communication by A Pathak, CRC Press 2013.
5.	Introduction to Quantum Mechanics by David J. Griffiths, Second Edition, Pearson, 2015.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH532	**Semester**: ODD	**Semester: 5th Session:** 2020 -2021 **Month from July to December**
Course Name	Materials Science		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Manoj Kumar and Sandeep Chhoker
	Teacher(s) (Alphabetically)	Manoj Kumar and Sandeep Chhoker

COURSE OUTCOMES		**COGNITIVE LEVELS**
C301-11.1	Recall variety of engineering materials for their applications in contemporary devices	Remembering (C1)
C301-11.2	Explain dielectric, optical, magnetic, superconducting, polymer and thermoelectric properties	Understanding (C2)
C301-11.3	Apply properties of dielectric, optical, magnetic, superconducting, polymer and thermoelectric materials to solve related problems	Applying (C3)
C301-11.5	Prove and estimate solution of numerical problems using physical and mathematical concepts involved with various materials	Evaluating (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Dielectric Materials	Polarization mechanism & Dielectric Constant, Behavior of polarization under impulse and frequency switching, Dielectric loss, Spontaneous polarization, Ferroelectrics, Piezoelectric effect; Applications of Dielectric Materials	10
2.	Magnetic Materials	Concept of magnetism, Classification – dia-, para-, ferro-, antiferro- and ferri-magnetic materials, Their properties and Applications; Hysteresis; Magnetic Storage and Surfaces.	**10**
3.	Super conducting Materials	Meissner effect, Critical field, type-I and type-II superconductors; Field penetration and London equation; BCS Theory, High temperature Superconductors and their	**5**

		Applications	
4.	Polymers and Ceramics	Various types of Polymers and their applications; Mechanical behavior of Polymers, synthesis of polymers; Structure, Types, Properties and Applications of Ceramics; Mechanical behavior and Processing of Ceramics.	**6**
5.	Optical Materials	Basic Concepts, Light interactions with solids, Optical properties of nonmetals: refraction, reflection, absorption, Beer-Lambert law, transmission, Photoconductivity. Drude Model, relation between refractive index and relative dielectric constant, Optical absorption in metals, insulators and semiconductors. Introduction to Photonic band gap (PBG) materials and its applications	**6**
6.	Thermoelectric Materials	Thermoelectric (TE) effects and coefficients (Seebeck, Peltier, Thompson); TE materials and devices, Heat conduction, Cooling, Figure of Merit; TE power generation (efficiency), refrigeration (COP), Examples and applications.	**3**
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10), Attend. (10) and Class performance (5)]
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.	S.O. Pillai, Solid State Physics, New Age International Publishers.
2.	B. B. Laud, Laser and Non-linear Optics, John Wiley & Sons
3.	Van Vlack, Elements of Material Science and Engineering, Pearson Education.

4.	Srivastava and Srinivasan, Material Science and Engineering,
5	W.D. Callister Jr., Material Science and Engineering: An Introduction, John Wiley.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH533	**Semester: ODD**	**Semester: 5th Session:** 2020 -2021 **Month from July to December**
Course Name	Laser Technology and Applications		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Navneet Kumar Sharma and Anshu Varshney
	Teacher(s) (Alphabetically)	Navneet Kumar Sharma and Anshu Varshney

COURSE OUTCOMES		**COGNITIVE LEVELS**
C301-12.1	Define the coherent properties, high brightness of laser, population inversion and optical feedback to laser technology	Remember Level (C1)
C301-12.2	Extend the knowledge of lasers in some applications like LIDAR, laser tracking, bar code scanner, lasers in medicine and lasers in industry	Understand Level (C2)
C301-12.3	Apply the optical ray transfer matrix to determine the stability of a laser resonator	Apply Level (C3)
C301-12.4	Distinguish the operational principles of CW, Q-switched, mode locked lasers; laser rate equations for three & four level lasers; different types of laser systems	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fundamentals of Lasers	Laser idea and properties; Monochromaticity, directionality, brightness, Temporal and spatial Coherence. Interaction of radiation with matter; Absorption, spontaneous and stimulated emission of radiation, Rates equations, Einstein's A and B coefficients. Laser rate equations: Four level and three level systems. Conditions	12

		for producing laser action, population inversion, saturation intensity, threshold condition and gain optimization. Experimental techniques to characterize laser beam.	
2.	Types of Lasers	Pumping processes; optical and electrical pumping. Optical Resonators; The quality factor, transverse and longitudinal mode selection; Q switching and Mode locking in lasers. Confocal, planar and spherical resonator systems. Types of Lasers; Solid state Lasers; Ruby Laser, Nd:YAG laser. Gas lasers; He-Ne laser, Argon laser, CO_2, N_2 and Excimer Laser. Dye (liquid) Laser, Chemical laser (HF), Semiconductor Lasers; Heterostructure Lasers, Quantum well Lasers. Free electron laser, X-ray laser and Ultrafast Laser.	16
3.	Applications of Lasers	Image processing; Spatial frequency filtering and Holography, Laser induced fusion; Fusion reactor, creation of Plasma. Lightwave communications. Use in optical reader (CD player) and writer. Nonlinear optics; harmonic generation, self focusing. Lasers in industry; Material processing, Cutting, welding and whole drilling. Precision length measurement, velocity measurement, Laser Tracking, Metrology and LIDAR. Lasers in medicines and surgery. Lasers in defense, Lasers in space sciences, Lasers in sensors.	12
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
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.	Thyagarajan and Ghatak, *Lasers Theory and Applications*, Macmilan India.
2.	W. T. Silfvast, *Laser Fundmentals*, Cambridge Univ-Press.
3.	O. Svelto, *Principles of Lasers*, Springer.
4.	Saleh and Teich, *Fundamentals of Photonics*, John Wiley & Sons.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH535	**Semester: ODD**	**Semester: 5th Session:** 2020 -2021 **Month from July 20 to December 20**
Course Name	NUCLEAR SCIENCE AND ENGINEERING		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Manoj Tripathi
	Teacher(s) (Alphabetically)	Manoj Tripathi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C301-14.1	Relate terminology and concepts of nuclear science with various natural phenomenon and engineering applications.	Remembering (C1)
C301-14.2	Explain various nuclear phenomenon, nuclear models, mass spectrometers, nuclear detectors, particle accelerators. and classify elementary particles.	Understanding (C2)
C301-14.3	Solve mathematical problems for various nuclear phenomenon and nuclear devices.	Applying (C3)
C301-14.4	Analyze the results obtained for various physical problems and draw inferences from the results.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Nuclear Constituents and their properties, Nuclear Forces	Rutherford scattering and estimation of nuclear size, Constituents of the nucleus and their properties, Nuclear Spin, Moments and statistics, Magnetic dipole moment, Electric quadruple moment. Nuclear forces, Two body problem - Ground state of deuteron, Central and non-central forces, Exchange forces: Meson theory, Yukawa potential, Nucleon-nucleon scattering, Low energy n-p scattering, Effective range theory, Spin dependence, charge independence and charge symmetry of nuclear forces, Isospin formalism.	07
2.	Nuclear Models	Binding energies of nuclei, Liquid drop model: Semi-	05

		empirical mass formula, Mass parabolas, Prediction of Nuclear stability, Bohr-Wheeler theory of fission, Shell model, Spin-orbit coupling. Magic numbers, Angular momenta and parities of nuclear ground state, Magnetic moments and Schmidt lines, Collective model of a nucleus.	
3.	Nuclear decay and Nuclear reactions	Alpha decay, Beta decay, Pauli's Neutrino hypothesis-Helicity of neutrino, Theory of electron capture, Non-conservation of parity, Fermi's theory, Gamma decay: Internal conversion, Multipole transitions in nuclei, Nuclear isomerism, Artificial radioactivity, Nuclear reactions and conservation laws, Q-value equation, Centre of mass frame in nuclear Physics, Scattering and reaction cross sections, compound nucleus, Breit-Wigner one level formula	08
4.	Interaction of nuclear radiation with matter	Interaction of charge particles with matters: Bohr's ionization loss formula and estimation of charge, mass and energy. Interaction of electromagnetic radiation with matter, Linear absorption coefficient. Nuclear particle detectors and neutron counters.	07
5.	Accelerator and reactor Physics	Different types of reactors, tracer techniques, activation analysis. Radiation induced effects and their applications: Accelerators: Linear accelerators, Van de Graff generator, LINAC, Cyclotrons, Synchrotons, Colliders.	06
6.	Cosmic radiation and Elementary Particles	Cosmic radiation: Discovery of cosmic radiation, its sources and composition, Latitude effect, altitude effect and east-west asymmetry, secondary cosmic rays, cosmic ray shower, variation of cosmic intensity and Van Allen radiation belt. Elementary particles: Classification of particles, K-mesons, Hyperons, particles and antiparticles, fundamental interactions, conservation laws, CPT theorem, resonance particles and hypernucleus, Quark model.	07
		Total number of Lectures	**40**
Evaluation Criteria			

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (7 M) and PBL & Cass performance (8 M)]
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.	K.S. Krane, 1987, Introductory Nuclear Physics, Wiley, New York.
2.	I. Kaplan, 1989, Nuclear Physics, 2nd Edition, Narosa, New Delhi.
3.	B.L. Cohen, 1971, Concepts of Nuclear Physics, TMH, New Delhi.
4.	R.R. Roy and B.P. Nigam, 1983, Nuclear Physics, New Age International, New Delhi.
5.	H.A. Enge, 1975, Introduction to Nuclear Physics, Addison Wesle, London.
6.	Y.R. Waghmare, 1981, Introductory Nuclear Physics, Oxford-IBH, New Delhi.
7.	R.D. Evans, 1955, Atomic Nucleus, McGraw-Hill, New York.

Course Description

Course Code	16B1NMA533	**Semester** - Odd	**Semester** V **Session** 2020 -2021 **Month from** Aug 2020 - Dec 2020
Course Name	Matrix Computations		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES After the successful completion of this course, the student will be able to		**COGNITIVE LEVELS**
C301-3.1	explain the basics of matrix algebra and inverse of a matrix by partitioning.	Understanding level (C2)
C301-3.2	solve the system of linear equations using direct and iterative methods.	Applying Level (C3)
C301-3.3	explain the vector spaces and their dimensions, inner product space, norm of a vector and matrix.	Understanding level (C2)
C301-3.4	apply the Gram-Schmidt process to construct orthonormal basis and Q-R decomposition of a matrix.	Applying Level (C3)
C301-3.5	construct Gershgorin's circles and solve eigenvalue problem using Jacobi, Givens, Housholder, power and inverse power methods.	Applying Level (C3)
C301-3.6	analyze systems of differential and difference equations arising in dynamical systems using matrix calculus.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Matrix Algebra	Review of matrices, partitioning, block diagonal matrix, elementary matrices, Inverse of a matrix by partitioning.	6
2.	Linear System of equations	Existence and uniqueness of solution for system of linear equations. Partial pivoting, LU decomposition, Crout's and Doolittle's methods, Cholesky factorization. Gauss Siedel, Gauss Jacobi iterative methods.	6
3.	Vector and Inner Product	Vector spaces, Subspaces, dimension and basis, *p*-	6

	Spaces	norms of vector, Inner product, Norm using inner product and norms of a matrix.	
4.	Orthogonality	Orthogonal and orthonormal sets, Gram-Schmidt process, QR factorization.	4
5.	Eigen value Problems	Eigen values and Eigenvectors, spectral radius, Greshgorin's theorem, Jacobi method, Givens rotations method and Householder's method, Power and Inverse power methods, Q-R algorithm.	12
6.	Matrix Calculus	Powers and functions of matrices, application to solve discrete dynamical systems $x(t+1) = Ax(t)$, $x(0) = \alpha$ and a system of differential equations of the form $dx/dt = Ax$, $x(0) = \alpha$.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments, Quizzes and Tutorial)
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.	**Bronson, R**., Matrix Methods an Introduction, Academic Press, 1991.
2.	**Golub, G. H., Loan, C. F. V.,** Matrix Computations, 4th Edition, Johns Hopkins University Press, 2013.
3.	**Datta, K. B.**, Matrix and Linear Algebra, 3rdEdition, Prentice Hall of India, 2016.
4.	**David, W. Lewis**., Matrix Theory, World Scientific, 1991.

Detailed Syllabus

Lecture-wise Breakup

Course Code	15B11EC313	**Semester** …Odd Semester **(specify Odd/Even)**	**Semester Vth, Session** 2020 -2021 **Month from August to Dec**
Course Name	Microprocessor and Microcontroller		
Credits	**3**	**Contact Hours**	

Faculty (Names)	**Coordinator(s)**	Smriti Bhatnagar, Varun Goel
	Teacher(s) (Alphabetically)	Atul Kr. Srivastava, Smriti Bhatnagar , Varun Goel

COURSE OUTCOMES		**COGNITIVE LEVELS**
C330-1.1	Recall the basics of digital circuits, specifications and applications.	C1
C330-1.2	Familiarize with the basics of 8 bit, 16 bit and 32 bit microprocessor / Microcontroller, and its internal organization.	C2
C330-1.3	Use the knowledge of different instructions of 8085 microprocessor/ 8051 Microcontroller to write the various programs in assembly language.	C3
C330-1.4	Interface the memory chips and peripheral chips, LED, LCD, Keyboard, Motor and Sensors with 8085 microprocessors and Micro controllers.	C4

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**

1.	Introduction to Digital Electronics & Microprocessor	Digital Circuit Parameters (Open collector outputs, Tristate outputs, I/O source and sink, Fan-in and Fan-out, Propagation delay, Figure of merit), Pipelining & Parallel Processing, Cache Memory, Memory Management, Virtual Memory System, Introduction to Microprocessors, Evolution of Microprocessor, Microprocessor Systems with Bus Organization, Concept of Memory & its internal Organization, Memory Expansion, Classification of Memories & their types.	6L
2.	Detailed Study of Microprocessor 8085	Features of 8085, Microprocessor Architecture in detail, Pin Diagram in detail, De-multiplexing Address & Data Bus, Generation of Control Signals, Interfacing with Memory & I/O Device with timing diagram, Instruction fetching, execution & data transfer operation, Programmer's Model & Instruction Set, Different Formats for Instruction, Opcode & Data, Addressing Modes, Complete Instruction Set (Data transfer, Arithmetic & Logical, Branch & Stack), Assembly language programming, Looping, Counting & Indexing techniques, Interrupt System of 8085, Polling & Interrupt, Basic definition of Interrupts, Interrupt Structure & their types, Masking/Unmasking of Interrupts, Interrupt driven I/O, Microprocessor (8086, 80186, 80286, etc.), Architecture Advancement of *Programming Examples*	15L
3.	Detailed Study of 8051 Microcontroller	Microprocessor Versus Microcontrollers, Microcontrollers for Embedded Systems, Embedded Versus External Memory Devices, CISC Versus RISC Processors, Harvard Versus Von-Neumann architecture, 8051/8031/8052 Microcontroller (Basic architecture, Pin configuration, Memory organization (registers and I/O ports), Assembly language programming (addressing modes and instruction set), Timers and Interrupts, Serial Communication, *Programming Examples.*	12L
4.	Real World Interfacing with Microcontroller	Interfacing of single LED, Blinking of LED with timer and without timer, Interfacing of push-button, LED & 7-segment display, Intelligent LCD Display, Interfacing	10L

		of intelligent LCD display, Interfacing of Matrix Keyboard to control 7-segment display, Stepper Motor & DC Motor, Interfacing with stepper & DC motor, Relay Interfacing, Different Sensor Interfacing, IR & LDR Sensor, DTMF, 8255 PPI Chip (Pin Configuration, Block Diagram, Operating Modes, Memory Mapped I/O & I/O Mapped I/O), Application of 8255 - 7 segment, Traffic Light Controller etc.	
		Total number of Lectures	**43 L**

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.	Muhammad Ali Mazidi, "The 8051 microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Pearson Education, 2008.
2.	R. S. Gaonkar, "Microprocessor Architecture Programming & Applications", Prentice Hall, 2002.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**15B19EC591**	**Semester Odd**	**Semester 5th Session** 2020-21 **Month from** Aug 20 to Dec 20
Subject Name	**Minor Project - 1**		
Credits	**2**	**Contact Hours**	**NA**

Faculty (Names)	**Coordinator(s)**	Neetu Singh, Raghvenda Kumar Singh
	Teacher(s) (Alphabetically)	NA

COURSE OUTCOMES		**COGNITIVE LEVELS**
C350.1	Identifying, planning and initiation of the individual projects in the domain selected by them, respectively.	Applying Level (C3)
C350.2	Analyze the potential research areas in the field of Embedded Systems, Signal Processing, VLSI, Communication, Artificial Intelligence and Machine Learning/Deep Learning etc.	Analysing Level (C4)
C350.3	Survey the available literature and gain knowledge of the State-of-Art in the chosen field of study.	Analysing Level (C4)
C350.4	Evaluate the existing algorithms of the domain selected and improvise the algorithm so that it yields better results than the existing metrics.	Evaluating Level (C5)
C350.5	Design and implement a working model, using various hardware components, which works as a prototype to showcase the idea selected for implementation.	Creating Level (C6)

Evaluation Criteria

Components	**Maximum Marks**
Mid Semester Evaluation	40
Final Evaluation	40
Report	20
Total	**100**

Detailed Syllabus

Lecture-wise Breakup

Course Code	17M12EC123	**Semester** :Odd 2020**(specify Odd/Even)**	**Semester** I **Session** 2020 -2021 **Month from Aug 2020 – Dec 2020**
Course Name	Information theory and Coding		
Credits	3	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Ankit Garg
	Teacher(s) (Alphabetically)	Dr. Ankit Garg

COURSE OUTCOMES		**COGNITIVE LEVELS**
C140.1	Understand the concept of probability, its relation with information, entropy, and their application in communication systems.	Understanding [Level II]
C140.2	Identify theoretical and practical requirements for implementing and designing compression algorithms.	Analyzing [Level IV]
C140.3	Analyze the need for channel coding in digital communication systems, the relationship between bandwidth and capacity of communication channels with its importance in real life communication systems.	Analyzing [Level IV]
C140.4	Generate block codes for error detection and correction.	Analyzing [Level IV]
C140.5	Generate convolutional codes for error detection and correction.	Analyzing [Level IV]

Module No.	**title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Review of Basic Probability	Probability spaces. Random variables. Distributions and densities. Functions of	3

		random variables. Statistical Averages. Inequalities of Markov and Chebyshev. Weak law of large numbers.	
2.	Information Measure	Discrete entropy. Joint and conditional entropies. Entropy in the continuous case. Maximization of continuous entropy. Entropy of a bandlimited white Gaussian process.	5
3.	Data Compression	Uniquely decipherable and instantaneous codes. Kraft- McMillan inequality. Noiseless coding theorem. Construction of optimal codes.	4
4.	Data Transmission	Discrete memoryless channel. Mutual information and channel capacity. Shannon's fundamental theorem and its weak converse. Capacity of a bandlimited AWGN channel. Limits to communication – Shannon limit.	5
5.	Error Control Coding	Coding for reliable digital transmission and storage. Types of codes. Modulation and coding. ML decoding. Performance measures.	3
6.	Linear Block Codes	Algebra Background, Groups, Fields, Binary field arithmetic. Vector Spaces over GF(2). Generator and parity check matrices. Syndrome and error detection. Standard array and syndrome decoding. Hamming codes.	8
7.	Cyclic Codes	Polynomial representation, Systematic encoding. Cyclic encoding, Syndrome decoding.	6
8.	Convolutional Codes	Generator Sequences. Structural properties. Convolutional encoders. Optimal decoding of convolutional codes- the Viterbi algorithm.	8

Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
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.	R.B. ASH: Information Theory, Dover, 1990.
2.	R. BOSE: Information theory, coding and cryptography, Macgraw Hill 2008.
3.	R.W. YEUNG: Information Theory and Network Coding, Springer, 2008.
4.	S. LIN & D.J. COSTELLO: Error Control Coding, 2nd Edn, Pearson, 2004.
5.	T.K. MOON: Error Correction Coding, Wiley, 2006.

Detailed Syllabus

Lab-wise Breakup

Course Code	18B15EC312	**Semester Odd (specify Odd/Even)**	**Semester 5th Session 2020-21 Month from July to December**
Course Name	Electromagnetic Field Theory Lab		
Credits	**1**	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Ashish Gupta, Monika
	Teacher(s) (Alphabetically)	Bhagirath Sahu, Neetu Joshi, Raghvenda Kumar Singh, Reema Budhiraja, Vishal Narain Saxena

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	To observe electromagnetic wave propagation in X-band waveguide and draw the dispersion curves. To simulate a rectangular waveguide and calculate its cut-off frequency.	Understanding (Level II)
CO2	Calculate and evaluate the various parameters such as VSWR and load impedance of transmission lines.	Applying (Level III)
CO3	Measure the microwave power in Gunn oscillator, directional coupler and also measure the radiation patterns of the antenna.	Evaluating (Level V)
CO4	Design and simulate the different antenna parameters using HFSS software and verify with the measured results.	Create (Level VI)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Rectangular Waveguide	To determine the frequency and wavelength in a	**1**

	Parameters	rectangular waveguide working in TE10 mode.	
2.	Rectangular Waveguide Parameters	To study the propagation of wave in X-band waveguide and draw the ω-β plot.	**1**
3.	Rectangular Waveguide Parameters	Determine the VSWR /input VSWR & corresponding impedance of the device at a spot frequency in X-band and also verify by using smith chart.	**2**
4.	Design of Rectangular Waveguide	Determine experimentally the broader dimension of rectangular waveguide using microwave test bench at X-band of microwave frequency.	**1**
5.	I-V characteristics of a Gunn-Diode	To study Gunn Oscillator as a source of microwave power and hence to study and plot its I –V characteristics.	**3**
6.	Measurement of Received Power	To study the variation of field strength of radiated wave, with distance from a transmitting antenna.	**3**
7.	Radiation Pattern	To plot and study the radiation pattern of Dipole and Yagi antenna.	**3**
8.	Measurement	Determine experimentally the propagation characteristic following microwave devices operating at X-band using microwave test bench a. Directional coupler, b. Magic Tee.	**3**
9.	Simulation	Design and Simulation of Rectangular Waveguide and plot the S- Parameters to obtain the cut-off frequency.	**1**
10.	Simulation	Design, Simulation, Optimization and characterization any planar Antenna on ANSYS HFSS.	**4**
11.	Measurement of Input parameters of the antenna	Measurement of Input parameters of an Antenna using Vector Network Analyzer.	**4**
Evaluation Criteria **Components**		**Maximum Marks**	

Viva 1(Mid Sem Viva)	20
Viva 2(End Sem Viva)	20
Assessment Components	30
Attendance	15
Lab Record	15
Total	**100**

Project Based Learning: Students will learn to design a rectangular waveguide for a given frequency range and to study the configuration of Electric and Magnetic waves. They can also see the number of supporting modes for a given rectangular waveguide and operating frequency. They will be able to operate and characterize different microwave devices such as Gunn Diode, Directional Coupler, magic tee etc. Students can also plot and measure the radiation patterns of the given antennas. Most importantly students will be able to simulate and characterize the designed antennas and waveguides with the help of Ansys High Frequency Structure Simulator (HFSS) tool. After designing and subsequent fabrication, antennas can be measured using vector network analyzer available in the lab. Thus students can make different projects by using the knowledge gained from the mentioned experiments.

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.N.O. Sadiku, S.V. Kulkarni, *Principles of Electromagnetics*, Oxford Press, 6th Edition, 2016.
2.	C.A. Balanis, Advanced Electromagnetics, Wiley Publishers, 2nd Edition, 2012.
3.	A.R. Harish, M.Sachidananda, aAntennas and Wave Propagation, Oxford University Press, 2015.

Detailed Syllabus

Lab-wise Breakup

Course Code	18B15EC314	**Semester** Odd **(specify Odd/Even)**	**Semester** 5th **Session** 2020 -2021 **Month from** Aug- Dec
Course Name	Python for Signal processing and Communication		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	B. Suresh, Neetu Singh
	Teacher(s) (Alphabetically)	B. Suresh, Kapil Dev Tyagi, Neetu Singh, Nisha Venkatesh, Parul Arora, Pankaj Kumar Yadav, Vivek Dwivedi

COURSE OUTCOMES: At the completion of the course, students will be able to:		**COGNITIVE LEVELS**
C310.1	Understand applications of Python in signal processing and communication.	Understanding Level (C2)
C310.2	Apply Python for implementing signal operations and transformations on 1-D signals.	Applying Level (C3)
C310.3	Apply Python for implementing signal operations and transformations on images.	Applying Level (C3)
C310.4	Analyze the different blocks of communication systems using Python.	Analyzing Level (C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Python	Introduction to Python and its various applications.	C310.1
2.	CT Signals	Generating Continuous time signals.	C310.1
3.	DT Signals	Generating Discrete time signals.	C310.1
4.	Signal Operations	Writing codes for generating various signal	C310.2

		operations.	
5.	DT Convolution	To calculate the convolution sum of two discrete time signals.	C310.2
6.	CT Convolution	To calculate the convolution integral of two continuous - time signals.	C310.2
7.	Signal Transformations	Writing codes to compute DFT (Discrete Fourier Transform) and IDFT (Inverse Discrete Fourier Transform) for the spectral analysis of signals.	C310.2
8.	Image Data	To read, write, display and explore image data.	C310.3
9.	Image Enhancement	To perform image enhancement in spatial domain.	C310.3
10.	Image Arithmetic	To perform arithmetic operations on the images.	C310.3
11.	Image Geometric Transformations	To apply geometric transformations to the images.	C310.3
12.	Sampling	Analysis of sampling techniques.	C310.4
13.	Pulse Code Modulation	To perform pulse code modulation and demodulation.	C310.4
14.	Digital Modulation Techniques	Analysis of digital modulation techniques.	C310.4
15.	Error Control Coding	Analysis of effect of various Data Encoding and Decoding Techniques on BER of digital communication systems.	C310.4

Evaluation Criteria

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

Project based learning: Students in group sizes of two-three will realize any one application of machine learning using Python programming.

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. UNPINGCO: Python for Signal Processing, Springer International Publishing Switzerland, 2014.
2.	M. WICKERT: Signal Processing and Communications: Teaching and Research Using IPython Notebook, In Proc. of the 14th python in science conf., (scipy. 2015).
3.	B. P. LATHI: Modern Digital and Analog Communication System: Python textbook Companion, Oxford University Press Inc.

Detailed Syllabus

Lecture-wise Breakup

Course Code	18B11EC312	**Semester** Odd **(specify Odd/Even)**	**Semester** 5th **Session** 2020 -2021 **Month from** August-December
Course Name	Electromagnetic Field Theory		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Ashish Gupta, Vishal Saxena
	Teacher(s) (Alphabetically)	K. Nisha, Neetu Joshi, Raghvenda Kumar Singh, Reema Budhiraja,

COURSE OUTCOMES		**COGNITIVE LEVELS**
C312.1	Recall concepts of vector calculus to solve complex problems and relate among different coordinate systems. Explain the basic principles of electrostatics and magnetostatics and relate the electric and magnetic fields using Maxwell's Equations.	Understanding Level (C2)
C312.2	Illustrate the propagation of electromagnetic waves in different medium and their reflection and transmission parameters. Distinguish among different wave polarizations.	Applying Level (C3)
C312.3	Estimate the current, voltage and power for the different types of transmission lines, determine reflection parameters. Demonstrate the Waveguide theory, Wave equations, and evaluate different waveguide parameters.	Evaluating Level (C5)
C312.4	Classify and compare the different parameters associated with the antenna and also interpret the radiation mechanism.	Understanding Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introductory material	Review of scalar, vector fields and coordinate systems (cylindrical and spherical coordinate) Electrostatic and Magneto static Fields	8

2.	Maxwell's Equations	Inconsistency of Amperes law, Continuity equation, Displacement current, Maxwell's equations, Boundary conditions.	4
3.	Electromagnetic Waves	Wave propagation in free space, Conductors and dielectrics, Polarization, Plane wave propagation in conducting and non conducting media, Phase velocity, Group velocity; Reflection at the surface of the conductive medium, Surface Impedance, Depth of penetration.	11
4.	Poynting Vector and Power	Poynting theorem, Poynting Vectors and power loss in a plane conductor.	2
5.	Transmission Lines	Transmission line equations, characteristic impedance, open and short circuited lines, standing wave and reflection losses. Impedance matching.	7
6.	Wave guides	Rectangular wave guides Modes in rectangular coordinates, characteristics, power transmission and losses.	6
7.	Radiation and Antennas	Scalar and vector potentials. Radiation from a current filament, Antenna characterstics, radiation pattern, radiation intensity, directivity and power gain.	4
		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.	M.N.O. Sadiku, S.V. Kulkarni, *Principles of Electromagnetics*, Oxford Press, 6th Edition, 2016.
2.	W. H. Haytt, J.A. Buck, M. J. Akhtar, *Engineering Electromagnetics*, McGraw Hill Education, 8th Edition, 2014.
3.	S. Salivahanan, S. Karthie, *Electromagnetic Field Theory*, McGraw-Hill Education, 2nd Edition, 2019.

4.	C.A. Balanis, Advanced Electromagnetics, Wiley Publishers, 2nd Edition, 2012.
5.	S.C. Mahapatra, S. Mahapatra, *Principles of Electromagnetic*, McGraw Hill Education, 2nd Edition, 2015.
6.	A.R. Harish, M.Sachidananda, aAntennas and Wave Propagation, Oxford University Press, 2015.

Detailed Syllabus

Lab-wise Breakup

Course Code	**18B15EC313**	**Semester: Odd**	**Semester: Vth Session** 2020 **Month from: July-December**
Course Name	**Embedded Systems and IOT Lab**		
Credits	1	**Contact Hours**	2 per week

Faculty (Names)	**Coordinator(s)**	Dr. Gaurav Verma
	Teacher(s) (Alphabetically)	Mr. Abhay Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	**Recall** the basic of digital electronics and relate its use in microprocessors and microcontrollers.	Remembering (Level I)
CO2	**Relate** the architecture of Microprocessors and Microcontrollers and its requirements in the area of embedded system and IOT with the help of algorithm.	Understanding (Level II)
CO3	**Apply** the skills and proficiency in the programming to demonstrate the use of instructions in microprocessors, microcontrollers and IOT Devices.	Applying (Level III)
CO4	**Analyze** the use of assemblers, cross compilers and real time hardware to program the microprocessors, microcontrollers, IOT boards and achieve the real time solutions to the problem.	Analyzing (Level IV)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1. MS, RA	8085 Microprocessors	To perform addition and subtraction of two 8-bit numbers using 8085 microprocessor.	1,2,3
2. MS, RA	8085 Microprocessors	To perform multiplication & division of two 8-bit numbers using 8085 microprocessor.	1,2,3
3.	8085	To find out the smallest & largest number in an array of 'N' 8-bit	1,2,3

	Microprocessors	numbers using 8085 microprocessor.	
4. RS	8051 Microcontrollers	Familiarization with 8051 Software Tools through examples of: a. LED Blinking. b. Varying square wave generation on any pin (with and without timers).	2,4
5. RS	8051 Microcontrollers	Design a token display system that has a seven segment display and switches. Whenever any switch is pressed the corresponding number is displayed on the segment.	3,4
6. GV	8051 Microcontrollers	Design a traffic light controller system that has three LEDs – RED, YELLOW, GREEN. The sequence in which the LEDs are turned on is as follows: RED for 10 count, YELLOW for 5 count, GREEN for 10 count. Interface a light-dependent resistor (LDR) to select manual and automatic mode using interrupt.	3,4
7. GV	8051 Microcontrollers	Display a) JIIT on LCD b) Sum of two 8 bit numbers on LCD.	3,4
8.	8051 Microcontrollers	Establish the serial communication between PC and microcontroller using RS232 protocol to send and receive the data.	3,4
9.	8051 Microcontrollers	Interface a DC motor and two IR sensors with the microcontroller. The IR sensors are used to control the direction of rotation of the motor.	3,4
10. ABY, Alok	Microcontrollers	Design an IOT based system to sense the humidity and temperature using DHT11 sensor and send it to cloud.	3,4
11. ABY, Alok	Microcontrollers	Design an IOT based system using microcontroller for controlling of home appliances using or ESP8266.	3,4
12.	Microcontrollers	Design a RFID based attendance system using LCD and microcontroller.	3,4
13.	Microcontrollers	Controlling of different household devices using an Android based application through bluetooth communication and microcontroller.	3,4
14.	Microcontrollers	Design a DTMF based wireless system using microcontroller for controlling of home appliances.	3,4

Evaluation Criteria	
Components	**Maximum Marks**
Viva 1(Mid Sem Viva)	20
Viva 2(End Sem Viva)	20
Assessment Components	20
Attendance	15
Lab Record	15
Virtual Lab Exps.	10
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.	Manish k. Patel, "The 8051 Microcontroller Based Embedded Systems", 1st Edition, McGraw Hill Education, 2014.
2.	Divyah Bala, ESP8266: Step by Step Tutorial for ESP8266 IOT, Arduino Nodemcu Dev Kit, 2018.

Detailed Syllabus

Subject Code	15B17CI578	**Semester:** ODD/ Special Sem	**Semester:** 5th **Session:** 2020-2021 **Month from:** Jun'21
Subject Name	Data Structures & Algorithms Lab		
Credits	0-0-1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Sarishty Gupta (62) , Akanksha Mehndiratta (128)
	Teacher(s) (Alphabetically)	Anita Sahoo, Krishna Asawa, Shardha Porwal, Shikha Jain, Sulabh Tyagi, Tribhuwan Tewari

COURSE OUTCOMES		**COGNITIVE LEVELS**
C371.1	Demonstrate the use of basic data structure and algorithm design such as Linked lists, Stacks, Queues, and others, for various applications.	Understanding Level (C2)
C371.2	Interpret the complexity of algorithms for given problems.	Understanding Level (C2)
C371.3	Apply Searching, Sorting, and Trees and use their properties for abstractions and defining modules for implementing functionalities.	Apply Level (C3)
C371.4	Examine case-study specific application of Heaps, Graphs, and Hashing methods.	Apply Level (C3)
C371.5	Model algorithmic solutions for small real-life problems using Backtracking, Greedy algorithm and Dynamic programming, Branch and Bound, and others	Apply Level (C3)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction & Algorithm Complexity	Conversion from one number system to another; Manipulation with arrays and strings, structures; Manipulation with a single Linked list of integers; Stacks and Queues Finding Complexity: Big O, Big Omega	CO1, CO2, Understanding Level (C2)

		Cost Analysis	
2.	Sorting, Searching & Trees	Doubly Linked List, Circular Linked List Multi-Linked Lists; Sorting, Searching, Application based. Binary Tree, Binary Search Trees, AVL Tree, Case-study: Priority Queue with Binary Trees, B Trees	CO1 Understanding Level(C2) CO3 Apply Level (C3)
3.	Heaps, Graph	Heaps, Directed and undirected graphs, weighted graphs, etc.	CO4 Apply Level (C3)
4.	Hashing & other Algorithms	Hashing, Backtracking, Branch and Bound, Greedy Algorithms, Dynamic Programming.	CO5 Apply Level (C3)

Evaluation Criteria

Components	**Maximum Marks**
Lab Test 1	20
Lab Test 2	20
Quiz 1	15
Quiz 2	15
Day-to-DayAssignments	15
Attendance	15
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)

Text Books

1	Data Structures and Algorithms in C++, Adam Drozdek, Cengage Learning; 4th edition (2012)
2	Data Structures and Algorithms Made Easy, by Narasimha Karumanchi, CareerMonk Publications; 5th edition (2016)
3	An Introduction to Data Structures with Application, by Jean-Paul Tremblay , Paul Sorenson, McGraw Hill Education; 2 edition (2017)

References

4	YedidyahLangsam, Moshe J., Augenstein and Aaron M. Tenenbaum: Data Structures Using C and C++, 2nd Edition, PHI, 2001
5	Kurt Mehlhorn: Data Structures and Algorithms 3, Springer, 1984
6	Dinesh P Mehta, Sartaj Sahani: Handbook of Data Structure and Applications, Chapman & Hall, 2004

7	Mark Allen Weiss: Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson
8	Sahni: Data Structures, Algorithms and applications in C++, Universities press, Hyderabad, 2005
9	Kruse, Tonso, Leung: Data Structures and Program Design in C, 2rd Edition, Pearson Education Asia, 2002
10	Weiss, Mark Allen: Data Structures and Algorithm Analysis in C/C++, 2nd Edition, Pearson Education Asia, 2003
11	Cormen et al: Introduction to Computer Algorithms, 2nd edition , PHI New Delhi 2003
12	Aho, Hopcraft, Ullman: Data Structures and Algorithms, Pearson Education Asia (Adisson Wesley), New Delhi, 2001
13	Standish: Data Structures in Java, Pearson Education Asia (Adisson Wesley), New Delhi, 2000
14	Knuth: The Art of Computer programming Vol I, Vol III, 2nd edition ,Pearson Education Asia (Adisson Wesley), New Delhi, 2002
15	Heileman: Data Structures, Algorithms and Object Oriented Programming, Tata Mc-Graw Hill, New Delhi, 2002
16	Sorenson and Tremblay: An Introduction to Data Structures with Algorithms, 2nd Edition, Tata Mc-Graw Hill, New Delhi, 2003

Detailed Syllabus

Course Code	20B12HS311	**Semester** Even **(specify Odd/Even)**	**Semester Session** 2020-21 **Month from** Jan - July
Course Name	Global Politics		
Credits	3(2-1-0)	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	Dr. Chandrima Chaudhuri

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C304-9.1	Demonstrate an understanding of the meaning and nature of globalization by addressing its political, economic, cultural and technological dimensions	Understanding (C2)
C304-9.2	Analyzing the significance of contemporary global issues	Analyze (C4)
C304-9.3	Analyze how the global politics shapes domestic politics	Analyze (C4)
C304-9.4	Demonstrate an understanding of the working of the global economy, its anchors and resistances offered by global social movements	Understanding (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Globalization: Conceptions and Perspectives	Political Dimension of globalization Globalization and Culture Technological Dimensions Debates on territoriality and sovereignty	6
2.	Global Economy	Its Significance and Anchors of Global Political Economy: IMF- history and India's benefit from its membership of IMF WTO- History and India's experience with WTO and reform proposals World Bank- history and role of world Bank in India Rise of TNCs and role of TNCs in globalization Global resistances (Global Social Movement and NGOs)- their nature and characteristics , prominent movements and their impact	8
3.	Contemporary Global Issues-I	Ecological Issues: historical overview of international environmental agreements-UNSCD, Paris agreement, climate change- Copenhagen summit to post Copenhagen summit policies of India, climate change and global initiatives	8

		global commons debate Proliferation of Nuclear Weapons-history of nuclear proliferation, threat of proliferation with increase in globalization	
4.	Contemporary Global Issues-II	International Terrorism: globalization and global terrorism, impact of terrorism on globalization, role of non-state actors and state terrorism; the US and war on terrorism Migration and Human Security- globalization, violent extremism and migration; new global regime	6
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Quiz, Project)
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.	C. Hay, Ed. *New Directions in Political Science: Responding to the Challenges of an Interdependent World.* New York, USA: Palgrave Macmillan Education, 2010
2.	D.Held& A. McGrew, *Globalization/Anti-globalization: Beyond the Great Divide*. Cambridge, UK: Polity Press, 2007
3.	F. Halliday, "Terrorism in Historical Perspective"., *Open Democracy*. 22 April, 2004 [Online] Available: http://www.opendemocracy.net/conflict/article_1865.jsp
4.	J. Baylis and S. Smith, Ed.*The Globalization of World Politics: An Introduction to International Relations*. Oxford, UK: Oxford University Press, 2017
5.	L.Gordon and S. Halperin, "Effective Resistance to Corporate Globalization" in *Contesting Global Governance,* R.O'Brien, A.M. Goetz, J.C. Scholte &M.Williams. Cambridge, UK: Cambridge University Press,2000

Detailed Syllabus
Lecture-wise Breakup

Course Code	**20B16CS326**	**Semester EVEN**	**Semester** VI **Session** 2020 -2021 **Month from JAN-JUN**
Course Name	Front End Programming		
Credits		**Contact Hours**	0-0-2 (2 hrs per week)

Faculty (Names)	**Coordinator(s)**	Dr. Shailesh Kumar
	Teacher(s) (Alphabetically)	Ms. Kritika Rani, Dr. Shailesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-11.1	Demonstrate new technologies by applying foundation paradigms	Understanding [Level 2]
C305-11.2	Build strong foundations for basic front end tools & technologies thereby making them understand the application development lifecycle.	Apply [Level 3]
C305-11.3	Develop elegant and responsive Front-end by leveraging latest technologies	Apply [Level 3]
C305-11.4	Explain activity creation and Android UI designing	Understanding [Level 2]
C305-11.5	Develop an integrated mobile application to solve any complex real time problem	Create [Level 6]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Object Oriented Programming Concepts	Objects, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism	1
2.	Introduction to basic front end techniques	HTML 5, CSS 3, Javascript, jquery, bootstrap	3
3.	Java Fundamentals	Decision Making, Loop Control, Operators, Array, String, Overloading, Inheritance, Encapsulation, Polymorphism, Abstraction	2
4.	Advanced Front End Programming Concepts	Storing and retrieving data, Python Programming Concepts, Python for developing Android Application.	2
5.	Designing Android Application	Android development lifecycle, Learning UI and layout, controller, component, Directives, Services & views.	3
6.	Android with Database	Data base Application Development	2
7.	Privacy & Security Issues	Security Issues with Android Platform	1
		Total number of Lectures	**14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Semester Examination	30
End Semester Examination	40
TA	30 (**Attendance-10, Assignments/ Class Test/ Quiz/ LAB Record -05, Project -15**)
Total	**100**

Project based learning: In this subject students will learn the latest front end technology. After completing the subject, each student in a group of 3-4 will be able to create a mobile application.

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

Reference Books:	
1.	Schildt, H. (2014). Java: The Complete Reference. McGraw-Hill Education Group.
2.	Mughal, K. A., & Rasmussen, R. W. (2016). A Programmer's Guide to Java SE 8 Oracle Certified Associate (OCA). Addison-Wesley Professional.
3.	Gaddis, T., Bhattacharjee, A. K., & Mukherjee, S. (2015). Starting out with Java: early objects. Pearson.
Text Books:	
4.	Duckett, J. (2014). Web Design with HTML, CSS, JavaScript and jQuery Set. Wiley Publishing.
5.	Shenoy, A., & Sossou, U. (2014). Learning Bootstrap. Packt Publishing Ltd.
6.	Lee, W. M. (2012). Beginning android for application Development. John Wiley & Sons.
7.	Hardy, B., & Phillips, B. (2013). Android Programming: The Big Nerd Ranch Guide. Addison-Wesley Professional.

DETAILED SYLLABUS AND EVALUATION SCHEME

CourseCode	21B12HS311	**Semester:EVEN** **(specify Odd/Even)**	**Semester:VI Session:2020-21** Month from: Jan-June
CourseName	Development Issues and Rural Engineering		
Credits	03	ContactHours	2-1-0

Faculty(Names)	**Coordinator(s)**	Dr.Amandeep Kaur
	Teacher(s) **(Alphabetically)**	Dr. Amandeep Kaur (amandeep.kaur@mail.jiit.ac.in)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-10.1	Understand the concept, philosophy and determinants of rural development	Understanding Level-(C2)
C304-10.2	Assess public policies related to rural development	Analyze Level –(C4)
C304-10.3	Explain the role of local self-governance in planning and development of rural areas.	Understanding Level-(C2)
C304-10.4	Analyze the impact of recent policy changes and schemes on rural development.	Analyze Level –(C4)
C304-10.5	Evaluate the issue and challenges of through possible determinants of rural development.	Evaluation Level-(C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Rural Development: An Introduction	Rural Development Philosophy, Concepts, Principles, Traditional and Modern Concept of Development, Trends and Pattern of micro as well as macro indicators of Rural Development.	4
2.	Public Policies and Rural Development	Policies related to Employment Generation, Poverty Reduction, Skill Development and, Infrastructure such as MGNGEGA, DDUGKY, AtamNirbhar Bharat rojgaryojna and schemes related to MSMEs etc.	6
3.	Rural Development Administration and Panchayat Raj Institutions	Rural Development administration: Panchayat Raj System (73rd Amendment Act), functions of Panchayat Raj System, Financial Distribution of Resources in Rural India through Panchayat Raj System, merits and demerits of Panchayat system, Ways to strengthen the existing system by overcoming the flaws.	6
4.	Rural Development Issues and Challenges	Issues and challenges of Rural development: Employment in line with sectoral distribution (GDP and Employment), Povertyand Migration Issue, Rural and Urban Consumption and Production Linkages.	7
5.	Recent Advancements and changes	Recent packages and schemes implemented in Rural India, Budget Allocation for Rural Development -2019-20 and 2020-21: For Employment Generation, poverty reduction,	5

		infrastructure and MSMEs.	
Total number of Lectures			**28**

Evaluation Criteria

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

Project-based Learning: Students are required to collect the data related to different indicators of rural development (related to agriculture, health and education infrastructure, literacy levels, population density, poverty, employment etc.). They also need to check the compatibility of data (data mining and data refining process) and then analyse the contribution of these indicators in rural development of particular state/country as whole. Moreover, they are required to analyse the extent of progress and failure of programmes/schemes implemented in rural areas for poverty reduction, employment generation and MSMEs. Collecting information and analysing the data related to development indicators and policies will upgrade students'knowledge regarding the development issues and strengthen their skills to tackle multiple data handling and measuring issues.

Recommended Reading material:

1.	**Singh, Katar.** Rural Development: Principles, Policies and Management *(3e).*2009
2.	**Coke, P., Marsden, T. and Mooney, P.** Handbook of Rural Studies. Sage Publications, 2006
3.	**Todaro, M.P**., **Stephen C. Smith,** Economic Development, Pearson Education, 2017
3.	**Ahuja, H. L.**, Development Economics, S Chand publishing, 2016
4.	**Musgrave, R. A., Musgrave, P. B.,** Public Finance in Theory and Practice, McGraw Hill Education,2017

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS611	**Semester EVEN** (specify Odd/Even)	**Semester VI Session**2020-2021 **Month from: Jan - June**
Course Name	Marketing Management		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	Dr Swati Sharma
	Teacher(s) (Alphabetically)	Dr Praveen Sharma, Dr Swati Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-7.1	To illustrate the fundamentals of marketing, marketing environment and market research	Understanding Level (C2)
C304-7.2	To model the dynamics of marketing mix	Applying Level (C3)
C304-7.3	To demonstrate the implications of current trends in social media marketing and emerging marketing trends.	Understanding Level (C2)
C304-7.4	To appraise the importance of marketing ethics and social responsibility	Evaluating(C5)
C-304-7.5	To conduct environmental analysis, design business portfolios and develop marketing strategies for businesses to gain competitive advantage.	Creating (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Understanding New Age Marketing**	Defining Marketing For 21st Century The importance of marketing and marketing's role in business and society. Introduction to Digital Marketing. Online Communication Tools. The Social Media-Conversations, Community and Content. Affiliate Marketing and Mobile Engagement. The Digital Campaigns	5
2	**Marketing Environment and Market Research and insights**	Internal and external forces impacting marketers. Marketing and Customer Value. Gathering Information and Scanning the environment. Company's Micro and Macro Environment Responding to the Marketing Environment	3
3	**Strategic Planning and the marketing**	Explore the impact of social forces on marketing actions. Describe how technological change affects	5

	Process	marketing. Designing the business Portfolio Discuss the Strategic Planning Process and Strategic Marketing Process.	
4	**Consumer and Business Buyer Behaviour**	Consumer Markets and consumer buyer behaviour. The buying decision process. Business Markets and business buyer behaviour. Discuss the modern ethical standards.	5
5	**Branding**	Brand Image, Identity and Association. Product brands and Branding decisions. Product line and mix decisions. Consumer Brand Knowledge. New Product Development and Product life cycle strategies.	4
6	**Pricing products: Pricing considerations and strategies**	Factors to consider when setting prices. New product pricing strategies. Product mix pricing strategies. Price adjustments and changes.	4
7	**The New Age Social Marketing**	Ethics and social responsibility in marketing. Ethical behavior in business. Ethical decision making. Social forces affecting marketing. Impact of culture on marketing. Discuss modern ethical standards. Importance of marketing in CSR and business sustainability.	2
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Viva, Oral Quiz)
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.	Kotler, Philip and Gary Armstrong, Principles of Marketing, 10th Edition, New Delhi, Pearson Education, 2004.
2.	Darymple, Douglas J., and Leonard J. Parsons, Marketing Management: Text and Cases, 7thEdition, John Wiley &Sons (Asia) Pte. Ltd., 2002.
3.	Kotler, Philip., and Kevin Lane Keller, Marketing Management, 12th Edition, New Delhi, Pearson Education, 2006.

4.	Winer, Russell S., Marketing Management, 2nd Edition, Prentice Hall,2003.
5.	Hollensen, S. (2019). Marketing management: A relationship approach. Pearson Education.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS612	Semester:Even	**Semester VI Session** 2020 -2021 **Month from** Jan2021 to June 2021
Course Name	Social Media and Society		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Shirin Alavi
	Teacher(s) (Alphabetically)	Dr. Shirin Alavi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-1.1	Infer the implications of digital change, and the concept of social media and e-marketing in the context of the changing marketing landscape	Apply Level(C3)
C304-1.2	Elaborate the implications of cyber branding and digitization on online marketing mix decisions	Create Level (C6)
C304-1.3	Develop specific models related to social media and social media analytics	Create Level (C6)
C304-1.4	Evaluate concepts related to Search Engine Marketing, Customer Centric Web Business models and Web Chain Analysis	Evaluate Level(C5)
C304-1.5	Illustrate the new age marketing practices	Understand Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction, Individuals Online and Rules for engagement for social media	What is social media marketing, the importance of social media for influencing target audience, Patterns of internet usage, Internet user demographics, The Behavioural Internet, E-Marketing, The Virtual world, the changing Marketing Landscape, E -Marketing-Strengths and Applications, Online Marketing Domains, Digital Marketing Optimization, The Need for Digital Engagement	4
2.	The Online Marketing Mix	The Online Marketing Mix, Consumer Segmentation, Consumer Traits, Consumers and Online Shopping Issues, E-Product, E-Place, E-Price, E-Promotion, Website Characteristics affecting online purchase decision.	3
3.	The Online Consumer and Social Media	The Digital Ecosystem, Online Consumer Behavior, Cultural Implications of key web characteristics, Models of website visits, Web 2.0 and Marketing, The collaborative web, Network evolution, Network science, Marketing with networks, Metcalfe's law, Netnography, Social Media Model by McKinsey, Social Media Tools-Blogs, Wikis, Online Communities, Facebook, Twitter, You Tube, Flickr, Microblogging.	4

4.	Online Branding and Traffic Building	Cyberbranding, Online brand presence and enhancement, The Digital Brand Ecosystem, Brand Experience, Brand Customer Centricity, Brands and Emotions, The Diamond Water paradox, Internet Traffic Plan, Search Marketing Methods, Internet Cookies and Traffic Building, Traffic Volume and quality, Traffic Building Goals, Search Engine Marketing, Keyword Advertising, Keyword value, Internet Marketing Metrics, Websites and Internet Marketing.	4
5.	Web Business Models, Social Media Strategy, Social Media Marketing Plan	The value of a Customer Contact, Customer Centric Business Management, Web Chain of Events, Customer Value Analysis and the Internet, Business Models, Revenue Benefits, Value Uncertainty, Purchase Importance, Define a social media plan, explain the social Media marketing planning cycle, list the 8C's of strategy development.	4
6.	Market Influence analytics in a Digital Ecosystem	Engagement Marketing through Content Management, Online Campaign Management, Consumer Segmentation, Targeting, and Positioning using Online Tools, Market Influence Analytics in a Digital Ecosystem, The Digital Ecosystem, Knowledge as a value proposition, CGM and Consumer behavior, The value of the power of influence, Amplifying Social Media Campaigns.	4
7.	The Contemporary Digital Revolution and its impact on society	Online Communities and Co-creation, The fundamentals of online community management strategies, The World of Facebook, The Future of Social media Marketing—Gamification and Apps, Game based marketing The world of Apps, Apps and the Indian Diaspora	3
8.	Integrating Mobile into Social Media Marketing	Types of Mobile Marketing, Progression of the mobile as a Marketing channel, some Indian mobile marketing campaigns, Impact of Social Media on government, the economy, development, and education	2
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project,Viva and Attendance)
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.	Digital Marketing, Chaffey, D., & Ellis-Chadwick, F, Seventh Edition, Pearson (U.K) 2019.
2.	Digital Marketing, Seema Gupta, First Edition, Mc Graw Hill Education (India) Private Limited ,2018
3.	Social Media Marketing A Strategic Approach, Melissa Barker, Donald Barker, Second Edition Cengage Learning ,2017.

4.	Internet Marketing: A Practical Approach in the Indian Context, Maity, Moutusy, First Edition Oxford University Press,2017.
5.	Fundamentals of Digital Marketing, Puneet Singh Bhatia, Second Edition, Pearson,2017.
6.	Digital Marketing, Vandana Ahuja, First Edition, Oxford University Press, 2015
7.	Social Media Marketing, Liana “Li” Evans, First Edition, Pearson, 2011.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**21B13HS311**	**Semester Even (specify Odd/Even)**	**Semester VI Session 2020 -2021 Month from Jan 2021-June 2021**
Course Name	**Poverty, Inequality and Human Development**		
Credits	**2**	**Contact Hours**	**1-0-2**

Faculty (Names)	**Coordinator(s)**	Dr Akarsh Arora
	Teacher(s) (Alphabetically)	Dr Akarsh Arora

COURSE OUTCOMES		COGNITIVE LEVELS
C305-13.1	Understand the concepts and dimensions of Poverty, Inequality and Human Development	Understand (Level 2)
C305-13.2	Evaluate different approaches to measure Poverty, Inequality and Human Development	Evaluate (Level 5)
C305-13.3	Apply an analytical framework to understand the factual or proximate causes or determinants of Poverty and Inequality	Apply (Level 3)
C305-13.4	Analyze the role of public policy and affirmative action to tackle Poverty and Inequality and strengthen Human Development.	Analyze (Level 4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Concepts and Dimensions	Concepts and Dimensions of Poverty, Inequality and Human Development	3
2.	Measurement	Measurement of Poverty and Inequality: Steps and Axioms. Steps to calculate Human Development	4
3.	Data Sources	Census Data, Unit level Household Data, Geospatial Data, Satellite Image Data	2
4.	Determinants	Determinants/ Factors: Demographics, Household, Individual, and Macroeconomic variables Introduction to Stata, Regression- Linear and Binary models	3
5.	Public Policies and Affirmative Actions	Review of different public policies of GOI to eradicate poverty. Role of education and health care policies to strengthen human development	2
		Total number of Lectures	**14**

Module No.	Title of the Module	List of Experiments/Activities	CO
1.	Concepts and Dimensions	Practical sessions on different dimensions of poverty and inequality.	CO1, CO2
2.	Measurement	Practical sessions on STATA software to measure poverty, inequality, and human development.	CO1, CO2
3.	Data Sources	Practical sessions on key survey issues and problems while collecting data on poverty, inequality and human development.	CO2, CO3
4.	Determinants	Practical sessions on STATA software to find and interpret the determinants of poverty using regression analysis.	CO2, CO3
5.	Public Policies and Affirmative Actions	Practical sessions on the impact of different Government of India policies and programmes on poverty, inequality and human development.	CO3, CO4

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term	30 (Project)
End Term	40 (Written)
TA	30 (Class Mock Activities, Assignment, Quiz)
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. Banerjee and E. Duflo, *Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty*. New York: Public Affairs, 2011
2.	J. Haughton and S. R. Khandker, *Handbook on Poverty and Inequality*. Washington, DC: The World Bank, 2009.
3.	A. Tarozzi and A. Deaton, "*Using census and survey data to estimate poverty and inequality for small areas*," The review of economics and statistics, vol. 91, no. 4, pp. 773-792, 2009.
4.	D. Ray, *Development Economics*, 19 ed. New Delhi, India: Oxford University Press, 2012
5.	A. Sen, *On Economic Inequality*. Oxford: Clarenson Press, 1997.
6.	S. Alkire and M. E. Santos, "*Acute Multidimensional Poverty: A New Index for Developing Countries*," OPHI WORKING PAPER. 2017.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH633	**Semester:Even**	**Semester:**VI **Session:**2019 -2020 **Month: January to June**
Course Name	Photovoltaic Techniques		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr. B. C. Joshi -JIIT 62 Dr. Prashant Chauhan – JIIT 128
	Teacher(s)	Dr. B. C. Joshi Dr. Prashant Chauhan

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Classify various type of renewable energy sources and explain working of photovoltaic device.	Understand Level (Level 2)
CO2	Demonstrate the use of basic principles to model photovoltaic devices	Understand Level (Level 2)
CO3	Identify challenges and apply strategies to optimize performance of various type of solar cells	Apply Level (Level 3)
CO4	Analyze Solar PV module, mismatch parameter and rating of PV module	Analyze Level (Level 4)
CO5	Evaluate the performance of various stand-alone PV systems with battery and AC and DC load	Evaluate Level (Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review	Energy issues, conventional energy sources, Renewable energy sources, Solar Energy	02
2.	Solar cell fundamentals	Fundamental of semiconductor, charge carriers and their motion in semiconductors, carriers generation and recombination, p-n junction diode, introduction to solar cell, p-n junction under illumination, Current-Voltage (I-V), open circuit voltage (V_{OC}), short circuit current (I_{SC}) Maximum power, current and voltage and Efficiency, Quantum Efficiency	10
3.	Design of solar cells	Upper limits of cell parameters, loses in solar cell, solar cell design, design for high I_{sc}, V_{oc}, FF, solar simulators	08
4.	Solar cell technologies	Production of Si, Si wafer based solar cell technology, thin film solar cell technologies (CIGS, microcrystalline and polycrystalline Si solar cells, amorphous Si thin film solar cells), multijunction solar cells, Emerging solar cell technologies: organics solar cells, Dye-sensitized solar cell (DSC), GaAs solar cell	12
5.	Photovoltaic system	PV system: Introduction, Stand-alone system, Grid connected system, Hybrid system, Designing of PV system, Balance of system- BOS (Inverters, Controllers, Wiring, Batteries) Photovoltaic Cells, Estimating PV system size and cost,	08

		Photovoltaic safety.	
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz+Attendance+PBL+class performance)
Total	**100**

PBL: Students are given the task to design a PV system for the water pump and home appliances. This design can help students in understanding the basic knowledge of PV systems, wiring, load calculation, battery sizing, PV panels, etc. This can help students in getting jobs in the renewable energy sector.

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

1.	Tom Markvart and Luis Castaner, "Solar Cells: Materials, Manufacture and Operations," Elsevier, 2006
2.	Stuart R. Wenhem, Martin A. Green, M.E. Watt, "Applied Photovoltaics," Earthscan, 2007
3.	Jenny Nelson, "The Physics of Solar Cells" Imperial college press," 003.Aatec publications, 1995.
4.	C S Solanki, Solar Photovoltaics, PHI

Detailed Syllabus

Course Code	16B1NPH636	**Semester: Even**	**Semester: VI Session** 2020 -2021 **Month from: January to June**
Course Name	**Medical & industrial applications of nuclear radiation**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Manoj Tripathi
	Teacher(s) (Alphabetically)	Dr. Manoj Tripathi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C302-11.1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
C302-11.2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
C302-11.3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
C302-11.4	Analyze different radiocarbon dating mechanisms and processes.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Nucleus, Radioactivity & Dating	Structure of matter**;** Nucleus: Nuclear Size, Structure and forces; Binding energy and Nuclear stability, mass defect; Nuclear reaction: Fission, Fusion, chain reaction. Nuclear fusion in stars, Formation of basic elements: proton-proton chain, CNO cycle, Hydrostatic equilibrium; Applications: atom bomb, hydrogen bomb, nuclear power plants, Nuclear reactor problems, precautions. **ii)** Radioactive decay, kinetics of radioactive decay, Types of radioactive decay and their measurement, Half life, decay constant, Population of states, Production of radionuclides. Radioactive dating, Radiocarbon dating: Formation, mechanism of dating, carbon cycle, radiocarbon clock and applications, advantages, disadvantages, precautions; Other dating techniques, protein dating, accuracy in dating;	17
2.	Radiation and matter interactions	Dosimetry and applications: Interaction of Radiation of matter: Biological effects of radiations; dosimetry, working principles, Tools and radiotherapy, Doses,	09

		Radioisotopes, Radiotracers;	
3.	NMR and MRI	Nuclear Magnetic Resonance: General Introduction to Magnetic Resonance, Reference Frame; RF Pulses, Larmor precision, Basic principles of NMR & ESR Spectroscopy, Nuclear shielding, Chemical shifts; Couplings, Nuclear Imaging; 1D,2D, 3D Images, Application of NMR in medical industry as MRI, working MRI, Types of differen MRI, Applications of NMR in quantum computation;	09
4.	Nuclear Medicine and Nuclear Imaging	Nuclear Medicine and Nuclear imaging techniques, preclinical imaging, detector designing, photon counting, Medical imaging using $\beta+\gamma$ coincidences, SPECT AND PET: Radiation tomography, applications;	05
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
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.	Basic Sciences of Nuclear Medicine; Magdy M K halil, Springer
2.	Physics and Radibiology of Nuclear Medicine; Gopal B Saha, Springer
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	Radionuclide Techniques in Medicine, JM McAlister (Cambridge University Press, 1979).
5.	Nuclear Physics; S.N.Ghosal

Course Description

Course Code	16B1NMA633	**Semester :**Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Statistics		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-1.1	make use of measures of central tendency, dispersion, skewness and, kurtosis for description and visualization of population data.	Applying Level (C3)
C302-1.2	apply correlation and regression in statistical analysis of data.	Applying Level (C3)
C302-1.3	explain sampling theory and its distributions.	Understanding Level (C2)
C302-1.4	explain the concepts and properties of estimation theory.	Understanding Level (C2)
C302-1.5	apply sampling and estimation theory to find the confidence interval.	Applying Level (C3)
C302-1.6	analyze small and large sample data by using the test of hypothesis.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Descriptive Statistics	Graphical representation such as histogram, frequency polygon, AM, GM, HM, median, mode, measures of dispersion, skewness and kurtosis such as central and non-central moments, population variance, β, γ coefficient, Box and Whisker plot.	8
2.	Correlation and Regression Analysis	Scatter diagram. Karl Pearson's and Spearman's rank correlation coefficient, regression lines, regression coefficient and their properties.	5
3.	Sampling and Sampling Distributions	Populations and Sample, random sample, statistics, sample moments, law of large numbers, central limit theorem, distribution of sample mean and sample variance, MGF, Chi-square distribution, F-distribution, Student's *t* distribution.	7
4.	Parametric Point Estimation	General concept of point estimation, methods of moments and maximum likelihood for finding estimators, unbiasedness, consistency, efficiency, UMVUE, Cramer-Rao inequality, sufficiency, factorization theorem, completeness, Rao-Blackwell theorem.	10
5.	Parametric Interval Estimation	definition of confidence interval, pivotal quantity, confidence interval for mean, variance, difference of means and difference of variances for small and large samples.	5
6.	Hypothesis Testing	The basic idea of significance test. null and alternative hypothesis, type-I and type II errors, testing of small and large samples for mean, variance, difference in means, and difference in variances.	7
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**

Project based learning: Students in a group of 4 will collect sample data set and make simple regression models. They will validate the model by hypothesis testing. By this students will be able to make simple linear regression models and validate it.

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.	**Biswas and Srivastava**, A Textbook, Mathematical Statistics Ist Edition, Narosa Publishing House, New Delhi.
2.	**W. Feller**, Introduction to Probability Theory and its Applications Vol. I and II. Wiley Eastern-Ltd, 1971
3.	**V. K.Rohatgi**, An Introduction to Probability Theory and Mathematical Statistics Wiley Eastern, 1984
4.	**R. V. Hogg, A. T. Craig,** Introduction to Mathematical Statistics, McMillan, 1971
5	**AM. Mood**, **F. A. Graybill, and D. C. Boes**, Introduction to the Theory of Statistics McGraw Hill, 1974
6.	**Des Raj & Chandak**, Sampling Theory, Narosa Publishing House, 1998.
7.	**Sheldon Ross**, A First Course in Probability, 10th edition, Pearson Education Asia, 2018.
8.	**Meyer, P.L**, Introductory Probability and Statistical Applications Addison-Wesley Publishing Company, 1965.

Course Description

Course Code	20B12MA311	**Semester** Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Applicational Aspects of Differential Equations		
Credits	**3**	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-2.1	solve ordinary differential equations in LCR and mass spring problems.	Applying Level (C3)
C302-2.2	explain orthogonality of functions and apply it to solve Sturm-Liouville boundary value problems.	Applying Level (C3)
C302-2.3	apply matrix algebra to find the solution of system of linear differential equations.	Applying Level (C3)
C302-2.4	formulate and solve first and second order partial differential equations.	Applying Level (C3)
C302-2.5	evaluate solution of differential equations arising in engineering applications.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic Theory of Ordinary Differential Equations	Existence and uniqueness of solutions, applications to ordinary differential equations in LCR and mass spring problem.	10
2.	Sturm-Liouville Boundary Value Problem	Sturm-Liouville problems, orthogonality of characteristic functions, the expansion of a function in a series of orthogonal functions, trigonometric Fourier series.	10
3.	Matrix Methods to solve ODE's	Matrix method for homogeneous linear systems with constant coefficients.	4
4.	Basic Theory of Partial Differential Equations	Solution of first order equations: Lagrange's equation, Charpit's method, higher order linear equations with constant coefficients.	4
5.	Applications of Differential Equations	Fourier integrals, Fourier transforms, solution of partial differential equations by Laplace and Fourier transform methods, applications of differential equations in mechanics.	14
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.	**Ross, S.L.,** Differential Equations, 3rd Ed., John Wiley & Sons, 2004.
2.	**Jain, R.K. and Iyengar, S.R.K.,** Advanced Engineering Mathematics, 3rd Ed., Narosa Publishing House, 2012
3.	**Chandramouli, P.N.,** Continuum Mechanics, Yes Dee Publishing India, 2014.
4.	**Kreysizg, E.,** Advanced Engineering Mathematics, 10th Edition, John Wieley& Sons, Inc. 2013.

Course Description

Course Code	18B12MA611	**Semester** Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Operations Research		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-3.1	construct mathematical models for optimization problems and solve linear programming problems (LPP) using graphical and simplex method.	Applying Level (C3)
C302-3.2	apply two-phase, Big-M and dual simplex method for linear programming problems.	Applying Level (C3)
C302-3.3	make use of sensitivity analysis to linear programming problems.	Applying Level (C3)
C302-3.4	solve transportation, assignment and travelling salesman problems.	Applying Level (C3)
C302-3.5	apply cutting plane and branch & bound techniques to integer programming problems.	Applying Level (C3)
C302-3.6	examine optimality conditions and solve multivariable nonlinear problems.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Preliminaries	Introduction, Operations Research Models, Phases and Scope of O.R. Studies.	3
2.	Linear Programming Problems (LPP)	Convex Sets, Formulation of LPP, Graphical Solutions, Simplex Method, Big-M Method, Two Phase Method, Special Cases in Simplex Method.	8
3.	Duality and Sensitivity Analysis	Primal-Dual Relationship, Duality, Dual Simplex Method, Sensitivity Analysis.	8
4.	Transportation Problems	Introduction, Matrix Form, Applications, Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method. Degeneracy, Resolution on Degeneracy, Optimal Solution, Maximization TP Model.	5
5.	Assignment Problems	Definition, Hungarian Method, Traveling Salesmen Problems.	4
6.	Integer Linear Programming Problems	Pure and Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and Bound Method.	6
7.	Non Linear Programming	Introduction to NLP, convex functions and graphical solution, Unconstrained Problem, Constrained Problems - Lagrange Method for equality constraints, Kuhn-Tucker Conditions for inequality constraints, Quadratic Programming -Wolfe's Method	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**

Project based learning: Each student in a group of 4-5 will collect literature on transportation, assignment and

integer programming problem to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with afore mentioned topics.	
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.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2011.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**15B11EC613**	**Semester: Even**	**Semester: 6th Session:** **Month from: Jan-Jun**
Course Name	Control Systems		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Ruby Beniwal, Mr. Varun Goel
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Classify the open loop and closed loop control systems and construct mathematical model for physical systems.	Applying (Level III)
CO2	Solve complex systems through block diagram reduction method and signal flow graph technique.	Applying (Level III)
CO3	Determine transient response and steady state response of the systems using standard test signals.	Evaluating (Level V)
CO4	Analyze the stability of the system and select suitable controllers and compensators for linear time invariant system.	Analyzing (Level IV)
CO5	Apply time domain and frequency domain techniques to identify the stability of control systems.	Applying (Level III)
CO6	Solve continuous time and discrete time systems using state variable approach.	Applying (Level III)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Control System	Development of control systems, non feedback and feedback systems, negative feedback a means of automatic regulation, basic classification of control systems	3
2.	Modelling and Mathematical Representation of Systems	Block diagram simplification of continuous-time systems, Classification of system models, input – output description of systems, signal flow graph representation	8
3.	Time Domain Analysis and Design	Time domain response, steady state error and error coefficients, design considerations for second order systems, time domain response considerations for higher order systems. PID Controller	7
4.	Stability Analysis for continuous-time systems	Basic stability concept of linear systems, absolute stability criteria for continuous-time systems, relative stability Concepts	5
5.	Root Locus Method and Design in Time Domain	Fundamentals of Root Locus, construction of root loci, root contour diagram	6

6.	Frequency Response Analysis and Design	Bodes plot and Nyquist plot , Gain Margin & Phase Margin, stability analysis	7
7.	State Variable Approach to Time Domain Analysis	State variable representation of continuous-time systems; System Response and State Transition Matrix (STM); Applications of STM.	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance : 5 Marks, Quiz:10 Marks, Assignment: 10 Marks)
Total	**100**

Project Based Learning: Students will design simplify the continuous time systems. By determining time response of continuous time systems, application ability will be enhanced in students. Understanding of stability concept for continuous time systems, System Response and State Transition Matrix (STM) with applications of STM, provide basic concept of designing of control systems.

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.	I. J Nagrath and M. Gopal, Control Systems Engineering, Fifth edition, New age International, 5th Edition, 2009.
2.	Normal S. Nise,, Control Systems Engineering, 7th Edition, John Wiley,2014
3.	K.Ogata, Modern Control Engineering, 5th Edition, Prentice Hall, 2010

Detailed Syllabus
Lab-wise Breakup

Course Code	**15B17EC671**	**Semester** VI (Even) **(specify Odd/Even)**	**Semester** 6th **Session** 2020 -2021 **Month from** Jan.-June 2021
Course Name	**TELECOMMUNICATION NETWORKS LAB**		
Credits	1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Juhi Gupta
	Teacher(s) (Alphabetically)	Ajay Kumar, Juhi Gupta, Neetu Singh, Pankaj K. Yadav, Ruby Beniwal, Shradha Saxena

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO375.1	Learn about network simulator, and building/installing NS2 for conducting network simulation and summarizing OSI, TCP & UDP	**Level-2** (Understanding)
CO375.2	Set up and anlaysis of the wired and LAN networks and understanding UDP/TCP agents with CBR/FTP traffic source respectively	**Level- 4** (Analyzing)
CO375.3	To create and analyze the mobile ad-hoc network and heterogenous networks and routing algorithm.	**Level-4** (Analyzing)
CO375.4	To label and explain data trace file (.tr) of Wired, Wireless and LAN Networks and evaluating throughput in Wired networks (with and without errors).	**Level-5** (Evaluating)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to NS2 and Linux	1. (a) To learn about network simulator, and use NS2 for conducting network simulation including LINUX commands. (b) To learn installing NS2 in Fedora.	CO1
2.	OSI Model	2. (a) Introduction to OSI, TCP & UDP. (b) To set up a network with two nodes; link them with duplex link, 10ms propagation delay, 1Mbps rate and DropTail procedure. Use Agent UDP with CBR traffic source. 3. To set up a network with two nodes; link them with duplex link, 10ms propagation delay, 1Mbps rate and DropTail procedure. Use FTP over Agent TCP.	CO2
3.	Ethernet	4. To implement wired LAN connection in NS2	CO2
4.	Mobile Networks	5. To create a mobile ad-hoc network with 3 nodes in 500*400 topography with following initial positions and movements: Node 0 (5, 5) Node 1 (490,285) Node 2 (150,240) At t = 10, 0 moves towards (250,250) at 3m/sec. At t =15, 10 moves towards (45,285) at 5m/sec. At t =110, 100 moves towards (480,300) at 5m/sec.	CO3
5.	Wired-cum-Wireless Networks	6. To create a Heterogeneous Network (wired cum wireless network).	CO3
6.	Interpretation of	7. To interpret data trace file (.tr) of Wired, Wireless and	CO4

	Trace Files	LAN Networks.	
7.	Throughput Calculation and Error Analysis	8. Throughput calculation for TCP or UDP in Wired network. 9. To create a network with 4 nodes 0-2, 1-2, 2-3 with TCP from 0-3 and UDP from 1-3. Apply an error model on link 2-3 with error rate 0.2 and uniform distribution. Apply queue monitor on 2-3 link and interpret any five lines of qm.out file. 10. To create a network with 5 nodes, and apply uniform, exponential and constant error model with error rate 1% on 3 different links.	CO4

Project-Based Learning: NS2 provides an interactive and graphical platform for the simulation of wired-cum-wireless networks. The TCL programming to generate any telecommunication networks is taught to the students, allowing further to analyze the performance of the network in the presence and absence of any error due to the channel fading or interference.

Evaluation Criteria

Components	**Maximum Marks**
Mid-Sem Viva	20
Final Viva	20
Day-to-Day	60
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.	The ns Manual (formerly ns Notes and Documentation), http://www.isi.edu/nsnam/ns/ns-documentation.html
2.	W. Stallings, Data & Computer Communication, PHI
3.	B. A Forouzan, DATA COMMUNICATIONS AND NETWORKING, 4th Edition TMH
4.	A.S. Tanenbaum, Computer Networks, PHI

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**15B19EC691**	**Semester Even**	**Semester 6**th **Session** 2020-21 **Month from** January 21 to June 21
Subject Name	**Minor Project - 2**		
Credits	**2**	**Contact Hours**	**NA**

Faculty (Names)	**Coordinator(s)**	Neetu Singh, Raghvenda Kumar Singh,
	Teacher(s) (Alphabetically)	NA

COURSE OUTCOMES		**COGNITIVE LEVELS**
C351.1	Identifying, planning and initiation of the individual projects in the domain selected by them, respectively.	Applying Level (C3)
C351.2	Analyze the potential research areas in the field of Embedded Systems, Signal Processing, VLSI, Communication, Artificial Intelligence and Machine Learning/Deep Learning etc.	Analyzing Level (C4)
C351.3	Survey the available literature and gain knowledge of the State-of-Art in the chosen field of study.	Analyzing Level (C4)
C351.4	Evaluate the existing algorithms of the domain selected and improvise the algorithm so that it yields better results than the existing metrics.	Evaluating Level (C5)
C351.5	Design and implement a working model, using various hardware components, which works as a prototype to showcase the idea selected for implementation.	Creating Level (C6)

Evaluation Criteria

Components	**Maximum Marks**
Mid SemesterEvaluation	40
Final Evaluation	40
Report	20
Total	**100**

Detailed Syllabus
Lecture-wise
Breakup

Course Code	16 B19EC691	**Semester-** Even **(specify Odd/Even)**	**Semester -6 / Session 2020 -2021 Month from Jan to June**
Course Name	Renewable Energy		
Credits	2	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	ShivajiTyagi
	Teacher(s) (Alphabetically)	ShivajiTyagi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-4.1	Explain the need of renewable sources of energy, impact of renewable energy on environment, challenges in the electric grid, Smart Grid.	Understanding Level (C2)
C305-4.2	Analyze basics of Solar radiation and Solar photovoltaics, Balance of PV systems	Analyzing Level (C4)
C305-4.3	Analyze wind energy resource and designing of Wind Energy Generators	Analyzing Level (C4)
C305-4.4	Illustrate different biomass energy resources, and extraction of biomass energy	Understanding Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction**	Overview of energy use and related issues, major energy options, issues of supply and demand, energy conversions, global climate change issues, effects on ecology and biodiversity, status of renewable energy in India.	4
2.	**Solar Energy**	Fundamentals of Solar radiation, Solar Resource Assessment, Solar Photovoltaics, Balance of PV Systems, and Solar Thermal.	10
3.	**Wind Energy**	Wind resource, Basics of aerodynamics, Maximum power extraction from wind resource fundamental power equations, Basic design concepts of Wind Energy Generators	8

4.	**Biomass Energy**	Biomass resource, extracting biomass energy, landfill gas, waste to energy, energy balances and economics.	6
5.	**Electric Grid**	Basic operations, performance related issues, new developments and challenges in the electricgrid.	2
		Total number of Lectures	**30**

Project Based Learning: Students will be asked to do the analysis and designing of the solar cell for high efficiency using industry standard simulation tools and the development of the complete system.

Evaluation Criteria

Components	**MaximumMarks**
Mid-Term	30
EndSemesterExamination	40
TA	30
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.	Solanki, C.S., *Solar Photovoltaics: Fundamental, technologies and applications,* 3rd ed., Delhi: Prentice Hall of India, 2015
2.	Momoh, J., *Smart Grid: Fundamentals of Design and Analysis*, Wiley-IEEE Press, 2012.
3.	Ahmed S., *Wind Energy: Theory and Practice*, 3rd ed., Delhi: Prentice Hall of India, 2016
4.	Earnest J., *Wind Power Technology*, 2nd ed., Delhi: Prentice Hall of India, 2015
5.	Kothari, D.P., Singal, K.C. and Ranjan, R., *Renewable Energy Sources and Emerging Technologies*, 2nd ed., Delhi: Prentice Hall of India, 2016.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17B1NEC741	**Semester EVEN**	**Semester-6 Session Even 2021** **Month Jan to May**
Subject Name	Digital Hardware Design		
Credits	3	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Shamim Akhter	
	Teacher(s) (Alphabetically)	Ms. Priyanka Kwatra, Dr. Shamim Akhter	

Course Outcomes		**Cognitive Levels**
C332-1.1	Design synchronous circuits using Finite State Machine approach	**Analyzing Level (C4)**
C332-1.2	Design and analyze asynchronous circuits	**Analyzing Level (C4)**
C332-1.3	Understand the advanced adders and multiplier circuit	**Understanding Level (C2)**
C332-1.4	Apply the concept of different ways of pulse or pattern generation	**Analyzing Level (C4)**
C332-1.5	Design digital circuits using VHDL	**Analyzing Level (C4)**

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
1.	Finite State Machine (FSM)	FSM Design methodology, State Reduction, State Assignment, Implementation, and State Diagram partitioning, Mealy to Moore Conversion and vice-versa.	9
2.	Pulse Generation Technique	Sequence generation using Direct and Indirect Approach, Shift Register Based Approach, Clock Dividers (Integer/Non-Integer)	5
3.	Advanced Topics in Digital Circuits	Different Types of Adders, Parallel Prefix Adders, Multipliers,	9
4.	VHDL based Digital Circuit Design	Importance of HDL, Basic Language elements, VHDL syntax, entities, and architectures, concurrent and sequential constructs, hierarchical design and test benches, FSM modeling and simulation	10
5.	Asynchronous Finite State Machines	Asynchronous Analysis, Design of Asynchronous Machines, Flow table realization, reduction, state assignments and design, Cycle and race analysis. Hazards, Essential Hazards, and its	9

		removal	
		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: Student will design and synthesize combinational and sequential circuits using VHDL.

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	William Fletcher: An Engineering approach to digital design, PHI, 2012
2.	Z.Kohavi: Switching and Finite Automata Theory, 2nd Edition, Tata Mc-Graw Hill, 2001
3.	A. Anand Kumar : Fundamental of Digital Circuits, PHI, 4th Edition 2016
4.	J. M. Rabaey, A. Chandrakasan, B. Nikolic: Digital Integrated Circuits: A Design Perspective, 2nd Edition, Pearson Education Inc., 2016.
5.	Volnei A. Pedroni: Circuit Design with VHDL, 2nd Edition, MIT Press 2020

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18B11EC315	**Semester (Even)**	**Semester 6 Session Even 2021 Month from Jan to May**
Subject Name	VLSI Design		
Credits	4	**Contact Hours**	4
Faculty (Names)	**Coordinator(s)**	Dr. Satyendra Kumar, Dr. Garima Kapur	
	Teacher(s) (Alphabetically)	Dr. Kirmender Singh, Mr. Vinay A. Tikkiwal	

Course Objectives: This course aims to convey knowledge of basic concepts of circuit design using CMOS with emphasis on the design, optimization and layout. Special attention will be devoted to the most important challenges facing digital circuit designers today and in the coming decade, being the impact of scaling, deep submicron effects and timing.

S. No.	Course Outcomes	Cognitive Levels/ Blooms Taxonomy
CO1	Understand VLSI design flow, VLSI design styles, digital systems modeling using Verilog-HDL	Understanding (Level II)
CO2	Demonstrate the operation of MOSFET, understanding technology scaling and its effects	Analyzing (Level IV)
CO3	Develop the concepts of static and dynamic characteristic of MOS inverters, combinational and sequential circuits	Analyzing (Level IV)
CO4	Understand the dynamic logic circuits, stick diagram, layout and working principle of different types of semiconductor memories	Analyzing (Level IV)

Module No.	Subtitle of the Module	Topics	No. of Lectures
1.	Introduction to VLSI	Overview of VLSI design methodologies, VLSI design flow, Design hierarchy, VLSI design styles.	3
2.	MOS Transistor Theory	MOS structure and operation, MOSFET I-V characteristics, Scaling and small-geometry effects, MOSFET capacitances, MOSFET models for circuit simulation	9
3.	MOS Inverters	Static and switching characteristics, Delay-time definitions, calculation of delay times, Inverter design with delay constraints, Static and switching power	9

		dissipation of CMOS inverter	
4.	MOS Logic Circuits	CMOS logic circuits, Complex logic circuits, Pass transistor logic, CMOS transmission gates, Sequential logic circuits, Dynamic logic circuits, Stick diagram, Layout, Layout design rules	13
5.	Semiconductor Memories	Working of Dynamic and Static Random Access Memory (DRAM, SRAM)	4
6.	System Design using HDL	Language fundamentals, Different modeling techniques using Verilog-HDL	4
		Total number of Lectures	42

Evaluation Criteria

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

PBL Component: Knowledge of VLSI Design industry, Basic of CMOS technology, CMOS circuits, power and delay calculations, CMOS technology layout and design rules, designs of memory and HDL language, all these topics develop designing and analysis ability in students.

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)

1.	Sung-Mo Kang, ; Yusuf Leblebici ; Chulwoo Kim, "CMOS Digital Integrated Circuits: Analysis and Design", 4th Edition, McGraw-Hill Higher Education, Indian Edition,2019.
2.	J. M. Rabaey, A. Chandrakasan, B. Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd Edition, Pearson Education Inc., 2016.
3.	Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson Education India, 2015.
4.	M.Morris Mano, Michael D.Ciletti, "Digital Design: With an Introduction to the Verilog HDL,VHDL, and System Verilog", 6th Edition, Pearson , 2018.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC311	**Semester** Even **(specify Odd/Even)**	**Semester** 6th **Session** 2020 -2021 **Month from** Jan to June
Course Name	Advanced Radio Access Networks		
Credits	3	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Bajrang Bansal
	Teacher(s) (Alphabetically)	Dr. Bajrang Bansal

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Recall the basic concepts of Digital Communication, Antenna and Wave Propagation, and Wireless Communication.	Remembering (Level I)
CO2	Identify the different components of wireless network based on the 3GPP reference network model.	Applying (Level III)
CO3	Analyze the architecture and channel structure of LTE and also examine the LTE call flow.	Analyzing (Level IV)
CO4	Explain the importance of Optimization and Pre-Launch Optimization in radio access network.	Evaluating (Level V)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Overview and evolution of Mobile Telephony, Telecom team structure, Generic network architecture, RAN network components, RAN life cycle.	6 [CO2]
2.	RF Basics	Concepts related to baseband signal processing, Microwave theory fundamentals, Concepts of radio propagation, Antenna Concepts, Fading in wireless communication.	6 [CO1]
3.	Radio Access Networks- Overview	Introduction to cellular concepts, Link adaptation, Power control, Generalized macro site overview, Generalized call flow, Introduction to KPI, Protocol layers, Standardization.	6 [CO2]
4.	Radio Access Network- LTE	Architecture of LTE, LTE Bearer, LTE QoS, LTE Radio Interface, Channel structure, Scheduling in LTE, Idle mode behavior, Power control in LTE, LTE mobility, LTE call flow.	18 [CO3]
5.	Radio Access Network Optimization	Optimization basics,RAN tuning and RAN optimization, Introduction to KPIs and Counters, Pre-launch optimization, Post-launch optimization.	6 [CO4]
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, PBL/Assignment)
Total	**100**

Project based learning: Here, students will learn the process of radio network planning as it is of the utmost importance to plan the radio network as efficiently as possible. Radio network planning comprises of services relevant to network operators, regulatory organizations, and system suppliers, including: coverage analysis, frequency planning, network design, network implementation, network optimization in terms of coverage or capacity. By using propagation tools (like TEMS that is widely used by telecom operators) or some simulation tool like MATLAB, students will learn to measure, analyze, and optimize the mobile networks. In particular, they will learn the simulations for RF coverage predictions, field-strength measurements in wireless propagation.

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.	Advanced Radio Access Network, Student Book, Ericsson AB 2018.
2.	T. S. Rappaport, Wireless Communications: Principles and Practice. Piscataway, NJ, USA: IEEE Press, 1996.
3.	TEMS Investigation, User Guide, ARAN Program-2018, Ericsson.
4.	Online resource material from NPTEL, Research Papers.

Detailed Syllabus

Lecture-wise Breakup

Course Code	18B13EC314	**Semester**Even	**Semester** VI**Session** 2020 -2021 **Month** Jan to Jun 21
Course Name	Machine Learning for Signal Processing		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Neetu Singh
	Teacher(s) (Alphabetically)	Neetu Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C331-3.1	Illustrate various machine learning approaches.	Understanding Level (C2)
C331-3.2	Experiment with the different techniques for feature extraction and feature selection.	Applying Level (C3)
C331-3.3	Apply and analyze various classifier models for typical machine learning applications.	Analyzing Level (C4)
C331-3.4	Make use of deep learning techniques in real life problems.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction and Basic Concepts	Linear algebra, Probability distributions, Representing signals, Types of Features and Proximitymeasures	8
2.	Linear Models for Regression and Feature Selection	Regression: Linear Basis Function Models, The Bias-Variance Decomposition, Types of Feature Selection: Mutual Information (MI) for Feature Selection, Goodman– Kruskal Measure, Laplacian Score, SVD, Ranking for Feature Selection,FeatureSelection for Time Series Data	12
3.	Linear Models for Classification	Discriminant Functions,Probabilistic GenerativeModels, ProbabilisticDiscriminative Models,TheLaplaceApproximation	6
4.	Decision Tree Learning	Decision Tree Representation, Hypothesis space search, Inductive bias, Issues in decision tree learning	7
5.	Support Vector Machines	Linear maximum margin classifier for linearly separable data, Linear soft margin classifier, Kernel induced feature spaces, Nonlinear classifiers, Regression by SVM, SVM variants	6

6.	Introduction to Deep Networks	Convolutional NeuralNetworks and its Applications	4
		Total number of Lectures	43

Evaluation Criteria

Components	**MaximumMarks**
T1	20
T2	20
EndSemesterExamination	35
TA25 (Attendance, Performance, Assignments/Quiz, Project)	
Total	**100**

Project based learning: Students will apply machine learning frameworks for the classification problems with the help of programming assignments. Additionally, students in group sizes of two-three will prepare a review of the one CNN application using current research papers.

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.	Pattern Recognition and Machine Learning, C.M. Bishop, 2nd Edition, Springer, 2011.
2.	Deep Learning, I. Goodfellow, Y, Bengio, A. Courville, MIT Press, 2016.
3.	The Elements of Statistical Learning, T. Hastie, R. Tibshirani, J. Friedman., 2nd Edition, 2008.
4.	Machine Learning, T. Mitchell, McGraw Hill, 1997.

Detailed Syllabus
Lab-wise Breakup

Course Code	18B15EC314	**Semester** Odd **(specify Odd/Even)**	**Semester** 5th **Session** 2020 -2021 **Month from** Aug- Dec
Course Name	Python for Signal processing and Communication		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	B. Suresh, Neetu Singh
	Teacher(s) (Alphabetically)	B. Suresh, Kapil Dev Tyagi, Neetu Singh, Nisha Venkatesh, Parul Arora, Pankaj Kumar Yadav, Vivek Dwivedi

COURSE OUTCOMES: At the completion of the course, students will be able to:		**COGNITIVE LEVELS**
C310.1	Understand applications of Python in signal processing and communication.	Understanding Level (C2)
C310.2	Apply Python for implementing signal operations and transformations on 1-D signals.	Applying Level (C3)
C310.3	Apply Python for implementing signal operations and transformations on images.	Applying Level (C3)
C310.4	Analyze the different blocks of communication systems using Python.	Analyzing Level (C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Python	Introduction to Python and its various applications.	C310.1
2.	CT Signals	Generating Continuous time signals.	C310.1
3.	DT Signals	Generating Discrete time signals.	C310.1
4.	Signal Operations	Writing codes for generating various signal operations.	C310.2
5.	DT Convolution	To calculate the convolution sum of two discrete time signals.	C310.2
6.	CT Convolution	To calculate the convolution integral of two continuous - time signals.	C310.2
7.	Signal Transformations	Writing codes to compute DFT (Discrete Fourier Transform) and IDFT (Inverse Discrete Fourier Transform) for the spectral analysis of signals.	C310.2
8.	Image Data	To read, write, display and explore image data.	C310.3
9.	Image Enhancement	To perform image enhancement in spatial domain.	C310.3
10.	Image Arithmetic	To perform arithmetic operations on the images.	C310.3
11.	Image Geometric Transformations	To apply geometric transformations to the images.	C310.3
12.	Sampling	Analysis of sampling techniques.	C310.4

13.	Pulse Code Modulation	To perform pulse code modulation and demodulation.	C310.4
14.	Digital Modulation Techniques	Analysis of digital modulation techniques.	C310.4
15.	Error Control Coding	Analysis of effect of various Data Encoding and Decoding Techniques on BER of digital communication systems.	C310.4

Evaluation Criteria

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

Project based learning: Students in group sizes of two-three will realize any one application of machine learning using Python programming.

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. UNPINGCO: Python for Signal Processing, Springer International Publishing Switzerland, 2014.
2.	M. WICKERT: Signal Processing and Communications: Teaching and Research Using IPython Notebook, In Proc. of the 14th python in science conf., (scipy. 2015).
3.	B. P. LATHI: Modern Digital and Analog Communication System: Python textbook Companion, Oxford University Press Inc.

Detailed Syllabus
Lab Breakup

Course Code	18B15EC315	**Semester** Even	**Semester VI** Session 2020-2021 **Month:** June
Course Name	VLSI Design Lab-II		
Credits	**1**	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Dr. Satyendra Kumar, Dr. Shruti Kalra
	Teacher(s) (Alphabetically)	Atul Srivastava, Priyanka Kwatra, Satyendra Kumar, Saurabh Chaturvedi, Shamim Akhter, Shruti Kalra

COURSE OUTCOMES		**COGNITIVE LEVELS**
C374.1	Relate the concepts of basic electronics circuits and recall the use/working of circuit simulation tools.	Remembering (Level I)
C374.2	Understand and explain the current-voltage characteristics of NMOS and PMOS transistors and extraction of MOSFET parameters	Understanding (Level II)
C374.3	Apply the MOSFET theory in MOS-based circuits, e.g. MOS inverters, combinational and sequential MOS logic circuits.	Applying (Level III)
C374.4	Analyze the static and switching characteristics of MOS inverters and examine the delay times Analyze and simulate the schematic and layout of CMOS Combinational and sequential logic circuits and examine their responses.	Analyzing (Level IV)

Exp No.	**Title of the Module**	**Description**	**CO**
1	Introduction to CAD/EDA tool	Introduction to Tanner tools: T-Spice, S-Edit and L-Edit.	C374.1
2	MOS Transistors	To study the I-V characteristics of NMOS and PMOS transistors.	C374.2
3	MOS Layout	Layout design and simulation of NMOS and PMOS transistors.	C374.4
4	MOS Inverter	Experiments related to CMOS inverter: -Simulation of CMOS inverter with arbitrary value of W/L -Analysis of VTC -Observe the effect on VTC by changing the W/L of NMOS and PMOS transistors -Observe the effect on VTC by changing the supply voltage	C374.3
5	MOS Inverter (Transient Characteristics)	To analyze and calculate the propagation delay, rise time and fall time of a CMOS inverter.	C374.4
6	MOS combinational logic circuits	Simulate the logic gates and verify the truth tables: Two-input NAND, two-input NOR	C374.3
Due to Corona Virus pandemic, the number of experiments has been reduced to 6.			

Evaluation Criteria

Components	**Maximum Marks**
Mid Sem Viva	20
End Sem Viva	20
D2D 60	
Total	**100**

Project Based Learning: Students will learn EDA/CAD tools, MOS/CMOS logic layout design, which is the utmost requirement to design a VLSI chip. Therefore, students with the knowledge of CMOS combinational logics, can design and analyze VLSI system/sub-system basedprojects.

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

1.	S -M Kang and Y. Leblebici, "CMOS digital integrated circuits: Analysis and design," 3rd edition, TMH, 2003 TMcGraw-Hill, 2003.
2.	N. H. E. Weste and D. M. Harris, "CMOS VLSI design: A circuits and systems perspective," 3rd edition, Addison-Wesley, 2005.

Detailed Syllabus
Lab-wise Breakup

Course Code	**18B15EC313**	**Semester: Odd**	**Semester: III[rd]Session** 2020 **Month from: June-December**
Course Name	**Embedded Systems and IOT Lab**		
Credits	1	**Contact Hours**	2 per week

Faculty (Names)	**Coordinator(s)**	**Dr. Gaurav Verma (CCC) and Dr.Alok Joshi (CC-128)**
	Teacher(s) (Alphabetically)	**Dr.Rachna Singh, Mr.Ritesh Kumar, Mr.Mandeep Singh and Mr.Abhay Kumar**

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	**Recall** the basic of digital electronics and relate its use in microprocessors and microcontrollers.	Remembering (Level I)
CO2	**Relate** the architecture of Microprocessors and Microcontrollers and its requirements in the area of embedded system and IOT with the help of algorithm.	Understanding (Level II)
CO3	**Apply** the skills and proficiency in the programming to demonstrate the use of instructions in microprocessors, microcontrollers and IOT Devices.	Applying (Level III)
CO4	**Analyze** the use of assemblers, cross compilers and real time hardware to program the microprocessors, microcontrollers, IOT boards and achieve the real time solutions to the problem.	Analyzing (Level IV)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	8085 Microprocessors	To perform addition and subtraction of two 8-bit numbers using 8085 microprocessor.	1,2,3
2.	8085 Microprocessors	To perform multiplication & division of two 8-bit numbers using 8085 microprocessor.	1,2,3
3.	8085 Microprocessors	To find out the smallest & largest number in an array of 'N' 8-bit numbers using 8085 microprocessor.	1,2,3
4.	8051 Microcontrollers	Familiarization with 8051 Software Toolsthrough examples of: a. LED Blinking. b. Varying square wave generation on any pin (with and without timers).	2,4
5.	8051 Microcontrollers	Design a token display system that has a seven segment display and switches. Whenever any switch is pressed corresponding number is displayed on the segment.	3,4
6.	8051 Microcontrollers	Design a traffic light controller system that has three LEDs – RED, YELLOW, GREEN. The sequence in which the LEDs are turned on is as follows: RED for 10 count, YELLOW for 5 count, GREEN for 10 count. Interface a light-dependent resistor (LDR) to select manual and automatic mode using interrupt.	3,4
7.	8051 Microcontrollers	Display a) JIIT on LCD b) Sum of two 8 bit numbers on LCD.	3,4
8.	8051 Microcontrollers	Establish the serial communication between PC and	3,4

		microcontroller using RS232 protocol to send and receive the data.	
9.	8051 Microcontrollers	Interface a DC motor and two IR sensors with the microcontroller. The IR sensors are used to control the direction of rotation of the motor.	3,4
10.	Microcontrollers	Design an IOT based system to sense the humidity and temperature using DHT11 sensor and send it to cloud.	3,4
11.	Microcontrollers	Design an IOT based system using microcontroller for controlling of home appliances using or ESP8266.	3,4
12.	Microcontrollers	Design a RFID based attendance system using LCD and microcontroller.	3,4
13.	Microcontrollers	Controlling of different household devices using an Android based application through bluetooth communication and microcontroller.	3,4
14.	Microcontrollers	Design a DTMF based wireless system using microcontroller for controlling of home appliances.	3,4

Evaluation Criteria

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

Project Based Learning Component: This lab teaches embedded system design using a building block approach, which allows one to visualize the requirement of an embedded system and then to design it efficiently. Learning out Embedded Systems will give the skills to design and manufacture embedded system products of the future which will help participants towards better employability. The lab will teach embedded system design using a microcontroller, namely Intel Corporation 8051 (AT89S51) microcontroller and also introduced the concept of IoT. The lab will teach IoT based system design using IoT boards, namely Arduino and ESP8266. The lab will introduce various interfacing techniques for popular input devices including sensors, output devices and communication protocols.It will also teach effective embedded programming techniques in C using Keil cross compiler. It will have a significant practical component in almost every lab exercise.

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.	Manish k. Patel, "The 8051 Microcontroller Based Embedded Systems", 1st Edition, McGraw Hill Education, 2014.
2.	DivyahBala, ESP8266: Step by Step Tutorial for ESP8266 IOT, Arduino NodemcuDev Kit, 2018.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	15B11EC611	**Even-Semester**	**Semester: 6th Session 2020-21** **Month from Jan 2021 to June 2021**
Subject Name	**Telecommunication Networks**		
Credits	**4**	**Contact Hours**	**40**

Faculty (Names)	**Teacher(s) (Alphabetically)**	1. Dr. Pankaj Kr. Yadav 2. Dr. Juhi Gupta 3. Dr. Sajal Agarwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C315.1	Understand the basic concepts of Telecommunication network model, Traffic Engineering and Switching technologies.	Understanding (Level II)
C315.2	Understand the concepts of OSI model and analyze the various error and flow control mechanisms introduced by data link layer.	Analyzing (Level IV)
C315.3	Understand the TCP/IP protocol, routing algorithm and apply the concept of subnetting to allocate and distribute the logical addresses in a network.	Apply (Level III)
C315.4	Understand concept of LAN access protocols, ISDN, B-ISDN and ATM, their implementation and performance issues.	Understanding (Level II)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Telecommunication network model	Telecommunication network model, Different networks types	2
2.	Switching technologies	Switched Communication Networks, Circuit Switching networks, Time Division Switching-Time Division Space Switching, Time Division Time Switching, Time Multiplexed Time Switching and TSI, Packet Switching Principles-Datagram and Virtual Circuit Approach, Message switching. Traffic engineering.	12

3	Computer Networks	Seven layered OSI model, Functions of different layers, primitives and services. Physical layers.	2
4	Detailed working of data link	Data link Control, Flow Control, Stop and Wait flow Control, Sliding Window Flow Control, Error Control, Go-Back-N ARQ, Selective-Reject ARQ, Performance Analysis, HDLC.	6
5.	Network Layer and Internet Protocol (IP)	Basic Principles of Network layer, IPv4, IPv6, IP Addressing, Subnetting, Supernetting, Routing Schemes-Distance Vector routing, Link-State routing, Hierarchical routing.	6
6	Transport and TCP/UDP description	Basic Principles of Transport Layer and TCP/UDP description. Congestion control and Quality of Service (QoS)	6

Evaluation Criteria

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

a) Attendance and Performance = 10
b) Class Test/Quiz = 10
c) Assignment = 5

7	Local area networks	LAN Protocols-ALOHA, CSMA, CSMA-CD, Implementation and performance issues.	4
8	ISDN, B-ISDN, ATM.	Introduction to ISDN, B-ISDN and ATM.	2
		Total number of Lectures	**40**

Project based learning: Here, students will learn the basic concepts of circuit switched Telephony and packet switched data networks (TCP/IP). These concepts are utmost importance for designing, implementing and testing of telecommunication networks.Students will be will doing assignments on different topics of switching systems and different TCP/IP layers.

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.	W. Stallings, Data & Computer Communication, PHI

2.	B. A Forouzan, DATA COMMUNICATIONS AND NETWORKING, 4th Edition TMH
3.	A.S. Tanenbaum, Computer Networks, PHI
4.	John C. Bellamy, Digital Telephony, 3rd Edition, Wiley.
5.	Thiagarajan Viswanathan, Telecommunication Switching Systems and Networks, PHI

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS631	**Semester Even**	**Semester 6th Session** 2020 -2021 **Month from January 2021to June 2021**
Course Name	PROJECT MANAGEMENT		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Swati Sharma, Dr. Deepak Verma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-5.1	Apply the basic concepts of project management such as features, objectives, life cycle, model and management, in a given context	Apply Level (C3)
C304-5.2	Analyze projects and their associated risks by understanding the various theoretical frameworks, non-numerical and numerical models in order to make correct selection decisions	Analyze Level (C4)
C304-5.3	Evaluate the stages of project management and identify and determine correct techniques for planning and scheduling	Evaluate Level (C5)
C304-5.4	Evaluate management processes for budgeting, controlling and terminating projects in order to achieve overall project success	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Project Management: Introduction	Characteristics of project; Life Cycle of Project; Project Model; Project Management as discipline; Contemporary aspects of Project Management	4
2.	Project Selection	Theoretical Models; Non-numeric models; Numeric Models; Financial Models; Project Portfolio process, Significance and applicability of Monte Carlo simulation	6
3.	Project Organization, Manager and Planning	Pure Project organization; Functional Organizations; Mixed organizations; Matrix organizations; Role, Attitudes and Skills of Project Manager, Project Coordination, Systems Integration, Work Breakdown Structure, Linear Responsibility Charts.	4
4.	Risk Management	Theoretical Aspects of risk, Risk Management process, Numeric Techniques, Hillier model,Sensitivity Analysis, Certainty Equivalent approach and Risk adjusted discount rates, Game theory.	4
5.	Project Scheduling and Resource Allocation	Theoretical aspects-Importance, Focus Area-PERT/CPM, AOA and AON charts, Probability Analysis, Gantt Charts, Crashing of Projects- Time and Cost tradeoff, Basics-Resource Leveling and Loading.	6
6.	Budgeting, Control	Estimating Project Budgets, Improving the process of cost	4

	and Project Termination	estimation, Basics, Importance, Purpose of control, Types of Control, Desirable features of Control, Control Systems, Critical Ratio Method, Control of creative activities, Control of change and scope creep, Why Termination, Types of termination, typical termination activities.	
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Project, Oral Questions)
Total	**100**

Project Based Learning: Students are supposed to form a group (Maximum 5 students in each group) and identify a real-life project. They are supposed to do the in-depth study of this project and assess it in terms and Time, cost, performance and client satisfaction. They are supposed to do the detailed study of project planning, organizing, scheduling, leading and controlling. They must highlight the various tools and techniques which are used in their chosen project. The project provides understanding to students that how organizations are managing their projects and what is the relevance and appropriate usage of the concepts, tools and techniques that they are studying in this subject. The fundamentals of Project management are very important in today's corporate world and certainly this subject enhances student's employability in every sector.

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.	Meredith, Mantel, Project Management-A Managerial Approach, 10th Edition, Wiley Publications,2017
2.	Timmothy Kloppenborg, Contemporary Project Management, 5th[t] Edition, Cengage Learning, 2017
3.	Harold Kerzner,Project Management: A Systems Approach to Planning, Scheduling, and Controlling,12th Edition,Wiley Publications,2017
4.	Wysocki,R.K., Effective Project Management: Traditional, Agile, Extreme, Hybrid, 8th Edition,Wiley Publications,2018
5.	Vohra, N. D., Quantitative Techniques in Management, 5thEdition, Tata McGraw Hill Publishing Company, 2017

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M11EC118	**Semester Odd (specify Odd/Even**	**Semester 1st Session 2020-2021 Month from July to December**
Course Name	ADVANCED DIGITAL SIGNAL PROCESSING(CO code : C110)		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Vineet Khandelwal
	Teacher(s) (Alphabetically)	NIL

COURSE OUTCOMES At the end of the semester, students will be able to		**COGNITIVE LEVELS**
CO1	Recall the principles of various transform techniques like Z, Chirp Z, Hilbert, Discrete Fourier transform and Fast Fourier Transform.	Applying Level (C3)
CO2	Demonstrate the ability to apply different methods to design and analyze digital FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) filters with its structural realization.	Analyzing Level(C4)
CO3	Analyze Multirate signal processing and examine its application.	Analyzing Level(C4)
CO4	Comprehend different methods for designing adaptive filters and examine its application	Analyzing Level(C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Review of Digital Signal Processing**	Review of discrete–time sequences and systems, Linear Shift Invariant (LSI) systems. Causality and Stability Criterion, FIR & IIR representations, Z-Transform, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT) algorithms using decimation in time and decimation in frequency techniques, Chirp Z- Transform, Hilbert Transform and applications	6
2.	**Design of IIR and FIR Filters**	Digital filter specifications, selection of filter type, and filter order, FIR filter design; using windowing Techniques, Fourier Series and frequency sampling method, Design of IIR Filters Using Butterworth, Chebyshev and Elliptic Approximations, Frequency Transformation Techniques;	12

		approximation of derivatives, Impulse invariant method, Bilinear transformation, Structures for IIR Systems – Direct Form I & II, Cascade, Parallel, Lattice & Lattice-Ladder Structures, Structures For FIR Systems – Direct , Cascade, Parallel, Lattice & Lattice ladder Structures.	
3.	**Multirate Digital Signal Processing**	Decimation & Interpolation, Sampling rate conversion, Identities, polyphase decomposition, General polyphase framework for Decimator and Interpolator, Multistage decimator and Interpolator, Efficient transversal structure for Decimator and Interpolator, FIR and IIR structure for Decimator, Filter design for FIR decimator and Interpolator, Application of Multirate Signal processing.	14
4.	**Adaptive Filters**	Introduction, Application of adaptive filters, correlation structure, FIR Weiner Filter, Adaptive Direct-form FIR filters Adaptive Lattice-Ladder filters, Introduction to linear prediction, linear prediction and autoregressive modeling.	10
		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.	J.G. Proakis & D.G. Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", 4th Edition, PHI, 2012
2.	Aurelio Uncini, "Fundamentals of Adaptive Signal Processing", Springr Nature, Jan 2015.
3.	Tulay Adah and Simon Haykins, "Adaptive Signal Processing: Next Generation Solutions", Wiley India, 2012.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NBT733	**Semester** Odd **(specify Odd/Even)**	**Semester** VII **Session** 2020 -2021 **Month from** July-December
Course Name	Stress: Biology, Behaviour and Management		
Credits	3 (3-0-0)	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Vibha Gupta
	Teacher(s) (Alphabetically)	Vibha Gupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-16.1	Explain the biological basis of stress.	**Understand Level (C2)**
C401-16.2	Relate cognitive processes and stress management.	**Understand level (C2)**
C401-16.3	Apply acquired knowledge in understanding and adjusting to different people and situations.	**Apply level (C3)**
C401-16.4	Improve quality of life by reducing stress.	**Create level (C6)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	The concept of Stress - Major stressors vs. routine hassles ; Major types of Stressors - Occupational Stressors; Organization Stress; Environmental Stressors; Happy Interactive Class (HIC)	3
2.	Scientific Foundations of Stress	HIC 1, The Nature of Stress; Human Physiology; Stress and Relaxation Responses; Stress and Disease	5
3.	Body Systems activated by stressors	HIC2, Nervous System, Endocrine System, immune system, Cardiovascular system, Gastrointestinal System, Muscles	9
4.	Cognitive Psychology	HIC3, Theoretical models: psychodynamic, behavioral, and cognitive; Thoughts, Beliefs and Emotions: Behavioral Patterns; Self-concept and Self-esteem; Stress emotions - Anger and Fear; Personality Traits – Stress prone and Stress resistant	11
5.	Social Psychology	HIC4, Family and Culture; Demands and Responsibilities; Relationships; Verbal and Non-verbal Communication; Human Spirituality	3
6.	Stress and the Human Environmental Interactions	HIC4, Time; Body Rhythms; Weather and Climate; Nutrition; Exercise; Drugs and Addictions; Violence and Post Traumatic Stress	3
7.	Happy Interactive Class (HIC) related to Stress management techniques and	HIC1 - DIY Strategies- Exercise and Health; HIC2 - Journal Writing/Music and Art Therapy; HIC3- Humor and Comic Relief; HIC4- Meditation/Mindfulness/Belly Breathing/Visual Imagery/Progressive Muscle Relaxation Psychological interventions; Developing Cognitive	HICs to be delivered in the modules 1-6

	therapeutic strategies	Coping Skills; Creative Problem Solving (case studies);	4
8.	The adaptive brain	Neuroplasticity – positive adaptation to stress	2
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Quiz and class discussions)
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.	George Fink "Stress: Concepts, Cognition, Emotion, and Behavior: Handbook in Stress Series; Volume 1; Academic Press; 2016
2.	Jeanne Ricks "The Biology of Beating Stress"Kindle Edition; 2014
3.	Jerrold S. Greenberg "Comprehensive Stress Management" Tata McGraw-Hill Edition; Tenth Ed., 2009
4.	Brian Luke Seaward "Managing Stress: Principles and Strategies for Health and Well-Being" Sixth Ed., Jones and Bartlett Publishers, 2009
5.	Saundra E. Ciccarelli, and Glenn E. Meyer "Psychology" South Asian Edition; Published by Pearson Education (2008); ISBN 10:8131713873 / ISBN 13: 9788131713877

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NPH732	**Semester: ODD**	**Semester: 7th Session:** 2020 -2021 **Month from July to December**
Course Name	Nanoscience and Technology		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Navendu Goswami
	Teacher(s) (Alphabetically)	Navendu Goswami

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-4.1	Define the Nanoscience and Technology and to know about various other terminologies and developments involved with Nanoscience and Technology	Remembering (C1)
C401-4.2	Classify the nanomaterials depending on the nature of dimensionalities, type of materials classes and explain the basic concepts of nanomaterials	Understanding (C2)
C401-4.3	Apply the concepts of Nanoscience for solving the theoretical and numerical problems	Applying (C3)
C401-4.4	Determine the properties of nanomaterials through suitable characterization tools	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Development of nanoscience and nanotechnology, naturally occurring nanomaterials, Crystallinity of nanomaterials, Metallic nanostructures, Semiconductor nanostructures Magnetic nanomaterials, Chemically assisted nanostructures, Growth in 2-D nanostructures, Carbon nanomaterials	10
2.	Properties of Nanomaterials	Surface to volume ratio, Surface states and energy, Nanoscale oscillators, Confinement in nanostructures, Density of States and number of states of 0-, 1-, 2-, 3-dimensional systems, Change in Band structure and gap, Energy levels, confinement energy and emission in nano, Fluorescence by QDs, Concept of Single electron transistor	5
3.	Nanomaterials Synthesis	Introduction to synthesis techniques, Top down and bottom up approach, Biological methods, Sol-gel method, Nucleation and growth, Ball Milling technique, Chemical vapor deposition, Physical Vapor deposition: Concept of Epitaxy and sputtering, Basics of Photolithography and its limitations, Soft Lithography and Nanolithography	10
4.	Characterization of Nanomaterials	Resolving power (Rayleigh and other criteria) of microscopes and their limitations for nanostructure measurements, Concept of Far and Near field and modification by NSOM, Basic principle, Design of setup, Theory and working, Characterization procedure, result analysis, Merits/demerits of SEM, TEM, STM, AFM	5
5.	Application of	Nanoelectronics, Nanobiotechnology, Catalysis by	10

	Nanomaterials	nanoparticles, Quantum dot devices, Quantum well devices, High T_c nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS	
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
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.	*Nanostructures and nanomaterials: synthesis properties and application*, Guozhong Cao, Imperial college press, London.
2.	*Introduction to nanotechnology,* Charles Poole *et al* J John Wiley & Sons, Singapore.
3.	*The Handbook of Nanotechnology: Nanometer Structures, Theory, Modeling, and Simulation*, A. Lakhtakia, Spie Press USA.
4.	*Springer Handbook of Nanotechnology,* Edited by B. Bhushan, Springer Verlag.

Detailed Syllabus
Lecture-wise Breakup

Course Code	20B12PH411	**Semester** ODD	**Semester 7th Session** 2020 -2021 **Month from July to December**
Course Name	SUPERCONDUCTING MATERIALS, MAGNETS AND DEVICES		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr. Dinesh Tripathi
	Teacher(s) (Alphabetically)	NA

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Define unusual properties exhibited by superconducting materials and how these properties are important in the development of superconducting Devices.	Remember Level (Level 1)
CO2	Explain the theories of superconductivity, the basic and operating parameters of superconductors, their classifications and design limitations for superconductor's applications-devices.	Understand Level (Level 2)
CO3	Solve the various issues related to fabrication of superconducting wires, tapes, design of superconducting magnets and devices.	Apply Level (Level 3)
CO4	Examine the potential use of low Tc and high Tc superconductors for designing both small and large scale applications.	Analyze Level (Level 4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic properties of Superconducting materials	Historical review, the state of zero resistance, Perfect Diamagnetism, Meissner effect, London's theory, Penetration depth, Concept of coherence length and origin of surface energy, Intermediate and mixed states, Critical currents and critical fields, Outlines of B-C-S theory, concept of energy gap, Levitation force of superconductors, Tunneling in superconductors: Gaiever tunneling and Josephson tunneling	10
2.	Classifications & synthesis of Superconducting materials	Type I and Type II superconductors, Classification of superconducting materials, Conventional superconductor: metals (Pb, Nb, Ti etc.), metal alloys (NbTi, Nb3Sn etc.) and Inter-metallic superconductors (MgB2); Non-conventional Superconductors: Oxide based superconductors (BSCCO, YBCO), iron pnictides superconductors, Fabrication of superconducting wires & tapes.	10
3.	Design of Superconducting magnet	Flux flow, Flux pinning, Pinning force, Magneto-thermal Instabilities in Type II superconductors, Flux Jumps, Stabilization Criterion: Cryostatic and dynamic stabilization, Manufacture of long length superconducting multifilamentary wires, Design and fabrication of superconducting magnets, Magnetic field calculations, current leads, Persistent switches, and superconducting magnet energization.	12

4.	Superconducting devices	Josephson junction in magnetic field, Superconducting Quantum Interference Devices (SQUIDS) and its applications, Superconductive Switches, Infrared detectors Superconducting energy storage system (SMES), Fault current limiters (SFCL), Maglev trains	8
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment (5), Quiz (5), Attend. (10) and Class performance (5))
Total	**100**

Recommended Reading material:

1.	Roseins & Rhodrih, Introduction to Superconductivity, 2nd Edition, Pergamon Press plc
2.	Vladimir Z. Kresin & Stuart A. Wolf, Fundamentals of Superconductivity, Springer Science & Business Media
3.	Williams, Applied Superconductivity , Academic press New York.
4.	M. N. Wilson, Superconducting Magnet Design (Monographs on Cryogenics), Clarendon Press, Oxford Science Publications

Course Description

Course Code	17B1NMA732	**Semester** - Odd **(specify Odd/Even)**	**Semester** VII **Session** 2020-21 **Month from** Aug 2020- Dec 2020
Course Name	Applied Numerical Methods		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C401-8.1	solve a single and a system of non-linear equations and analyze the convergence of the methods.	Applying Level (C2)
C401-8.2	explain finite and divided difference formulae for numerical interpolation.	Understanding Level (C3)
C401-8.3	apply numerical differentiation and integration in engineering applications.	Applying Level (C3)
C401-8.4	solve a system of linear equations using direct and iterative methods with their applications in various engineering problems	Applying Level (C3)
C401-8.5	solve eigen-value and corresponding eigen- vector problem for a square matrix	Analyzing Level (C4)
C401-8.6	evaluate the solutions of initial and boundary value problems using various numerical methods.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Roots of Non-linear Equations	Concept of round-off and truncation errors. Iterative methods to find roots for one or more nonlinear equations with their convergence	6
2.	Interpolation and Approximation	Interpolating polynomial, Lagrange formula with error, Formulae for equi-spaced points, Divided differences,Spline interpolation, Least square approximation	7
3.	Numerical Differentiation and Integration	Approximation of derivatives, Newton-Cote's formulae, Gauss-Legendre quadrature formulae, Double integration	7
4.	Numerical Linear Algebra	Gauss-elimination and LU-Decomposition Methods. Iterative methods: Jacobi and Gauss Seidel Methods and their convergence. Power's method for the largest eigen-value, Jacobi and Householder's methods for eigen-values of real symmetric matrices	10
5.	Numerical Solutions of ODE and PDE	Runge-Kutta and predictor corrector methods for IVPs, Finite difference methods for BVPs, Shooting methods, Numerical solutions of parabolic and elliptic partial differential equations by Finite Difference Methods	12
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20

T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, PBL)
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.	**Gerald, C.F. and Wheatley P.O.**, Applied Numerical Analysis, 7th Ed., Pearson Education, 2004.
2.	**Conte, S.D. and deBoor, C.**, Elementary Numerical Analysis, 3rd Ed., McGraw-Hill, 1980.
3.	**Gupta, R.S.**, Elements of Numerical Analysis, 2nd Ed., Cambridge University Press, 2015.
4.	**Jain, M.K., Iyengar, S.R.K. and Jain, R.K.**, Numerical Methods for Scientific and Engineering Computation, 6th Ed., New Age International, New Delhi, 2014.
5.	**Smith, G.D.**, Numerical Solution of Partial Differential Equations, 2nd Ed., Oxford, 1978.

Detailed Syllabus
Lab-wise Breakup

Course Code	15B19EC791	**Semester** Odd **(specify Odd/Even)**	**Semester** 7th **Session** 2020 -2021 **Month from** August to December
Course Name	Major Project Part-1		
Credits	4	**Contact Hours**	

Faculty (Names)	**Coordinator(s)**	Dr. Sajai Vir Singh
	Teacher(s) (Alphabetically)	Mr. Varun Goel

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Summarize the contemporary scholarly literature, activities, and explored tools/ techniques/software/hardware for hands-on in the respective project area in various domain of Electronics Engineering.	Understanding (C2)
CO2	Analyze/ Design the skill for obtaining the optimum solution to the formulated problem with in stipulated time	Analyzing (C4)
CO3	Evaluate /Validate sound conclusions based on evidence and analysis	Evaluating (C5)
CO4	Develop the skill in student so that they can communicate effectively in both verbal and written form.	Create Level (C6)

Evaluation Criteria

Components	**Maximum Marks**
Mid Sem Viva	20
Final Viva	30
Day to Day	30
Project Report	20
Total	**100**

Detailed Syllabus
Lecture-wise Breakup

Course Code	15B1NEC733	**Semester** ODD **(specify Odd/Even)**	**Semester** 7th **Session** 2020 -2021 **Month from** July 20 to Dec 20
Course Name	Fundamentals of Embedded Systems		
Credits	4	**Contact Hours**	3L+ 3T

Faculty (Names)	**Coordinator(s)**	Mr. Ritesh kumar Sharma (62)
	Teacher(s) (Alphabetically)	Dr. Gaurav Verma, Mr. Ritesh kr Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C431-4.1	**Understanding of the fundamental concepts for embedded systems design and complete architecture of the ATMEGA16/32 microcontroller.**	Understand [Level 2]
C431-4.2	**Identify various on chip peripherals of the ATMEGA16/32 microcontroller and make use of them for designing embedded applications.**	Apply [Level 3]
C431-4.3	**Experiment the basic concepts of embedded 'C' programming and make use of them in designing embedded system applications around various sensors and actuators.**	Analyzing [Level 4]
C431-4.4	**Understanding of the basic concept of RTOS, detailed study of ARM7 architecture (32 bit) and study of wireless protocols.**	Understand [Level 2]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fundamental for Embedded Developers.	Embedded System and its applications, Future Trends of Embedded System, Design Parameters of Embedded System and its significance, Microprocessor Versus Microcontrollers, Microcontrollers for Embedded Systems, Embedded Versus External Memory Devices, CISC Versus RISC Processors, and Harvard Versus Von-Neumann architecture.	4
2.	Detailed Study of AVR Microcontroller	ATmega16/32 Microcontroller (Basic architecture, Pin configuration, Memory organization (registers and i/o ports), Embedded C programming, Timers, on chip PWM, on chip ADC, Interrupts and Serial Communication.	10
3.	Concept of Embedded 'C' programming	Introduction to C, Difference between C and Embedded C, Data Types used in Embedded C, Arithmetic & Logical Operators, Control Flow, If & If – else, While & Do – while, For, Switch & Case, Continue & Break, Array & String, Functions and Header files, Pointers.	6
4.	Real World Interfacing with Microcontroller	Interfacing of single LED, Blinking of LED with timer and without timer, Interfacing of push-button and LED, Interfacing of 7-segment display, Interfacing of 8 push-buttons to control 7-segment display, Intelligent LCD Display, Interfacing of intelligent LCD display, Interfacing	12

		of Matrix Keyboard to control 7-segment display, ADC and DAC Modules, Interfacing of ADC0804, Interfacing with DAC0808, Different wave generation through DAC0808, Stepper Motor & DC Motor, Interfacing with stepper & DC motor, Different Sensor Interfacing, (IR Sensor, DTMF, Temperature Sensor)	
5.	Concept of RTOS and Advanced Microprocessor	Real Time Operating System (RTOS), Types of real time tasks, Task Periodicity, Process state diagram, Kernel and Scheduler, Scheduling algorithms, Shared data (Resource) and Mutual Exclusion, Semaphore, Introduction to ARM, Features, ARM Pipeline, Instruction Set Architecture (ISA), Thumb Instructions, Exceptions in ARM, Embedded Wireless Protocols (Infrared Data Association (IrDA), Bluetooth, IEEE 802.11).	10
		Total number of Lectures	**42**

Evaluation Criteria

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

Project Based Learning Component: This course teaches embedded system design using a building block approach, which allows one to visualize the requirement of an embedded system and then to design it efficiently. Learning out Embedded Systems will give the skills to design and manufacture embedded system products of the future which will help participants towards better employability. The course will teach embedded system design using a microcontroller, namely ATMEL Corporation ATmega16/32 microcontroller and also introduced the concept of advanced microprocessor of ARM family. The course will introduce various interfacing techniques for popular input devices including sensors, output devices and communication protocols. It will also teach effective embedded programming techniques in C and RTOS. It will have a significant practical component, which will be achieved by distributing different minor projects to group of students.

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.	Muhammad Ali Mazidi, "The AVR microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Pearson Education, 2008.
2.	Frank Vahid / Tony Givargis, "Embedded System Design", Willey India, 2002.
3.	Santanu Chattopadhyay, "Embedded System Design", 1st Edition, PHI Learning, 2010.

Detailed Syllabus

Course Code	15B19EC792	**Semester -:** Odd (specify Odd/Even)	**Semester-: 7th Session** 2020 -21 **Month- :** August - December
Course Name	**Term Paper**		
Credits	3	**Contact Hours**	40

Faculty (Names)	**Coordinator(s)**	**Bhagirath Sahu, Mandeep Narula**
	Teacher(s)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C460.1	**Summarize the contemporary scholarly literature, activities and techniques for various domain of Electronics Engineering.**	**Understand Level (C2)**
C460.2	**Analyze the recent technology and research trends in Electronics and Communication.**	**Analyzing Level (C3)**
C460.3	**Develop the skill so that they can communicate effectively in both verbal and written form.**	**Applying Level (C4)**

Evaluation Criteria

Components	**Maximum Marks**
Mid-Term Seminar & Viva	20
D2D upto Mid-Term	20
End Term Seminar & Viva	20
D2D upto End-Term	20
End-Report	20
Total	**100**

Detailed Syllabus

Course Code	15B19EC793	**Semester -:** Odd (specify Odd/Even)	**Semester-:** 7th **Session** 2020-21 **Month- :** July - December
Course Name	Summer Training Viva		
Credits	2	**Contact Hours**	Six weeks

Faculty (Names)	**Coordinator(s)**	Dr. Bajrang Bansal, Mrs. Smriti Bhatnagar
	Teacher(s)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C455.1	Extend theoretical knowledge to real time Industry	Understanding Level (C2)
C455.2	Demonstrate the capacity for critical reasoning and independent learning	Understanding Level (C2)
C455.3	Make use of Industrial Training experience to prepare a scientific report	Applying Level (C3)
C455.4	Develop greater clarity about career goals in present condition	Applying Level (C3)

Evaluation Criteria

Components	**Maximum Marks**
Viva	25
Real world idea and knowledge of Industry	25
Report	25
Diary	25
Total	**100**

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NEC734	**Semester** Odd	**Semester** VII **Session** 2020 -2021 **Month from** August to December
Course Name	RF and Microwave Engineering		
Credits	3	**Contact Hours**	3L+1T

Faculty (Names)	**Coordinator(s)**	Monika
	Teacher(s) (Alphabetically)	Abhay Kumar, Monika, Prof. Shweta Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
C332-3.1	Explain the concepts of microwave circuits and scattering parameters.	Understanding (C2)
C332-3.2	Evaluate the performance of several waveguide components and determine their responses and applications.	Evaluating (C5)
C332-3.3	Analyze the behaviour of microwave sources based on solid state devices and tubes at microwave frequencies.	Analyzing (C4)
C332-3.4	Determine mearurent parameters of microwave components and understand the ISM applications of Microwave Energy.	Applying (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to RF and Microwave Engineering	History of Microwaves, applications of Microwaves, Maxwell's Equations.	2
2.	Microwave Transmission Lines	Review of Transmission lines, Line Equations. Microwave Integrated Lines: Microstrip line, Strip line, CPW line.	3
3.	Impedance matching	λ/4 Transformer, Tapered Lines :Exponential	3
4.	Scattering Parameters	S-parameters: definition, properties, 2-port, 3-port and 4-port.	4
5.	Microwave Components	H-plane, E-plane and Magic Tee, Isolator, Circulator, Directional Coupler, Cavity Resonators, Q of Cavity Resonator, Rectangular waveguide cavities.	10
6.	Microwave Devices and Sources	Microwave semiconductor devices, Schottky diode, Gunn diode, Microwave Tubes.	7
7.	Microwave Measurements	Impedance and Power Measurement Vector Network Analyzer, Spectrum analyzer.	4
8.	RF Filters	Classification of filters, Filter Design by Insertion loss method	3

9.	Microwave Propagation and Applications	Industrial, Scientific and Medical applications of Microwave Energy, Biological effects of microwave energy.	4
		Total number of Lectures	40

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	20
PBL	05
Total	**100**

Project Based Learning:

Microwave Engineering is a fundamental course in Electronics and Communication Engineering. In this course, a brief introduction about basics of RF and Microwave Engineering is presented, which can be utilized to impart knowledge to design various microwave circuits at high frequencies. The project based exercises using RF basics can be used for filter designing.

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.	D.M. Pozar, Microwave Engineering (2nd Ed.), John Wiley, 1998.
2.	S.Y. Liao, Microwave Devices and Circuits (3rd Ed.), Pearson, 2003.
3.	Peter A. Rizzi, Microwave Engineering, Pearson, 1998.
4.	B. R. Vishvakarma , R. U. Khan and M.K. Meshram , Microwave Circuit Theory and Applications, Axioe Books, 2012.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17B1NEC735	**Semester Odd (Specify Odd/Even)**	**Semester** 7th **Session** 2020-21 **Month from** Aug 2020 to Dec 2020
Subject Name	Information Theory and Applications		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Neetu Singh
	Teacher(s) (Alphabetically)	Neetu Singh

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C430-5.1	Understand the concept of probability, its relation with information, entropy, and their application in communication systems.	Understanding Level (C2)
C430-5.2	Identify theoretical and practical requirements for implementing and designing compression algorithms.	Analyzing Level (C4)
C430-5.3	Analyze the relationship between bandwidth and capacity of communication channels and its importance in real life communication systems.	Analyzing Level (C4)
C430-5.4	Analyze the need for channel coding in digital communication systems.	Analyzing Level (C4)
C430-5.5	Generate error correcting codes for error detection and correction.	Analyzing Level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Review of Basic Probability	Probability spaces. Random variables. Distributions and densities. Functions of random variables. Statistical Averages. Inequalities of Markov and Chebyshev. Weak law of large numbers.	3
2.	Information Measure	Discrete entropy. Joint and conditional entropies. Entropy in the continuous case. Maximization of continuous entropy. Entropy of a bandlimited white Gaussian process.	6
3.	Data Compression	Uniquely decipherable and instantaneous codes. Kraft- McMillan inequality. Noiseless coding theorem. Construction of optimal codes.	4
4.	Data Transmission	Discrete memoryless channel. Mutual information and channel capacity. Shannon's fundamental theorem and its weak converse. Capacity of a bandlimited AWGN channel. Limits to communication – Shannon limit.	5
5.	Error Control Coding	Coding for reliable digital transmission	2

		and storage. Types of codes. Modulation and coding. ML decoding. Performance measures.	
6.	Linear Block Codes	Algebra Background, Groups, Fields, Binary field arithmetic. Vector Spaces over GF(2). Generator and parity check matrices. Syndrome and error detection. Standard array and syndrome decoding. Hamming codes.	8
7.	Cyclic Codes	Polynomial representation, Systematic encoding. Cyclic encoding, Syndrome decoding.	6
8.	Convolutional Codes	Generator Sequences. Structural properties. Convolutional encoders. Optimal decoding of convolutional codes-the Viterbi algorithm.	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
Test-1 Examination	20
Test-2 Examination	20
End Semester Examination	35
TA	25 (Attendance, Performance. Assignment/Quiz)
Total	**100**

Project Based Learning: Students will learn about the design and implementation of compression algorithms as well as error-correcting codes with the help of assignments.

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.B. ASH: Information Theory, Dover, 1990.
2.	R.W. YEUNG: Information Theory and Network Coding, Springer, 2010.
3.	SHU LIN & D.J. COSTELLO: Error Control Coding, 2nd ed., Pearson, 2011.
4.	T.K. MOON: Error Correction Coding, Wiley, 2006.
5.	A. POPOULIS: Probability, Random Variables and Stochastic Processes, Tata McGraw-Hill Edition, 2002**.**
6.	R. BOSE: Information Theory, Coding and Cryptography, Tata McGraw-Hill Education, 2016.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17B1NEC736	**Semester:** ODD	**Semester**: 7th **Session** 2020 -21 **Month:** Aug 2020 **to** December 2020
Subject Name	Essentials of VLSI Testing		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Shamim Akhter
	Teacher(s) (Alphabetically)	Dr. Shamim Akhter, Dr Vikram Karwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C430-4.1	Understand the fundamental of Digital System testing	Analyzing Level (C4)
C430-4.2	Analyze Stuck-at faults model and Fault Simulation algorithms	Analyzing Level (C4)
C430-4.3	Perform Combinational and Sequential ATPG	Evaluating Level (C5)
C430-4.4	Analyze Controllability and Observability of Combinational and Sequential circuits	Analyzing Level (C4)
C430-4.5	Understand Design for Testability (DFT), Built-In-Self-Test(BIST), and Test Vector Compression	Analyzing Level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to VLSI Testing	Types of tests, Test Process and Equipments, Automatic Test Equipment, Fault coverage, Defect level	5
2.	Fault Modeling	Stuck-at faults, Fault equivalence & dominance, Logic and Fault Simulation	8
3.	Testability measures	Controllability & Observability for Combinational and Sequential circuits, SCOPE algorithm	7
4.	Testing algorithms for Combinational & sequential circuits	Combinational ATPG, D-algorithm, PODEM, FAN, Sequential ATPG algorithms	12
5.	Design For Testability and BIST Architecture	Introduction to Design for Testability (DFT), Scan Test, Built-In-Self-Test, Test Compression Techniques	11

	Total number of Lectures	**43**
Evaluation Criteria **Components** **Maximum Marks** T1 20 T2 20 End Semester Examination 35 TA 25 **Total** **100**		

Project Based Learning: Students will learn about implementation of different ATPG algorithms for combinational and sequential circuit with the help of assignments.

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.L. Bushnell and V.D. Agrawal, Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits, 1st Edition, Springer, 2013, **[TEXTBOOK]**
2.	Alexander Miczo, Digital Logic Testing and Simulation, 2nd Edition, John Wiley & Sons, 2003
3.	Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen, VLSI Test Principles and Architectures, 1st Edition, Morgan Kaufmann, 2006.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	17B11EC733	**Semester: ODD**	**Semester: 7th Session : 2020-21 Month : from July to December**
Subject Name	OPTICAL COMMUNICATION		
Credits	4	**Contact Hours**	3(L)+1(T)

Faculty (Names)	**Coordinator(s)**	Dr. Rahul Kaushik
	Teacher(s) (Alphabetically)	Dr. Rahul Kaushik

S. No.	Course Outcomes	Cognitive Levels
C412.1	Develop an understanding of optical fiber, its structure, types, and propagation and transmission properties.	Remembering (C1)
C412.2	Identify and examine the different kinds of losses and signal distortion in optical Fibers.	Analyzing (C4)
C412.3	Classify the Optical sources and detectors and their principle of operation.	Understanding (C2)
C412.4	Design a fiber optic link based on budget analysis.	Evaluating (C5)

Module No.	Subtitle of the Module	Topics	No. of Lectures
1.	Overview of Optical fiber Communications	Electromagnetic Spectrum, Historical development and advantages of optical fiber communication, Elements of optical fiber transmission link, Optical laws and definitions, optical fiber modes and configurations.	3
2.	Optical fibers Structures	Optical fiber wave guides, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays. Cylindrical fibers Modes, V Number, Mode Coupling, Step Index fibers, Graded Index fibers. Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index.	4
3.	Signal Degradation in Optical fibers	Signal distortion in optical fibers- Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity, Group delay, Types of Dispersion - Material dispersion, Wave-guide dispersion, Polarization mode dispersion, Intermodal dispersion, Pulse broadening. Optical fiber Connectors-	7

		Connector types, Single mode fiber connectors, Connector return loss.	
4.	Optical Sources	Light emitting diode (LEDs)-structures, materials, Figure of merits, Quantum efficiency, Power, Modulation, Power bandwidth product. Laser Diodes -Modes & threshold conditions, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, temperature effects, external quantum efficiency, and laser diode rate equations. Reliability of LED & ILD.	6
5.	Power Launching and Coupling	Source to fiber power launching: - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, LED coupling to single mode fiber. Fiber Splicing- Splicing techniques, splicing single mode fibers. Multimode fiber joints and single mode fiber joints. Fibre alignment and joint loss.	6
6.	Photo detectors& Receivers	Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation:- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers.	7
7.	Optical System Design	Considerations, component choice, multiplexing.Point-to- point links, System considerations, Link considerations. Overall fiber dispersion in multi mode and single mode fibers. Rise time considerations. Distance consideration in optical transmission system. Line coding in Optical links, WDM Principles & Types of WDM, Measurement of Attenuation and Dispersion, Eye pattern.	7
		Total number of Lectures	40

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 constituents of an optical link and their suitability/choice for any application. Understanding of various losses incur in an optical link provide requisite skills in design, analysis and evaluation of the performance of analog and digital optical fiber link. Students will be able to design an optical link with the given specifications. Designing based questions given in the assignments built-up the thought process of the students in the field applications.

Recommended Reading(Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)	
1.	Gerd Keiser, Optical Fiber Communications, 3rd Edition, McGraw-Hill International edition, 2000.

2.	John M. Senior, Optical Fiber Communications, 2nd Edition, PHI, 2002.
3.	D.K. Mynbaev,S.C. Gupta and Lowell L. Scheiner,Fiber Optic Communications,Pearson Education, 2005.
4.	Govind P. Agarwal, Fiber Optic Communication Systems, 3rd Edition, John Wiley, 2004.
5.	Joseph C. Palais,Fiber Optic Communications, 4th Edition, Pearson Education, 2004

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC412	**Semester**Odd **(specify Odd/Even)**	**Semester** 7th **Session** 2020 -2021 **Month from** July to Dec
Course Name	Multimedia Communications		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Richa Gupta
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES Upon completion of the course, the students will be able to		**COGNITIVE LEVELS**
C430-7.1	familiarize with basics of data compression used in the development of various construction algorithms for source codes.	C3
C430-7.2	identify theoretical and practical requirements for implementation and designing of Error Resilient Codes.	C3
C430-7.3	learn fundamentals of transform coding, digital image processing and its applications.	C3
C430-7.4	analyse the need of image compression & video compression and distinguish between different image CODECs.	C4
C430-7.5	familiarize with psychoacoustic principle used in the development of audio codec standards.	C4

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Information Theory	Introduction, Information Measure, Discrete entropy. Joint and conditional entropies.	3
2.	Data Compression	Uniquely Decipherable Codes and Instantaneous Codes. Kraft - McMillan inequality. Noiseless coding Theorem. Data Compression: Lossless Compression and Lossy Compression. Optimal codes. Construction algorithms of source codes – Huffman Codes, Shannon - Fano codes, Arithmetic Codes, Lempel Ziv Welch Code and Run Length Coding.	8
3.	Error Resilient Codes	Reversible Variable Length Codes: Introduction, Types of RVLCs, Construction Algorithms of Symmetrical and Asymmetrical RVLCs. Applications of RVLCs in Multimedia Communications.	8
4.	Multimedia Information Representation and Transform Coding	Introduction, Digital Principles, Representations of text, image, audio and video data. Transform Coding, Discrete Cosine Transforms – 1 D and 2D. Energy compaction.	3

5.	Digital Image Processing	Basics of digital image processing, Structure of the Picture Information, luminance and chrominance components, RGB components. Image Enhancement, Image segmentation, Image Restoration and Morphological Image Processing.	12
6.	Image Compression	Basics of Image Compression, Joint Photographic Expert Group (JPEG) compression.	3
7.	Video Compression	Basic principle of video processing, I, P and B pictures in video content, Structure of video frame, Macroblock, Motion Estimation and Compensation, Compression on the block level, Video Coding Standards.	4
8.	Audio Compression	Basics of Audio Signal Processing, Principle of Psychoacoustic and its applications, Audio Compression and Standards for Audio codec.	4
		Total number of Lectures	**45**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Research Assignment, Assignment, Quiz, Class Tests)
Total	**100**

Project Based Learning: Students are required to prepare a consolidated summary (including approach, limitations, pros and cons, applications, scope etc.) of any recent research paper published in reputed International Conference or International Journal related to Multimedia Communications. They will submit this research assignment towards the end of the semester.

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. Bosi and R. Goldberg, Introduction to Digital Audio Coding and Standards. Kluwer Academic, Boston, 2003.
2.	R. C. Gonzalez and R. E. Woods, Digital Image Processing Using MATLAB, Prentice Hall, 2009.
3.	K. Sayood, Introduction to data compression, Elsevier, 4th edition.
4.	A. K. Jain, Fundamentals of Digital Image Processing, Prentice Hall, 1989.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B11EC731**	**Semester ODD**	**Semester** 7th **Session** 2020 -2021 **Month from** Aug **to** Dec
Subject Name	Mobile Communication		
Credits	**4**	**Contact Hours**	**3-1-0**

Faculty (Names)	**Coordinator(s)**	Kuldeep Baderia, Juhi Gupta
	Teacher(s) (Alphabetically)	Bajrang Bansal, Juhi Gupta, Kuldeep Baderia, Vivek Dwivedi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C410.1	Explain the evolution of mobile communication and basics of all the wireless standards currently being employed.	Understanding Level (C2)
C410.2	Perform mathematical analysis of cellular systems and cellular capacity improvement designs.	Analyzing Level (C4)
C410.3	Analyze large and small scale propagation models and their design both mathematically and conceptually. Analysis of various fading models.	Analyzing Level (C4)
C410.4	Analyze architecture of 2G, 3G and 4G systems and issues associated with them. Formulate research problems based on the issues associated with 4G systems.	Analyzing Level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Mobile communication system evolution	Evolution of mobile communication systems. 2G, 3G, and 4G systems. Block diagram of mobile communication system. Problems of mobile communication: spectrum, propagation. Near far problem.	3
2.	The cellular Concept – System Design Fundamentals	Introduction, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage & capacity in cellular system	8
3.	Mobile Radio Propagation	Free Space Propagation Model, Ground Reflection Model, Small scale Propagation, Impulse Response model of a multipath channel, Parameters of mobile multipath channels, Types of small scale fading, Rayleigh and Ricean distributions, Level crossing rates and Average fade duration.	12
4.	Multiple Access Techniques	FDMA, TDMA, CDMA and OFDMA techniques and their performance. Number of channels.	5
5.	Mobile communication network architectures	GSM**:** GSM standards and architecture, GSM Radio aspects, typical call flow sequences in	8

		GSM, security aspects. GPRS, UMTS.	
6	Introduction to 4G systems	Long Term Evolution (LTE) and Worldwide Interoperability for Microwave Access (WiMax).	4
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
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.	**T. S. Rappaport, Wireless Communications (principle and practice), PHI/Pearson, 2002.**
2.	William C.Y. Lee, Mobile Cellular Telecommunications- Analog & Digital Systems, Mc.Graw Hill, 1995
3.	Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
4.	V.K.Garg, Principles and Applications of GSM, Pearson Education, 1999
5.	V.K.Garg, IS-95 CDMA and CDMA 2000, Pearson Education, 2000

Detailed Syllabus
Lecture-wise Breakup

Course Code	**20M41EC117**	**Semester:** ODD **(specify Odd/Even)**	**Semester: 1 Session: 2020-21 Month from Aug to Dec**
Course Name	**ADVANCED DIGITAL COMMUNICATION SYSTEMS**		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Dr. Ashish Goel	
	Teacher(s) (Alphabetically)	Dr. Ashish Goel	

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C112.1	Understanding of line coding schemes and study of various issues related to ISI	Understanding Level (C2)
C112.2	Understand and analyse the Optimum filter realization for digital signals	Analyzing Level (C4)
C112.3	Understand the concepts of digital modulation techniques and evaluate their probability of error and bandwidth efficiency.	Evaluating Level (C5)
C112.4	Understanding of symbol and carrier synchronization and various equalization schemes.	Understanding Level (C2)
C112.5	Analyse different types of spread spectrum techniques.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	**Waveform Coding and Baseband Shaping for Data Transmission**	Overview of wave form coding scheme, Companding scheme for PCM system, Signal to Quantization Noise Ratio of Companded PCM system. Line codes and Power Spectral Density of line coding schemes, Intersymbol Interference: Ideal solution, Practical Solution and Correlative Coding. Eye pattern.	10
2.	**Optimal Reception of Digital Signals**	Baseband Signal Receiver, Peak signal to RMS Noise output Voltage Ratio, Probability of error, Optimum Threshold: Maximum Likelihood Detector and Bayes' Receiver, Optimal receiver design: calculation of the optimum filter transfer function, Optimum filter realization using Match filter, Probability of error of Matched filter, Optimum filter realization using Correlator	8
3.	**Digital Modulation Techniques**	Digital modulation formats, M-ray modulation techniques: Modulation, Demodulation, Power spectra, Bandwidth efficiency, symbol error probabilities. Channel capacity theorem for M-ary modulation formats. Minimum Shift keying: Effect of side lobes, MSK as FSK, Signal Space representation of MSK, Phase continuity in MSK, generation and reception of MSK, GMSK.	10
4.	**Synchronization and Equalization**	Synchronization: Phase Jitter in Symbol Synchronization, Carrier synchronization. Equalization: Maximum–Likelihood Sequence	7

		Estimation (MLSE), Linear equalization, Decision -feedback equalization, Reduced complexity ML detectors	
5.	**Spread Spectrum Signals for Digital Communication**	Model of spread spectrum digital communication system, Spreading code sequences; generation and properties: PN Sequence, Gold Code, Walsh Hadamard Code. Direct sequence spread spectrum signals; Frequency hopped spread spectrum signals, FDMA, TDMA, CDMA, Time hopping SS, Synchronization of SS systems.	7
		Total number of Lectures	**42**

Project based learning: Here, students will learn the advanced concept digital communication starting from the basics process of modulation, demodulation and its impairment. These schemes are of utmost importance to understand the concepts of any current or future generations of communication system and to design the same . Student will be able to design the physical layer of digital communication and to analyze the effect of ISI, effect of noise and fading issues. Students can perform the some simulation on Matlab to analyze the same. Understating of these techniques will further help to work in any core communication industry.

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
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.	John G. Proakis, "Digital Communication", McGraw Hill, 5th edition, 2013.
2.	H. Taub, D. L. Schilling and Gautam Saha, Principles of Communication Systems, 4th/ed, TMH, 2017
3.	S.Haykin, Digital Communication Systems ,John Wiley & Sons, 2013
4.	Don Torrieri, " Principles of Spread-Spectrum Communication Systems ", Springer, 2015.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NBT732	**Semester** Odd **(specify Odd/Even)**	**Semester VII Session** 2020 -2021 **Month from** July-December
Course Name	Healthcare Marketplace		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Indira P. Sarethy
	Teacher(s) (Alphabetically)	Dr. Indira P. Sarethy, Dr. Shweta Dang

COURSE OUTCOMES		**COGNITIVE LEVELS**
C401-14.1	Explain healthcare market, drugs and devices, role of various stakeholders	Understand Level (C2)
C401-14.2	Apply related intellectual property laws and regulatory approvals for healthcare sector	Apply Level (C3)
C401-14.3	Analyze the various business models/ innovations in the healthcare industry	AnalyzeLevel (C4)
C401-14.4	Compare and examine economic aspects pertaining to the sector	AnalyzeLevel (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Healthcare markets**	About the various Regulatory bodies for approval of new medical innovations	**02**
2.	**Clinical Pharmacokinetics and Clinical trials for new Drugs**	Biologic sampling techniques, analytical methods for the measurement of drugs and metabolites, and procedures that facilitate data collection and manipulation. Clinical Trials: PhI, II, III and IV	**05**
3.	**Regulatory approval pathways**	Preclinical studies US and EU filings IND submissions, NDA and BLA Submissions, Non-patent exclusivities, data and market exclusivities cost analysis	**06**
4.	**Patents of drugs and devices, Entry for generics in health care markets**	Role of patents on new drugs and devices, Ever-greening of patents, Product and Process patents. Hatch Waxman act and Introduction of generics and resulting cost reduction, Orange book (FDA) and related case studies.	**08**
5.	**Economics of healthcare**	Stakeholders in healthcare- doctors, hospitals and insurers and theirroles, technology and human capital	**7**
6.	**Medical technology and insurance**	For medical devices, pharmaceuticals, genetic diagnostic tests and their regulations	**4**
7.	**Indian hospital sector**	Various players – government, private, PPP models, strategic perspectives, case studies	**4**
8	**Innovations in the marketplace**	Health to market innovations	**4**

9	**Healthcare informatics**	e-health, collection of health data, data processing, evaluation, health information systems, case studies	**2**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments 1, 2, 3, Attendance)
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.	Research papers and online resources

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B1NHS732**	**Semester: Even**	**Semester : 8th Session : 2020 -2021 Month:January to June**
Subject Name	**INDIAN FINANCIAL SYSTEM**		
Credits	**3**	**Contact Hours**	**3 (3-0-0)**

Faculty (Names)	**Coordinator(s)**	1. Dr. Mukta Mani (Sec 62) 2. Dr.Sakshi Varshney (Sec 128)
	Teacher(s) (Alphabetically)	2. Dr. Mukta Mani 2. Dr.Sakshi Varshney

NBA Code	Course Outcomes	Cognitive Level
C401-31.1	Understand the inter-linkage of components of financial system and financial instruments of Money market and Capital market.	C2
C401-31.2	Analyze ways of fund raising in domestic and international markets	C4
C401-31.3	Understand functioning of Stock market and evaluate securities for investment.	C5
C401-31.4	Apply the knowledge of Mutual Funds and Insurance in personal investment decisions	C3
C401-31.5	Apply knowledge of Income tax for calculation of tax liability of individual.	C3

Module No.	Subtitle of the Module	Topics in the module	No. of Hours
1.	Introduction	Meaning, Importance, and functions of Financial system. Informal and Formal financial system, Financial markets, Financial Institutions, Financial services and Financial instrument	3
2.	Money Market	Features of money market Instruments: Treasury bills, commercial bills, commercial papers, certificates of deposit, call and notice money, Functions of money market, Linking of money market with Monetary policy in India	3
3.	Capital Market	Features of Capital market instrument: Equity shares, Bonds. Fund raising through Initial Public Offering, Rights issue, Preferential allotment and Private Placement. Process of IPO-Intermediaries in IPO, Book building process and allotment of shares	3
4.	Foreign investments in India	Fund raising from foreign market through: Foreign direct investment and foreign institutional investment, ADR, GDR, ECB, and Private equity.	3
5.	Stock Market	Trading in secondary market- Stock exchanges, regulations, demutualisation, broker, listing of securities, dematerialisation, trading, short selling, circuit breaker, stock market indices- methods of calculation of indices.	3
6.	Stock Valuation and Analysis	Investing basics: Consideration of Risk and Return, Stock Valuation and Analysis-Fundamental analysis: Economy, industry and company analysis; Technical Analysis of stocks using technical charts	7
7.	Investing in Mutual Funds and Insurance	Mutual Funds: Basics, Types of funds, risk and return considerations in selection of funds; Insurance: Basics, Life insurance and health insurance, types of policies	6
8.	Overview of Income Tax	Basics of Income tax- Concept of previous year, assessment year, person, income. Calculation of Income tax liability for individuals: Income from salaries- basic, DA, HRA, leave salary, Gratuity, Pension, Allowances and Perquisites; Income from Capital	14

		Gain, Deductions under section 80C to 80U.	
Total number of Lectures			**42**
Evaluation Criteria			
Components	**Maximum Marks**		
T1	20		
T2	20		
End Semester Examination	35		
TA	25 (Project, Class participation and Attendance)		
Total	**100**		

Project Based learning: The students will form groups of 4-5 students. They will carry-out stock analysis of a selected company on the basis of fundamental and technical analysis techniques studied in lecture classes. Finally they will give their recommendation about the performance of stock.

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	Pathak Bharti V, *Indian Financial System,*5th Edition,Pearson Education, 2018
2	Madura Jeff, *Personal Finance*, 6th Ed, Pearson Education, 2017.
3	Machiraju H R, *Indian Financial System*, 4th Ed, Vikas Publication, 2010
4	Bhole L M, *Financial Institutions and Markets*, 4th ed. Tata McGraw Hill Publication, 2006.
5	Singhania & Singhania, Students Guide to Income Tax, Taxmann Publication, 2019.
6	*How to Stimulate the Economy Essay* [Online]Available:https://www.bartleby.com/essay/How-to-Stimulate-the-Economy-FKJP5QGATC
7	Reserve Bank of India, 'Money Kumar & the Monetary Policy', 2007
8	Ashiwini Kumar,Sharma,' De-jargoned: Book building process,Live Mint,2015.
9	Madhavan, N. "Pushing the accelerator instead of brakes: Can Subhiksha make a comeback?", Business Today, 28th June 2009.
10	Kaul, Vivek, "Master Move: How Dhirubhai Ambani turned the tables on the Kolkata bear cartel", The Economic Times, July 1, 2011.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**19M13HS111**	**Semester: Even**	**Semester: M.Tech II & Dual degree VIIISession 2020-21** **Month from January to June 2021**
Subject Name	**English Language Skills for Research Paper Writing**		
Credits	**2**	**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**	DrMonali Bhattacharya	
	Teacher(s) (Alphabetically)	DrMonali Bhattacharya	

Course Outcomes:

At the completion of the course, students will be able to,

COURSE OUTCOMES		**COGNITIVE LEVELS**
C204.1	Demonstrate an understanding of all the aspects of grammar and language needed to write a paper.	Understand Level (C2)
C204.2	Apply grammatical knowledge & concepts in writing and presentation.	Apply level (C3)
C204.3	Examine each section of a paper after careful analysis of Literature Review.	Analyze Level (C4)
C204.4	Determine the skills needed to write a title, abstract and introduction, methods, discussion, results and conclusion.	Evaluate Level (C5)
C204.5	Compile all the information into a refined research paper after editing and proofreading	Create Level (C6)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lecturesand Tutorials for the module**
1.	Grammar & Usage	Structure of English Language Voice, Aspect & Tense SVOCA Sense & Sense Relations in English Enhancing Vocabulary Connotation, Denotation & Collocation	**6**
2.	Elements of Paper Writing	Planning & Preparation Word Order Breaking Long Sentences Structuring Paragraphs Being Concise and RemovingRedundancy Avoiding Ambiguity and Vagueness	**4**
3.	Paraphrasing & Writing	Highlighting Your Findings Hedging andCriticising Paraphrasing and Plagiarism Sections of a Paper Abstracts; Introduction	**6**
4.	Process of Writing	Review of Literature Methods Results Discussion	**4**

		Conclusion The Final Check	
5.	Key Skills Needed	Key skills needed when writing a Title Key skills needed whenWriting an Abstract Key skills needed when writing an Introduction Key skills needed when writing a Review of the Literature Key skills needed when writing Methods & Results Key skills needed when writing Discussion & Conclusion	**4**
6.	Refining the Paper	Incorporating useful phrases Editing Proofreading References Annexures Ensuring good quality in submission	**4**
		Total number of Lectures and Tutorials	**28**

Evaluation Criteria

Components	**MaximumMarks**
Mid Term	30
End Semester Examination	40
TA	30 (Project, Assignment/ Class Test/ Quiz, Class Participation)
Total	**100**

Recommended Reading material:

1.	Goldbort R. 'Writing for Science', Yale University Press (available on Google Books), 2006
2.	Day R. 'How to Write and Publish a Scientific Paper', Cambridge University Press, 2006
3.	Adrian Wallwork. 'English for Writing Research Papers', Springer, New York, Dordrecht Heidelberg, London, 2011
4.	Yadugari M.A. ' Making Sense of English: A Textbook of Sounds, Words & Grammar' Viva Books Private Limited, New Delhi, 2013, Revised Edition
5.	Strauss Jane. 'The Blue Book of Grammar and Punctuation, Josseybass, Wiley, San Francisco, 1999.
6.	Rizvi, A. R. 'Effective Technical Communication' 2nd edition, McGraw Hill Education Private Limited, Chennai, 2018

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH812	**Semester: Even**	**Semester: 8**, **Session :** 2020 -2021 **Month from: January to June**
Course Name	**Astrophysics**		
Credits	3	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Prof.Anirban Pathak and Dr. Sandeep Chhoker
	Teacher(s) (Alphabetically)	Anirban Pathak Sandeep Chhoker

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-4.1	Relate historical development of astrophysics with the modern concepts and recall the mathematical techniques used & definition of different units	Remembering (C1)
C402-4.2	Explain the models of universe, ideas of stellar astrophysics, life cycles of stars, physical principles that rules galaxies, and general theory of relativity	Understanding (C2)
C402-4.3	Apply mathematical principles and laws of physics to solve problems related to astrophysical systems	Applying (C3)
C402-4.4	Compare different models of universe and decide which one is logically acceptable and why	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	Introduction to Astrophysics	Historical development of astrophysics (from mythology to contemporary astrophysics), Mass, length and time scales in astrophysics, sources of astronomical information (effect of discovery of spectroscopes and photography), astronomy in different bands of electromagnetic radiation (e.g. Optical astronomy, infra-red astronomy radio astronomy, X-ray astronomy. Gamma-ray astronomy etc. with specific mention of Hubble space telescope). Kirchoff's law, Doppler effect and Hubble's law.	**8**
2.	Stellar Astrophysics	Classification and nomenclature of stars. Basic equations of stellar structure, main sequence, red giants and white dwarfs, HR diagram, stellar evolution, supernovae, extra solar planets.	**8**
3.	Death of a star	End states of stellar collapse: degeneracy pressure of a Fermi gas, structure of white dwarfs, Chandrasekhar mass limit, neutron stars pulsars and black holes.	**6**
4.	Our galaxy	The shape and size of Milky way and its interstellar mater	**2**
5.	Extragalactic astrophysics	Normal galaxies, active galaxies, cluster of galaxies, large-scale distribution of galaxies.	**6**

6.	GTR and Models of Universe	Qualitative idea of general theory of relativity (without using tensor calculus) and its implications. Different models of universe. Specific attention to the ideas related to big bang, cosmological constants, dark matter and dark energy.	**6**
7.	Astrobiology	Drake equation and related questions.	**2**
8.	Conclusion	Review of the present status of Astrophysics and open questions.	**2**
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quizes (10 M), Attendance (10 M) and Class performance (5 M)]
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.	Astrophysics for Physicists, Arnab Rai Choudhuri, Cambridge University Press, Delhi, 2010.
2.	Astrophysics: Stars and Galaxies, K D Abhyankar, University Press, Hyderabad, 2009.
3.	Facts and Speculations in Cosmology, J V Narlikar and G Burbidge, Cambridge University Press, Delhi, 2009.
4.	The Cosmic Century, Malcolm Longair, Cambridge University Press, Cambridge, 2006.
5.	An Introduction to Astrophysics, BaidyanathBasu, Prentice Hall of India, Delhi 1997.
6.	Fundamentals of Equations of State, S. Eliezer, A Ghatak and Heinrich Hora, World Scientific, Singapore, 2002. Only Chapter 15.

Course Description

Course Code	16B1NMA831	**Semester** Even	**Semester** VIII **Session** 2020-21 **Month from** Jan - Jun 2021
Course Name	Optimization Techniques		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C402-2.1	apply generalized, revised and dual simplex method for linear programming problems (LPP).	Applying Level (C3)
C402-2.2	apply graphical, algebraic and linear programming techniques for pure and mixed strategy problems in game theory.	Applying Level (C3)
C402-2.3	classify and solve the problems on queuing and inventory models.	Analyzing Level (C4)
C402-2.4	solve and analyze the network scheduling and sequencing problems.	Analyzing Level (C4)
C402-2.5	make use of dynamic programming technique to solve complex linear programming problems.	Applying Level (C3)
C402-2.6	determine numerical solution of nonlinear multidimensional problems.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Linear Programming	Convex sets, Linear Programming Problems (LPP), graphical and simplex method, Big-M method, Two phase method, generalized simplex method, revised simplex method, Duality theory, dual simplex method.	08
2.	Game Theory	Rectangular Games, Minmax Theorem, Graphical Solution of 2×n, 3×n, m×2, m×3 and mxn Games, Reduction to Linear Programming Problems.	06
3.	Queuing Theory & Inventory Model:	Introduction, Steady-State Solutions of Markovian Queuing Models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited space, M/G/1, Inventory Models.	08
4.	Sequencing & Scheduling	Processing of Jobs through Machines, CPM and PERT.	06
5.	Dynamic Programming	Discrete and Continuous Dynamic Programming, Simple Illustrations.	06
6.	Nonlinear Programming	Unimodal function, One Dimensional minimization problem, Newton's Method Golden Section, Fibonacci Search, Bisection, Steepest Descent Method, Multidimensional Newton's method.	08
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based learning: Each student in a group of 4-5 will analyse literature on mathematical application of discrete and continuous dynamic programming technique to solve complex linear programming problems. To make the subject application based, the students analyze the

optimized way to deal with dynamic programming problems.	
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.	Taha, H. A., Operations Research - An Introduction, Tenth Edition, Pearson Education, 2017.
2.	Rao, S. S. - Engineering Optimization, Theory and Practice, Third Edition, New Age International Publishers, 2010.
3.	Hillier F., Lieberman G. J., Nag,B. and Basu, P., Introduction to Operations Research, 10th edition, McGraw-Hill, 2017.
4.	Wagner, H. M., Principles of Operations Research with Applications to Managerial Decisions, 2nd edition, Prentice Hall of India Pvt. Ltd., 1980.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**17M11EC119**	**Semester** …Even **(specify Odd/Even)**	**Semester** Even **Session** 2020 -2021 **Month from** January **to** May
Course Name	**Advanced Wireless and Mobile Communication**		
Credits	03	**Contact Hours**	03

Faculty (Names)	**Coordinator(s)**	Dr. Rahul Kaushik
	Teacher(s) (Alphabetically)	Dr. Rahul Kaushik

COURSE OUTCOMES		**COGNITIVE LEVELS**
C113.1	Relate and recall the concepts of Wireless and Mobile Communication.	RememberingLevel (C1)
C113.2	Understand the Wireless and Mobile Communication Techniques of Mobile wireless Networks.	UnderstandingLevel (C2)
C113.3	Apply theknowledge of Wireless and Mobile CommunicationTechniques in Mobile wireless Networks like (GSM/UMTS/HSPA/LTE)	Applying Level (C3)
C113.4	Analyze the application of 3GPP based techniques in Mobile wireless Networks like (GSM/UMTS/HSPA/LTE)	AnalyzingLevel (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Overview of wireless communications, Evolution mobile networks, Mobile Standards, Spectrum Considerations. Generic wireless network architecture.	**4**
2.	Cellular Concept and Engineering	Problems in mobile communication. Need for Cells. Spectrum and its utilization –frequency reuse. Cell design considerations. Cell Topology. Co-channel and adjacent –channel cells interference. Cell splitting and sectoring. Coverage and capacity of cellular system. Hand-off techniques.	**8**
3.	Propagation of Mobile Radio Signals	Radio wave propagation mechanism. Path loss .Outdoor and Indoor propagation models. Antenna types, size and height. Multipath propagation model .Different types of fading. Doppler effect and mobility.	**7**
4.	Multiple Access Techniques	FDMA, TDMA, CDMA, techniques and their performance. Number of channels. Introduction to OFDM,OFDMA and SC-FDMA in LTE.	**5**
5.	Mobile Wireless Networks	Architectures of GSM, UMTS, HSPA and LTE	**5**
6.	LTE Radio Access Network	LTE Radio Interface ; Logical, Transport and physical Channels; Reference Signals, Physical Cell ID, Time-	**8**

		Domain Structure, Scheduling in LTE, LTE Advanced	
7.	Introduction of 5G	Evolution and characteristics of 5G cellular networks, Enabling technologies for 5G: mm waves, massive MIMO, Small cells, Beamforming, Convergence of cellular and Wi-Fi technologies	**5**
		Total number of Lectures	**42**

Evaluation Criteria

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

a) Attendance and Performance = 10

b) Class Test/Quiz = 5

c) Assignment = 10

Total **100**

Project Based Learning: The students will learn the practical limitations of mobile channels imposed on communication systems with the help of assignments. Further, each student is required to prepare an independent review in the area of wireless communication using one or more research publications. The understanding of recent trends helps students in analyzing practical systems andenhance their employability 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.	T. S. Rappaport, Wireless Communications, PHI, 2002.
2.	Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
3.	Harri Holma, Antti Toskala, LTE for UMTS: Evolution to LTE-Advanced, John Wiley and Sons, 2011
4.	5G Technology Evolution Recommendations, 4G Americas, 2015
5.	C. Beard, W. Stallings, Wireless Communication Networks and Systems, Pearson, 2016
6.	http://www.3gpp.org/ftp/Specs/html-info/36-series.htm

Detailed Syllabus

Course Code	15B19EC891	**Semester:**Even **(specify Odd/Even)**	**Semester:**8th **Session** 2020 -2021 **Month from:**January to May
Course Name	Project Part-2		
Credits	12	**Contact Hours**	**----**

Faculty (Names)	**Coordinator(s)**	Dr. Sajai Vir Singh, Ms. Shradha Saxena
	Teacher(s) (Alphabetically)	Sajai Vir Singh, Shivaji Tyagi, Shradha Saxena, Varun Goel

COURSE OUTCOMES- At the completion of the course, students will be able to,		**COGNITIVE LEVELS**
C451.1	Summarize the contemporary scholarly literature, activities, and explored tools/ techniques/software/hardware for hands-on in the respective project area in various domain of Electronics Engineering.	Understanding level (C2)
C451.2	Analyze/Design the skill for obtaining the optimum solution to the formulated problem with in stipulated time	Analyzing level (C4)
C451.3	Evaluate /Validate sound conclusions based on evidence and analysis	Evaluating level (C5)
C451.4	Develop the skill in student so that they can communicate effectively in both verbal and written form.	Creating Level (C6)

Evaluation Criteria

Components	**Maximum Marks**
MidSem Viva	20
Final Viva	30
D2D	30
Thesis	20
Total	**100**

Project based learning: Project part II is the continuation of Project part 1 done in the previous semester. The Project Work is by far the most important single piece of work in the B. Tech programme. It provides the opportunity for student to demonstrate independence and originality, to plan and organize a large Project over a long period and to put into practice some of the techniques, student have been taught throughout the course.In Project work initially, first all students are advised to make groups having 2-3 students in each group and also to select the supervisor of their own choice and research field. The students are also advised to choose a Project that involves a combination of sound background research, software skill, or piece of theoretical work. Interdisciplinary Project proposals and innovative Projects are encouraged and more appreciable. Objective of project part II is for the students to learn and experience all the major phases and processes involved in solving "real life engineering problems related to electronics and communication or Interdisciplinary area. The major outcome of this project work must be well-trained the students. More specifically students must have acquired:

- System integration skills
- Documentation skills
- Project management skills
- Problem solving skills
- team work skill.

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12EC125	**Semester** : Even 2021	**Semester** 8th **Session** 2020 -2021 **Month from Jan – May 2021**
Course Name	Detection and Estimation Theory		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Vikram Karwal
	Teacher(s) (Alphabetically)	Dr. Vikram Karwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C115.1	The course aims to familiarize student with stochastic processes and its properties.	Understanding Level (C2)
C115.2	The course helps students to analyze probabilistic models and estimate the parameters of the model parameters.	Analyze Level (C4)
C115.3	The course helps students evaluate the observations of the noise-corrupted functions and determine the best estimate of the state.	Evaluating Level (C5)
C115.4	The course helps student compute the optimality criteria to quantify best estimates or detection decisions and limits on performance.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of random variables	Distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of random variables, Schwarz Inequality, Orthogonality principle in estimation, Central limit theorem, Random Process, stationary process, autocorrelation and autocovariance functions, Spectral representation of random signals, Wiener Khinchin theorem, Properties of power spectral density, Gaussian Process and white noise	6
2.	Parameter estimation theory	Principal of estimation and applications, Properties of estimates, unbiased and consistent estimators, MVUE, CR bound, Efficient estimators; Criteria of estimation: the methods of maximum likelihood and its properties; Baysean estimation: Mean Square error and MMSE, Mean Absolute error, Hit and Miss cost function and MAP estimation	8

3.	Estimation of signal in presence of White Gaussian Noise(WGN)	Linear Minimum Mean-Square Error(LMMSE) Filtering: Wiener Hoff Equation FIR Wiener filter, Causal IIR Wiener filter, Noncausal IIR Wiener filter, Linear prediction of signals, Forward and Backward Predictions, Levinson Durbin Algorithm, Lattice filter realization of prediction error filters.	8
4.	Complexity Computations	Principle and Application, Steepest Descent Algorithm, Convergence characteristics; LMS algorithm, convergence, excess mean square error, Leaky LMS algorithm; Applications of Adaptive filters; RLS algorithm, derivation, Matrix inversion Lemma, Initilization, tracking of nonstationarity.	8
5.	Kalman Filtering	Principle and application, Scalar Kalman filter, Vector Kalman filter	4
6.	Detection Theory	Hypothesis testing, Bayesian, Neyman-Pearson and Minimax detetion, Composite Hypothesis testing, Generalized LRT, Sequential and Distributed Detection, Non-parametric detection, Detection in Gaussian noise	9
		Total number of Lectures	43

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Assignment, 5 Quiz, 5 Class Participation, 10 Attendance)
Total	100

Project based Learning Component: After studying the contents of this Course students will be able to design Least Mean square estimators, Biased and Unbiased estimators, Optimal estimators. These esti- mators find widespread applications in the area of Communication and Signal Processing applications specially adaptive systems. Students shall also learn the techniques to design and analyse detectors for various 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.	An Introduction to Signal Detection and Estimation by H. Vincent Poor, Springer, 1994
2.	Linear Estimation by Thomas Kailath, Ali H sayed, Babak Hassibi, Prentice Hall, 2000
3.	Fundamentals of Statistical Signal Processing: Detection theory by Steven M Kay, Pearson, 2010
4.	Fundamentals of Statistical Signal Processing: Estimation theory by Steven M Kay, Pearson, 2010

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12EC128	**Semester** :Even2021**(specify Odd/Even)**	**Semester** 8th **Session** 2020 -2021 **Month from Jan2021 – June 2021**
Course Name	Software Defined Radio and Cognitive Radio Network		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Ankit Garg
	Teacher(s) (Alphabetically)	Dr. Ankit Garg

COURSE OUTCOMES		**COGNITIVE LEVELS**
C122.1	Understand the concepts of Software Defined Radio (SDR) and its architecture	Understanding Level (C2)
C122.2	Understand the concepts of radio (CR) architecture, functions of cognitive radio	Understanding Level (C2)
C122.3	Analyzing the Spectrum sharing and management and Spectrum sensing methods	Analyzing Level (C4)
C122.4	Evaluating the performance ofNext GenerationWireless Networks	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	**Software Defined Radio (SDR)**	Essential functions of the SDR, SDR architecture, design principles of SDR, traditional radio implemented in hardware and SDR, transmitter architecture and its issues, A/D & D/A conversion, parameters of practical data converters, techniques to improve data converter performance, complex ADC and DAC architectures, digital radio processing, reconfigurable wireless communication systems.	8
2.	**Cognitive Radio (CR) features and architecture**	Cognitive Radio (CR) features and capabilities, CR functions, CR architecture, components of CR, CR and dynamic spectrum access, interference temperature, CR architecture for next generation networks, CR standardization.	8
3.	**Spectrum sensing**	Spectrum sensing and identification, primary signal detection. energy detector, cyclostationary feature detector, matched filter, cooperative sensing, spectrum opportunity, spectrum opportunity detection, fundamental trade-offs: performance versus constraint, sensing accuracy versus sensing overhead.	10
4.	**Spectrum management of cognitive radio**	Spectrum decision, spectrum sharing and spectrum mobility, mobility management of heterogeneous wireless networks, Cooperation and cognitive systemsand research challenges in	10

	net-works	CR	
5.	**Next GenerationWireless Networks**	Control of CRN, Self-organization in mobile communication networks, security in CRN	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25(Attendance, Performance. Assignment/Quiz)
Total	**100**

Project Based Learning: Students will learn about the design and implementation of cognitive radio using SDR. Additionally, students in group sizes of three-four required to prepare a review ofSDR andcognitive radio using one or more research publications including interfacing softwares.

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.	Kwang-Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & Sons, Ltd, 2009.
2.	Alexander M. Wyglinski, Maziar Nekovee, and Y. Thomas Hou, "Cognitive Radio Communications and Networks - Principles and Practice", Elsevier Inc., 2010.
3.	Jeffrey H. Reed "Software Radio: A Modern Approach to radio Engineering", Pearson Education Asia.

Detailed Syllabus
Lecture-wise Breakup

Course Code	20M31EC114	**Semester:** Even 2021 **(specify Odd/Even)**	**Semester:** Even **Session:** 2020-21 **Month from: Jan 2021 to June 2021**
Course Name	Digital Image and Video Processing		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Richa Gupta	
	Teacher(s) (Alphabetically)	Richa Gupta	

COURSE OUTCOMES- At the completion of the course, students will be able to		**COGNITIVE LEVELS**
C115.1	familiarize with the concept of digital image formation, image structure and transform coding.	Applying Level (C3)
C115.2	understand the basics of digital image processing with necessary skills to solve practical problems.	Applying Level (C3)
C115.3	Learn fundamentals of digital video processing, motion estimation and compensation.	Applying Level (C3)
C115.4	Identify the need of image & video compression, and image & video applications.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Fundamentals of Digital Image and Image Transform	Basics of digital image processing, Structure of the Picture Information, luminance and chrominance components, RGB components, Transform Coding, Discrete Cosine Transforms – 1 D and 2D. Energy compaction.	6
2.	Digital Image Processing	Image Enhancement - Spatial Domain Processing: Digital Negative, Contrast Stretching, Thresholding, Gray Level Slicing, Bit Plane Slicing, Log Transform and Power Law Transform. Neighborhood Processing: Averaging filters, Order statistics filters, High pass filters and High boost filters, Filtering in frequency domain: Smoothing and Sharpening filters, Image Segmentation, Image Restoration & Construction, Morphological Image Processing, Image quality assessments.	10
3.	Digital Video Processing	Digital Video Sampling and Interpolation, Video Frame Classifications, I, P and B frames, Notation, Motion Estimation and compensation, Application of motion estimation in video coding, Video Enhancement and Restoration, Video quality Assessment.	9
4.	Image Compression and Video Compression	Data Compression: Lossless Compression and Lossy Compression, Optimal codes, Construction algorithms of source codes - Huffman Codes, Error Resilient Codes–types, construction and applications,	10

		Basics of Image Compression, Joint Photographic Expert Group (JPEG) compression, Basics of Video Compression, Inter-frame and Intra-frame redundancy, Video Coding Standard – H.263++	
5.	Image and Video Applications	Image and Video Segmentation, Biomedical Image Processing, Image Annotation, Video Annotation, Video surveillance.	8
		Total number of Lectures	**43**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Performance. Assignment/Quiz)
Total	**100**

Project Based Learning: Students are required to prepare a consolidated summary (including approach, limitations, pros and cons, applications, scope etc.) of any recent research paper published in reputed International Conference or International Journal related to Image and Video processing. They will submit this research assignment towards the end of the semester.

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.	Gonzaleze and Woods, "Digital Image Processing using MATLAB", 2nd Edition, McGraw Hill Education, 2010.
2.	K. Sayood, Introduction to data compression, Elsevier, 5th edition, 2017
3.	A Murat Tekalp, "Digital Video Processing", Prentice Hall, 2nd Edition, 2015

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**20M41EC119**	**Semester: EVEN (specify Odd/Even)**	**Semester** : 2 **Session** 2020 -21 **Month from** Jan **to** June
Subject Name	**MIMO-OFDM for Wireless Communications**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	1. Dr. Ashish Goel
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C117.1	To understand OFDM system with its impairments.	Understanding (C2)
C117.2	To understand and analyze the various performance parameters of OFDM system.	Analyzing (C4)
C117.3	To understand and analyze the performance of MIMO systems	Analyzing (C4)
C117.4	To understand the Single Carrier Frequency Division Multiplexing System	Understanding (C2)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Basic principles of orthogonality, Single carrier vs. multi carrier systems, orthogonal frequency-division multiplexing (OFDM): Block diagram, modulation, demodulation, frequency spectrum, need of cyclic prefix. synchronization, peak-to-average power ratio, effect of HPA on OFDM signal,	7
2.	PAPR and PAPR Reduction Schemes	PAPR of Base band and Bandpass OFDM signal, PDF & CCDF of PAPR, Need of PAPR reduction , PAPR reduction techniques: Clipping, Iterative clipping and filtering, Companding schemes, Selective mapping (SLM), Partial transmit sequence (PTS), Tone Reservation (TR), Tone Injection, Active Constellation Extension (ACE).	12
3.	Inter Carrier Interference (ICI) and ICI cancellation Schemes	Effect of Frequency offset, ICI Cancellation Schemes: ICI self cancellation, Symmetric ICI Self-Cancellation Scheme , ICI conjugate cancellation etc.	8
4.	Multiple-input multiple-output (MIMO) Systems	MIMO System model, antenna diversity, MIMO detection algorithms: MIMO Zero-Forcing Receiver, MIMO MMSE Receiver, Singular Value Decomposition of MIMO Channel, MIMO capacity, Space-time coding. V-BLAST, MIMO Beamforming	12

5.	Single Carrier Frequency Division Multiplexing (SC-FDMA)	SC-FDMA, Transmitter and Receiver, Subcarrier Mapping, Advantages and disadvantages	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	**20**
T2	**20**
End Semester Examination	**35**
TA	**25(Attendance, Performance. Assignment/Quiz)**
Total	**100**

Project based learning: Here, students will learn latest 4G wireless communication technologies, starting from the basics process of modulation, demodulation and its impairment. These schemes are of utmost importance to understand the concepts of current and future generations of communication system and to design the same . Student will be able to design the physical layer of 4G communication and to analyze its implementations issues. Students can perform the some simulation on Matlab to analyze the same. Understating of these techniques will further help to work in any core communication industry.

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.	Aditya K Jagannatham, Principles of Modern Wireless Communication Systems Theory and Practice, TMH, 2/e, 2017
2.	Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung-Gu Kang , MIMO-OFDM Wireless Communications with MATLAB, Wiley, 2013
3.	T. Jiang and Y.Wu, "An Overview: Peak-to-average power ratio reduction techniques for OFDM signals", IEEE Transactions on Broadcasting, vol. 54, no. 2, pp. 257–268, Jun. 2008.
4.	Y. Zhao, S.G. Häggman , "Intercarrier interference self-cancellation scheme for OFDM mobile communication systems" , IEEE Transactions on Communications, 49(7), pp .1185-1191, 2001.
5.	Hyung G. Myung, "Introduction to single carrier FDMA", In Proceedings of 2007 15th European Signal Processing Conference, Poznan, Poland, pp. 2144-48.
6.	Journal articles i.e. IEEE, Springer, NPTEL video lectures.

Detailed Syllabus

Course Code	18B12BT414	Semester Even	Semester VIIIth Session 2020-2021 Month from Jan - June
Course Name	Machine Learning tools in Bioinformatics		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	1. Dr. Chakresh Kumar Jain
	Teacher(s) (Alphabetically)	1. Dr. Chakresh Kumar Jain

COURSE OUTCOMES		COGNITIVE LEVELS
C402-13.1	Explain about the machine learning principle biological complexities and resources	Understand Level (C2)
C402-13.2	Apply Pattern Identification methods for motif discovery	Apply Level (C3)
C402-13.3	Apply machine learning in solving biological problems.	Apply Level (C3)
C402-13.4	Analyzing the use of machine learning in disease-drug discovery	Analyze Level (C4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Overview of machine learning methods and scope in bioinformatics	Fundamentals of machine learning, algorithms, introduction to biological problem and mapping, gene and genome, Structure, function and organization, biological database, Scope of machine learning in bioinformatics (Genomics, proteomics, transcriptomics etc.)	7
2.	Pattern identification	Pattern and motif, domain, profile in Bioinformatics, Search algorithms, String search, Boyer moore, Robin Karp algorithm KMP algorithm, Dynamics programming and greedy approach etc. case studies	4
3.	Data classification: Clustering and tree algorithm	Gene finding tools, Discrimination analysis ; LDA, Clustering methods: Hierarchical , K mean, Normalization, similarity measure (distances), Basics of tree, suffix tree and its applications in Bioinformatics , validations,	8

		statistical inferences and biological interpretation (Gene ontology and microarray data)	
4.	Basics of ANN and HMM	Fundamental of ANN, Back propagation algorithm, kNN, ANN model, Biological tools like PHD, Intron identifier, splice site prediction etc. Basics of HMM Stochastic algorithm, profile generation, Pfam, protein families, Gibbs sampling, Viterbi algorithm, tools evaluation	10
5.	SVM	Introduction to SVM. Feature selection, kernel methods, case studies(Bioinformatics application ; protein structure and function prediction , data mining in drug discovery etc.)	5
6.	Applications and tools	SVM_light, GIST server, applications of SVM, QSAR prediction, ADMET predictions, case studies, Protein coding region prediction, gene identification, folding problems in protein sequences, network analysis, RNAi Designing, PSORT, Genscan, HMMTOP, DAS, Genemark , Glimmer, etc., case studies	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA evaluation)	25 (Assignment, Quiz, Case study, Project based
Total	**100**

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

1.	Pierre Baldi and Søren Brunak "Bioinformatics The Machine Learning Approach" , February 1998, 371 pp., 62 illus.,
2.	Thomas H. Cormen "Introduction to Algorithms" , 2nd edition McGraw-Hill Science,2001, 1056 pages.
3	Yang, Zheng Rong, " Machine :Learning Approaches to Bioinformatics", New Delhi world Scientific, Pp 336, 2017
4	Research papers and manuals

Detailed Syllabus

Course Code	15B1NHS832	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2020 -2021 **Month from :**Jan - June
Course Name	International Studies		
Credits	3	**Contact Hours**	**3**(3-0-0)

Faculty (Names)	**Coordinator(s)**	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	Dr. Chandrima Chaudhuri

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C402-8.1	Demonstrate an understanding of the basic concepts in the area of international studies	Understanding (C2)
C402-8.2	Compare the changes in India's foreign policy in the Cold War era and the post Cold War era	Applying (C3)
C402-8.3	Analyze the major political developments and events since the 20th century	Analyzing (C4)
C402-8.4	Demonstrate an understanding of the rise of new power centers in the changing world order	Understanding (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Basic Concepts	Balance of power and Collective security National Interest and its instruments	4
2.	An Overview of Twentieth Century International Relations History	World War I: Causes and Consequences Significance of the Bolshevik Revolution Rise of Fascism / Nazism World War II: Causes and Consequences	8
3.	Cold War Politics	Origin of the Cold War Evolution of the Cold War Collapse of the Soviet Union Causes of the End of the Cold War	8
4.	India's foreign policy during the Cold War era	Basic Determinants (Historical, Geo-Political, Economic, Domestic and Strategic) India's Policy of Non-alignment	6
5.	India's foreign policy in the Post-Cold War era	India and SAARC India and the Look East policy Impediments to regional co-operation: river water disputes; illegal cross-border migration; ethnic conflicts and insurgencies; border disputes	8
6.	Emergence of OtherPower Centres	European Union Rise of Asia Powers- Russia, China and Japan	8

Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Quiz, Attendance)
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. Chatterjee, *International Relations Today*. Noida, India: Pearson, 2019
2.	Appadorai, & M.S.Rajan, *India's Foreign Policy and Relations*. New Delhi, India: South Asian Publisher, 1985
3.	E.H. Carr,*International Relations between the Two World Wars: 1919-1939*. New York, USA: Palgrave, 2009
4.	J. Baylis &S. Smith, Ed. *The Globalization of World Politics: An Introduction to International Relations*. Oxford, UK: Oxford University Press, 2011
5.	P. Calvocoressi, *World Politics: 1945—2000*. Essex, UK: Pearson,2009