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
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**

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

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
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 Trace Files	7. To interpret data trace file (.tr) of Wired, Wireless and LAN Networks.	CO4

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	18B11EC315	**Semester (Even)**	**Semester 6 Session** 2020-21 **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	9

		circuit simulation	
3.	MOS Inverters	Static and switching characteristics, Delay-time definitions, calculation of delay times, Inverter design with delay constraints, Static and switching power dissipation of CMOS inverter	9
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
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 from 10.			

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 based projects.

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
Lecture-wise Breakup

Course Code	**15B11EC613**	**Semester: Even**	**Semester:** 6th **Session:** 2020-21 **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

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 Semester Evaluation	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)**	Shivaji Tyagi
	Teacher(s) (Alphabetically)	Shivaji Tyagi

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

Course Code	17B1NEC734	**Semester EVEN**	**Semester** VI **Session** 2020 -2021 **Month from** Jan to June
Course Name	RF and Microwave Engineering		
Credits	3	**Contact Hours**	3L

Faculty (Names)	**Coordinator(s)**	Monika
	Teacher(s) (Alphabetically)	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	17B1NEC741	**Semester EVEN**	**Semester-6 Session 2020-21** **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	10

		modeling and simulation	
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 removal	9
		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

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
Lecture-wise Breakup

Subject Code	**17B11EC731**	**Semester Even**	**Semester** 6th **Session** 2020 -2021 **Month from** Jan **to** May 2021
Subject Name	Mobile Communication		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Kuldeep Baderia, Ankur Bhardwaj
	Teacher(s) (Alphabetically)	Ankur Bhardwaj, Kuldeep Baderia

COURSE OUTCOMES		**COGNITIVE LEVELS**
C331-2.1	Explain the evolution of mobile communication and basics of all the wireless standards currently being employed.	Understanding Level (C2)
C331-2.2	Perform mathematical analysis of cellular systems and cellular capacity improvement designs.	Analyzing Level (C4)
C331-2.3	Analyze large and small scale propagation models and their design both mathematically and conceptually. Analysis of various fading models.	Analyzing Level (C4)
C331-2.4	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 GSM, security aspects. GPRS, UMTS.	8
6	Introduction to 4G systems	Long Term Evolution (LTE) and Worldwide	4

		Interoperability for Microwave Access (WiMax).	
		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**

Project based Learning Component: Here, students will learn frequency planning in mobile communication and designing the network in such a way so as to maximize the system capacity. System capacity is used to characterize the total number of users that can be supported by the system. As an alternate to measurements, different propagation models will be analyzed. Using some simulation tool (like MATLAB) performance of different propagation models (like Okumura, Hata, SUI, etc.) will be analyzed to find the best suited model for a particular wireless generation. Further to characterize the fading scenarios in wireless communication, simulations will be performed for different fading distributions like Rayleigh or Ricean. Summarizing, students will learn the simulations required to analyze the different aspects of wireless communication like system capacity, signal strength, and fading.

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

Course Code	**20B16CS324**	**Semester** Even	**Semester** VI **Session** 2020 -2021 Month from Jan 2021 to Jun 2021
Course Name	**Non-linear Data Structures & problem solving**		
Credits		**Contact Hours**	1- 0 - 2

Faculty (Names)	**Coordinator(s)**	Dr. Manju
	Teacher(s) (Alphabetically)	Dr. Aparajita Nanda, Dr. Manish Ku. Thakur, Dr. Manju

COURSE OUTCOMES At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-10.1	Demonstrate operations on different data structures.	Understand Level (C2)
C305-10.2	Use critical thinking skills and creativity to choose the appropriate data structure and solve the given problem.	Apply Level (C3)
C305-10.3	Identify the correctness and efficiency of the solution by constructing different test cases.	Apply Level (C3)
C305-10.4	Develop solutions to real world problems by incorporating the knowledge of data structures	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Problem Solving and Data Structures	Concepts of Problem Solving, Performance metrics for Algorithm Analysis, Why study Data structures and Abstract Data Types. Practice problems on Sparse Matrix	**1**
2.	Practice problems on advanced list structures	Multi-list, skip list, XOR linked list, self organizing list, unrolled linked list	**2**
3.	Practice problems on point and range queries using tree structures	Suffix array and suffix tree, Trie and persistent trie, Segment tree and persistent segment tree, Interval tree, K dimensional tree, Binary indexed tree, Splay tree, Treap (randomized BST), Order statistics tree	**4**
4.	Practice problems on optimization problems using tree	Tournament tree, Decision tree, Cartesian tree	**2**

	structures.		
5.	Practice problems on heaps and sets	Sparse set, Disjoint set, Leftist heap, K-ary heap	**2**
6.	Problem solving using graphs	Social graphs, Transportation system graphs, Resource allocation graphs	**3**
		Total number of Lectures	**14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance – 10, Quizes/Mini Project – 20)
Total	**100**

Project based Learning: Each student in a group of 3-4 will develop a simulator with the help of various advanced data structures. Students will be able to understand and apply algorithms and advanced data structures properly; know how to evaluate, choose appropriate algorithms or data structures; know how to design and implement algorithms or data structures to serve the purpose of designing solution. Selecting t**he appropriate** data **structure** is an integral part of the programming and problem-solving process. The project typically incorporates various advanced data structure concepts to enable the synthesis of knowledge from real-life experiences.

Recommended Reading material:	
Text Books	
1.	Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Fourth Edition.
2.	Handbook of Data Structures and Applications, 2nd Edition by Sartaj Sahni, Dinesh P. Mehta, CRC Press
References	
3.	Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.
4.	Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
5.	Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
6.	Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
7.	Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS 531**	**Semester : Even (specify Odd/Even)**	**Semester : VI Session: 2020 - 2021 Month from: Jan- June 2021**
Course Name	**Sociology of Youth**		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	**Ms Shikha Kumari**
	Teacher(s) (Alphabetically)	**Ms Shikha Kumari**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-13.1	Demonstrate an understanding of Youth and youth culture in sociological perspectives	Understanding (C 2)
C304-13.2	Explain the ethical, cultural& social issues concerning Youth	Evaluating(C 5)
C304-13.3	Examine the relative importance of structure and agency in shaping young people's experiences and life opportunities	Analyzing(C 4)
C304-13.4	Evaluate youth experience in a context of social change	Evaluating(C 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Youth	Meaning and characteristics of youth, demographic profile of youth in India, Challenges faced by Youth, Youth's roles and responsibilities in society	2
2.	Youth Culture	Concept of Youth Culture, role of Popular culture in shaping youth culture,	2
3.	Perspectives on Youth Culture	Functionalist, Conflict, Interactionist and Feminist Perspective on Youth Culture, Youth and Gender	3
4.	Youth and Identity	Social divisions: sexuality, urban and rural youth, social identities: subcultural, digital, Experiences of youth to negotiate identities in contemporary societies	6
5.	Socialization of Youth	Concept and processs of socialization, Internalization of norms, types of socialization, conditions of learning, internalized objects, theories of socialization, stages of socialization, adult socialization, agents of socialization, role of culture in socialization, socialization and cultural differences, importance of socialization, Failure of the socialization process	7
6.	Problems of Youth	Role and Value conflicts, Generation Gap, Career decisions and Unemployment, Emotional adjustment, Coping with pressures of living, Unequal Gender norms, Crime (Social Strain theories),	6

7.	Changing perceptive of Youth and Youth Culture in 21st century	involvement of youth in major decision making institutions, Post-modernity and Youth, Youth Unrest	2
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20 (Project based)
T2	20
End Semester Examination	35
TA	25 (Presentation, Assignment, attendance, Quiz and Participation in 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.	Tyyskä, V. *Youth and Society: The long and winding road*, 2nd Ed., Canadian Scholars' Press, Inc. (2008).
2.	White, Rob, Johanna Wyn and Patrizia Albanese. *Youth & Society: Exploring the Social Dynamics of Youth Experience*. Don Mills, ON: Oxford University Press, 2011.
3.	Bansal, P. *Youth in contemporary India: Images of identity and social change*. Springer Science & Business Media, 2012.
4.	Furlong, Andy. *Youth studies: An introduction*. Routledge, 2012.
5.	Blossfeld, Hans-Peter, et al., eds. *Globalization, uncertainty and youth in society: The losers in a globalizing world*. Routledge, 2006.
6.	Ruhela, Satya Pal, ed. Sociology of the teaching profession in India. National Council of Educational Research and Training, 1970.
7.	Frith, S. "The sociology of youth. Themes and perspectives in sociology." Ormskirk, Lancashire: Causeway Books , 1984.

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 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

Subject Code	**16B1NHS632**	**Semester: EVEN**	**Semester 6th Session 2020-21** **Month from Jan to June**
Subject Name	**COGNITIVE PSYCHOLOGY**		
Credits	**3**	**Contact Hours**	**2-1-0**
Faculty (Names)	**Coordinator(s)**	**Dr. Badri Bajaj**	
	Teacher(s) (Alphabetically)	**Dr. Badri Bajaj**	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-4.1	Understand and apply the concepts of cognitive psychology in everyday life	Applying Level (C3)
C304-4.2	Analyze the different models of various cognitive processes	Analyzing Level (C4)
C304-4.3	Evaluate cognitive psychology issues and recommend possible solutions	Evaluating Level (C5)
C304-4.4	Evaluate interventions/solutions for self-development through cognitive processes	Evaluating Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Cognitive Psychology	Historical Background: Emergence of modern cognitive Psychology; Approaches: Information Processing and PDP Model; Research Methods	**3**
3.	Perceptual Processes	Perceptual learning and development; perception of shape, space, and movement.	**4**
3.	Attention	Selective Attention and Divided Attention: Meaning, Definition, and Theories.	**4**
4.	Memory	Short Term Memory	**3**
5.	Imagery	Properties of mental images; Representation of images and cognitive maps.	**3**
6.	Language	Structure of language and its acquisition, speech perception, factors affecting comprehension.	**4**
7.	Thinking and Problem Solving	Types of thinking; Classification of problems; Problems solving approaches,	**4**

		Problems space theory by Newell and Simon, Creativity	
8.	Decision Making	Logical reasoning types and errors in reasoning processes. Concept formation and categorization; Judgment and decision making	**3**
Total number of Hours			**28**

Evaluation Criteria

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

Project based learning: Students in a group will choose a research topic from the syllabi of cognitive psychology. Students will cover the following points to prepare project reports: Understanding of concept, related theories and perspectives; Describe the relevance of the chosen concept for personal growth; Discuss the application of chosen topic for your professional life; Elaborate the relevance of the topic at group level and societal level. Discussions on these practical aspects will enhance students' understanding & application of concepts of cognitive psychology in everyday life.

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.	Ronald T. Kellogg, Fundamentals of Cognitive Psychology, 2nd Ed., Sage Publishing, 2012
2.	Robert Solso, Otto Maclin, M. Kimberly Maclin, Cognitive Psychology, 8th Ed., Pearson Education, 2013
3.	Kathleen M. Galotti, Cognitive Psychology, 5th Ed., Sage Publishing, 2014
4.	Michael W. Eysenck, Mark T. Keane, Cognitive Psychology: A Student's Handbook , 7th Ed, Psychology Press, 2015
5.	Robert Sternberg, Karin Sternberg, Cognitive Psychology, 6th Ed, Wadsworth/Cengage Learning, 2011
6.	Edward E. Smith, Stephen M. Kosslyn, Cognitive Psychology: Mind and Brain, Ist Ed, Pearson Education India; 2015

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS635**	**Semester: Even**	**Semester: VI Session: 2020 -2021** **Month: Jan 2021 to June 2021**
Course Name	**Organizational Behavior**		
Credits	**3**	**Contact Hours**	**3(2-1-0)**

Faculty (Names)	**Coordinator(s)**	**Dr Anshu Banwari**
	Teacher(s) (Alphabetically)	**Dr Anshu Banwari**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-6.1	Identify dynamic human behavior through an insight into relationships between individuals, groups and organizations	Apply (C3)
C304-6.2	Analyze individual management style as it relates to influencing and managing behavior in the organization.	Analyze (C4)
C304-6.3	Decide and justify set of strategies for meeting the special challenges in the 21st century competitive workplace	Evaluate (C5)
C304-6.4	Assess the potential effects of important developments in the external environment on behavior in organizations	Evaluate (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	Introduction to OB: Challenges and Opportunities	Interdisciplinary Field, Concepts, Approaches, Responding to Globalization; Improving Quality & Productivity; Improving Customer Service; Improving People Skill; Empowering People; Stimulating Innovation & Change; Coping with Temporariness; Positive Organizational Behavior, Working in Networked Organizations; Balancing Work-Life Conflict	3
2	Managing Workforce Diversity	Major forms of Workplace Diversity, Valuing Diversity, Role of Disabilities, Discrimination, Diversity Initiatives, Diversity Awareness and Affirmative Action, Diversity Management and strategies to implement it Competitive Advantage of Diversity Management Generational Workforce	4
3.	Job Design and Flexible Job Environment	Job Design & its uses; Flexible Job Environment; Job Enrichment Model	2
4.	Leadership: Authentic Leadership	Inspirational Approach to Leadership: Authentic, Ethical & Servant Leadership Defining Authentic Leadership through Intrapersonal, Interpersonal and Developmental Aspects; Basic Model of Authentic Leadership; Practical Approach to Authentic Leadership through the research of Terry and Bill	6

		George; Authentic Leadership: Trust and Ethics, Dimensions of Trust, Counseling & Mentoring	
5.	Power & Politics	Concept of Power; Sources of Power Contingencies of Power; Power Tactics; Measuring Power Bases: Power Authority Obedience Organizational Politics: Types Factors contributing to Political Behavior; Consequences & Ethics of Politics	5
6.	Employee Engagement	Creating a Culture of Engagement, Models of engagement, Benefits of Employee Engagement, Gallup Study, Methods of engaging employees – from entry to exit, Managers Role in Driving Engagement	2
7.	Organizational Culture & Workplace Spirituality	Creating Organizational Culture Approaches to Organizational Culture; How employees learn culture; Measuring Organizational Culture; Spirituality & Organizational Culture	3
8.	Organizational Change & Development	Organizational Change: Meaning & Types; Technology & Change; Resistance to Change v/s Inviting Change; Approaches to Organizational Change; Planning & Implementing Change; Organizational Development; OD Interventions & Change	3
		Total number of Lectures	**28**

Evaluation Criteria

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

Project: To Identify the behavioral strategies adopted by a specific corporate/ business leader for his organization to meet the challenges of the 21st century competitive workplace and achieve the tangible outcomes of productivity and employee wellness within his organization

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. Robbins, T. Judge, S. Sanghi**, *Organizational Behavior*, 13th Ed, Prentice-Hall India, 2001
2.	**P.Subba Rao**, *Organizational Behavior: Text Cases & Games*, 2nd Edition, Himalaya Publishing House , 2015
3.	**John R. Schermerhorn, Richard N. Osborne, Mary Uhl-Bien; James G. Hunt**, *Organizational Behavior*, 12th Edition, Wiley India Pvt. Ltd, 2012
4.	**Debra L.Nelson and James C. Quick**, *Organizational Behavior*, Cengage Learning, India Edition, 2009
5.	**Steven L. McShane and Mary Ann Von Glinow**, *Organizational Behavior Essentials*, Tata McGraw Hill Publishing Company Ltd, 2007
6.	**Jerald Greenberg**, *Behavior in Organizations*, 10th Ed, PHI Learning Pvt Ltd

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS636**	**Semester : Even**	**Semester VI Session** 2020 -2021 **Month: January 2021 to June 2021**
Course Name	**Literature & Adaption**		
Credits	**3**	**Contact Hours**	**2-1-0**

Faculty (Names)	**Coordinator(s)**	Dr. Ekta Srivastava (Sector 128)
	Teacher(s) (Alphabetically)	Dr. Ekta Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-3.1	Understand and outline the elements and theories of adaptation and its various forms, and relate with the texts reflecting the cultural, moral and linguistic changes in the contemporary society.	Understanding Level (C2)
C304-3.2	Utilize visual literacy to analyze the language and style adopted in filmed texts and examine them as reflections of Readers' and Audience' values and perceptions in the context of myriad cultures and multidisciplinary settings individually and in groups.	Applying Level (C3)
C304-3.3	Analyze texts and their adaptations beyond the surface level of narrative or character as reflections of value systems of various cultures and times individually and in a team.	Analysing Level (C4)
C304-3.4	Evaluate, interpret and document source texts and adaptations thematically and stylistically to learn the nuances of language, culture and values of the society.	Evaluating Level (C5)
C304-3.5	Compose and make an effective presentation of a literary/non literary piece in any genre and design an ethical adaptation of any literary/non literary piece in another form individually and in groups.	Creating Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction Literary Devices	Figures of speech, Character, Plotline, Conflict, Point of View	2
2.	Literature & Adaptation	Understanding Cultural Contexts Forms of Adaption Cinematography & Narratology	4
3.	Framework	Adaptation Theories; Reader Response & Audience Response Theories Case study of the Classic Fairy Tale The Sleeping and its contemporary adaptation Maleficent	7
4.	Play & adaptations	The Pygmalion: George Bernard Shaw Hamlet : William Shakespeare	6

5.	Novel & Adaptations	Pride & Prejudice: Jane Austen The Giver: Lois Lowry The Godfather: Mario Puzo	9
		Total number of Lectures	28

Evaluation Criteria

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

Recommended Reading material:

1.	**Linda Hutcheon**, *A Theory of Adaptation*, Routledge, 2006
2.	**Mark William Roche**, *Why Literature matters in the 21st Century*, 1st edition, Yale University Press 2004
3.	**George Bernard Shaw**, *Pygmalion*, Electronic Version, Bartleyby.com, New York, 1999
4.	**Stanley Wills & Gary Taylor**, *The Complete Works. The Oxford Shakespeare* (Compact ed.). Oxford: Clarendon Press. , 1988.
5.	https://www.sparknotes.com/film/sleepingbeauty/
6.	**Jane Austen**, *Pride & Prejudice*, Reprint, Thomas Egerton, 2013
7.	**Mario Puzo,** *The Godfather*, 1st Edition, G. P. Putnam's Sons, USA, 1969
8.	**Lois Lowry,** *The Giver, 1st Edition*, Houghton Mifflin Harcourt Publishing Company, USA, 1993

SYLLABUS AND EVALUATION SCHEME

Lecture-wise Breakup

Course Code	19B12HS611	**Semester : EVEN (specify Odd/Even)**	**Semester:** VI **Session** 2020-21 **Month from:** January- June
Course Name	Econometric Analysis		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Manas Ranjan Behera
	Teacher(s) (Alphabetically)	Manas Ranjan Behera

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	*Demonstrate* the key concepts from basic statistics to understand the properties of a set of data.	Understanding Level - C2
CO2	*Apply* Ordinary Least Square method to undertake econometric studies.	Apply Level - C3
CO3	*Examine* whether the residuals from an OLS regression are well-behaved.	Analyze Level - C4
CO4	*Evaluate* different model selection criteria for forecasting.	Evaluation Level - C5
CO5	*Create* models for prediction from a given set of data.	Creation Level - C6

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Statistical Inference	Point and interval estimation; ;The Z distribution ;The Null and Alternate hypotheses ;The chi-square distribution; The F distribution; The t distribution	3
2.	Regression Analysis	Two variable regression model; The concept of the PRF; Classical assumptions of regression; Derivation of the OLS estimators and their variance; Properties of	7

		OLS estimators under classical assumptions; Gauss-Markov Theorem; Tests of Hypothesis, confidence intervals for OLS estimators; Measures of goodness of fit: R square and its limitations; Adjusted R square and its limitations	
3.	Econometric Model Specification	Identification: Structural and reduced form; Omitted Variables and Bias; Misspecification and Ramsay RESET; Specification test; Endogeneity and Bias	5
4.	Failure of Classical Assumptions	Multi-collinearity and its implications; Auto-correlation: Consequences and Durbin-Watson test ;Heteroskedasticity: Consequences and the Goldfeld - Quandt test	2
5.	Forecasting	Forecasting with a)moving averages b) linear trend c) exponential trend CAGR; Forecasting with linear regression; Classical time series decomposition; Measures of forecast performance: Mean square error and root mean square error; Limitations of econometric forecasts	5
6.	Time Series Analysis	Univariate Time Series Models: Lag Operator, ARMA , ARIMA models, Autoregressive Distributed Lag Relationship	3
7.	Linear Programming	Linear programming; Dual of a linear programming problem; Simplex method Transportation	3
		Total number of Lectures	**28**

Evaluation Criteria

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

Project based Learning: Students have to form a group (maximum 5 students in each group) and have to do an econometric analysis on the topic assigned. Students will use the different

statistical methods using quantitative data to develop theories or test existing hypothesis. Students will also be encouraged to forecast future economic trends.

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.	Gujarati, D.N. (2002), Basic Econometric (4^{th} ed.), New York: McGraw Hill.
2.	Greene, W.H. (2003), Econometric Analysis, New Jersey: Prentice Hall.
3.	Madala, G.S. (1992), Introduction to Econometrics (2^{nd} ed.), New York: Macmillan.
4.	Wooldridge,J (2010), Econometric Analysis of Cross Section and Panel Data(2nd ed.), Cambridge, The MIT Press.
5.	Stock, J. H., and M. W. Watson. (2015). Introduction to Econometrics, (Third Update), Global Edition. Pearson Education Limited.

Detailed Syllabus

Course Code	20B12HS311	**Semester** Even **(specify Odd/Even)**	**Semester** VI **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

Java Programming (20B16CS322)

Detailed Syllabus

Course Description with CO

Course Code	**20B16CS322**	**Semester** Even	**Semester** VI **Session** 2020 -2021 Month from Jan to Jun
Course Name	**Java Programming**		
Credits	Audit	**Contact Hours**	[1- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Mr. Mahendra Kumar Gurve
	Teacher(s) (Alphabetically)	Mr. Mahendra Kumar Gurve

COURSE OUTCOMES At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-8.1	Write basic Java programs using Java constructs – loops, switch-case and arrays.	Understand Level (C2)
C305-8.2	Define all basic concepts related to OOP concepts	Remember Level (C1)
C305-8.3	Develop java programs using Java collection framework	Apply Level (C3)
C305-8.4	Create or design an application based on Java programming constructs	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Overview of OOA (Object Oriented Analysis) and Java basics	Classes, Objects, OOPs concept using JAVA, Packages and Interfaces.	**3**
2.	JVM Internals	Memory management, Garbage Collection	**1**
3.	String Handling	Using String and StringBuilder class. String Immutability(toString())	**2**
4.	Exception Handling in JAVA	Fundamentals, Exception types, Java built-in exceptions, Custom Exceptions, Chained Exceptions.	**2**

5.	Collections Framework	Collection Overview, List, Map (hashCode & Equals), Set, Queue & other collections	**4**
6.	Multithreading in Java	Multithreading overview and requirement, Thread state diagram, Java multithreading implementation (Thread/Runnable), Challenges in multithreading/Mutual Exclusion, Java handling of mutual exclusion (synchronization), Communication between threads (wait/notify)	**2**
		Total number of Lectures	**14**

Evaluation Criteria

Components	**Maximum Marks**
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance = 07, Quizzes = 08, Internal assessment = 07, Assignments in PBL mode = 08.)
Total	**100**

Project based learning: Assignments on different topics are given to each student. They utilize the java concepts and try to solve different problems given as assignments.

The course emphasized on the Skill development of students in Java Programming. Topics like inheritance, classes, exception handling, multithreading, collection frameworks, etc. are taught to enhance the programming skills of the students for making them ready for employability in software development companies.

Recommended Reading material:

Text Books

1.	Schildt, H. (2014). *Java: the complete reference*. McGraw-Hill Education Group.
2.	Bloch, J. (2016). *Effective java*. Pearson Education India.

Referenc Books

1.	Sierra, K., & Bates, B. (2005). Head First Java: A Brain-Friendly Guide. " O'Reilly Media, Inc.".
2.	Mughal, K. A., & Rasmussen, R. W. (2003). A programmer's guide to Java certification: a comprehensive primer. Addison-Wesley Professional.

Detailed Syllabus

Course Code	**20B16CS323**	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2020 -2021 Month from January to June
Course Name	Problem Solving using C and C++		
Credits	2	**Contact Hours**	[1- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Mradula Sharma
	Teacher(s) (Alphabetically)	Mradula Sharma, Dr. Alka , Dr. Ashish Mishra

COURSE OUTCOMES [NBA Code: C305-9] At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-9.1	Apply and use library functions, pointer arithmetic, arrays, and regular expressions and secure coding practices in programs.	Apply Level (C3)
C305-9.2	Use critical thinking skills and creativity to choose the appropriate containers, iterators and algorithms for a given problem.	Apply Level (C3)
C305-9.3	Demonstrate the use of concurrency principles, input and output streams and defensive techniques in programs.	Apply Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review and practice problems on Functions in C/C++	Functions, all function syntax, Function return type deduction, static, const and inline functions, default parameters, overloaded functions- operator and members, friends, overriding functions.	**1**
2.	Practice problems on Arrays and Pointers and Indirections	Smart pointers, pointers and dynamic memory allocation, type inference, array and pointers and their arithmetic and indirections	**2**
3.	Secure Coding practices in C/C++	Common String, Integer and dynamic memory allocation Errors, Integer and dynamic memory allocation and String vulnerabilities their mitigation strategies.	**2**
4.	String Localization and Regular Expression	Localization and working with regular expression, Programming with Regex library	**1**
5.	Practice problems	Errors and Exceptions, Exception Mechanisms,	**1**

	on Exception Handing and Assertions	Exceptions and Polymorphism, Stack unwinding and Cleanup, Common error handling issues	
6.	Applications with Disk Files and other I/O	Using streams, Input and Output with Streams, String Streams, File Streams and Bidirectional I/O	**1**
7.	Generic Programming with Templates	Class templates, Function templates, variable templates, Template parameters, Specialization of templates, template recursion, variadic templates, Meta-programming	**2**
8.	Working with Standard Template Library	Understanding and working with containers, container adapters and iterators, Lambda expressions, Function objects, STL algorithms, Customize and extend STL	**2**
9.	Programming using Dynamic Memory Allocation Model	Working with dynamic memory, array-pointer duality, low level memory operations, smart pointers and common memory pitfalls	**1**
10.	Problems on Concurrency in Programming	Introduction, Threads, Atomic operations library, Mutual Exclusion, Conditional variables	**1**
			14

Evaluation Criteria

Components	**Maximum Marks**
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance – 10, Quizes/Mini Project – 20)
Total	**100**

Project based leaning: Each student in a group of 3-4 will develop a simulator with the help of various advanced C and C++ topics. In a team, they will learn how to apply the concepts for problem solving in a meaningful way. The project typically incorporates various advanced C and C++ concepts to enable the synthesis of knowledge from real-life experiences.

Recommended Reading material:

1.	C++: The Complete Reference, 4th Edition H. Schildt Tata MacGrawhill
2.	Object-Oriented Programming in C++, Fourth Edition Robert Lafore
3.	C++ How to Program Dietel and Dietel
4.	Advanced C Peter D. Hipson.

5.	Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
6.	Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
7.	Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education
8.	Secure C and C++ Robert C. Seacord

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
Lecture-wise Breakup

Course Code	21B12CS311	**Semester: odd (specify Odd/Even)**	**Semester VI Session** 2020 -2021 **Month from** Jan21 to May21
Course Name	Software Development Principles and Practices		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Aparajita Nanda
	Teacher(s) (Alphabetically)	NA

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain software engineering principles and software process models for project development.	Understand Level (Level 1)
CO2	Analyze software requirements and document software requirements specification.	Analyze Level (Level 4)
CO3	Design and develop the system models for software development.	Apply Level (Level 3)
CO4	Apply risk management principles and processes to determine risk and its mitigation plans.	Apply Level (Level 3)
CO5	Assess software quality using various metrics	Evaluate Level Level 5

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Software Engineering**	Introduction to software engineering principles, Software process models(build and fix model, waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models. Introduction to Agile Methodologies , Project planning, and Project Scheduling.	7
2.	**Requirement Engineering**	Balancing Development Needs with Organizational Expectations, Writing Requirements and Requirements Specifications, Quality Assurance of Requirements, Types of requirement, Prioritizing Requirements, SRS.	7
3.	**Software Design**	Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram and Package diagram. Design Modularity: Coupling Cohesion.	8
4.	**Risk Assessment and management**	Task Analysis, Accident Theory, Accident Investigation and Reporting, Accident Statistics, Safety Inspection Procedures, Disaster Planning, Risk Management Systems, Analysis of risk at various stages of SDLC, Tools and techniques	5

5.	**Software Metrics**	Size-Oriented Metric, Functional Point metric, Function-oriented Metric, Halstead's Software Metric, Information Flow Metric, Objectoriented Metric, Class-Oriented Metric, COCOMO Model.	6
6.	**Software Testing and Debugging**	White-Box Testing, Basis Path Testing, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Equivalence class partitioning, Boundary Value Analysis, Decision table testing, Cause effect graphing, Mutation Testing and regression Testing. Debugging and its types.	9
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (**Attendance-05, Assignments/Quiz/Mini Project-20**)
Total	**100**

Project based learning: Each student in a group of 4-5 will choose an application or problem Software Development Principles to understand the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment. To make subject application based, the students demonstrate an understanding of current theories, models, and techniques that provide a basis for the software lifecycle. Expose students to current technologies and issues that provide ability to use the techniques and tools necessary for engineering practice and employability into software 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.	Roger S. Pressman and Bruce R Maxim, "Software Engineering: A practitioner approach", 8th Edition-McGraw-Hill - ISBN: 978-0-07-802212-8
2.	Sommerville , "Software Engineering" , Seventh Edition - Addison Wesley
Other Reference books	
3.	GRADYBOOCH**,** JAMES RUMBAUGH**,** IVAR JACOBSON, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts.
4.	Richard Thayer , "Software Engineering Project Management", Second Edition - Wiley-IEEE Computer Society Press.
5.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press.
6.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third addition , Springer Press

DETAILED SYLLABUS AND EVALUATION SCHEME

Course Code	21B12HS311	**Semester: EVEN (specify Odd/Even)**	**Semester: VI Session:2020-21** Month from: Jan-June
Course Name	Development Issues and Rural Engineering		
Credits	03	Contact Hours	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, Atam Nirbhar Bharat rojgar yojna 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), Poverty and 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, infrastructure and MSMEs.	5
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 Process**	Explore the impact of social forces on marketing actions. Describe how technological change affects marketing.	5

		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, 7th Edition, 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** Jan 2021 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	Cyber branding, 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	**18B13HS612**	**Semester Even (specify Odd/Even)**	**Semester VI Session 2020-2021 Month from Jan-June**
Course Name	**Effective tools for Career Management and Development**		
Credits	**2**	**Contact Hours**	**1-0-2**

Faculty (Names)	**Coordinator(s)**	Dr Kanupriya Misra Bakhru
	Teacher(s) (Alphabetically)	Dr Kanupriya Misra Bakhru

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-2.1	Assess ones personal priorities, skills, interests, strengths, and values using a variety of contemporary assessment tools and reflection activities.	Evaluate Level (C 5)
C305-2.2	Apply knowledge of all the Career Stages in making informed career decisions.	Apply Level (C 3)
C305-2.3	Develop and maximize ones potential for achieving the desired career option.	Create Level (C6)
C305-2.4	Analyze the processes involved in securing and managing career by employees of different organizations.	Analyze Level (C 4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures and Tutorial for the module**
1.	Introduction to Career Life cycle	Introduction to Career Life Cycle of an individual-Role and importance of human resource in an organization, Evolution of Strategic Human Resource Management.	3
2.	Self Branding and strategies to do well in Recruitment and Selection	Introduction to complete cycle of Recruitment and Selection, Introduction to various tools used for assessment and testing candidates-aptitude test, personality test, graphology test etc. Introduction to Workforce planning, Importance and practical application of Job Analysis, Job Description and Job Specification.	3
3.	Personnel Development and your career	Introduction to various learning and development, Introduction to various techniques used for learning and development, measure of training effectiveness, Training techniques / delivery, Kirkpatrick Model, Introduction to Succession Planning, Transactional Analysis.	3
4.	Human Resource Evaluation and Compensation	Performance Management: Measurement Approach, Developing Job Descriptions, Key Result Areas, Key Performance Indicators, Assessment Centre, 360 Degree feedback, Balanced Scorecard, Effective Performance Metrics. Compensation Strategy and trends- Compensation package, ESOPs, Performance based pay, Recognition, Retrial benefits, Reward management, Team rewards.	3

5.	Human Resource Control and special topics	Human Resources Audit, The Human Resource Information System (HRIS), Human Resources Accounting, Competency Management, Human Resource Management Practices in India, Internationalization of Human Resource Management Commonly Used Jargons.	2
		Total number of Lectures	**14**

Module No.	Title of the Module	List of Experiments/Activities	CO
1.	Introduction to Career Life cycle	Practical Sessions on Resume and Cover Letter Writing	CO1, CO2
2.	Self Branding and strategies to do well in Recruitment and Selection	Practical Sessions on Job Description, Job Specification and Self-Branding, Psychometric self-reflection tools on Personal Orientation and behavior-Personal Efficacy, Personal effectiveness, Locus of Control, Emotional Intelligence and Assertiveness.	CO3, CO4
3.	Personnel Development and your career	Practical Sessions on Johari Window-Knowing Thyself, Transaction Analysis-Parent, Child, Adult Ego State for effective interpersonal communication.	CO1, CO3
4.	Human Resource Evaluationand Compensation	Practical Sessions on HR Interview and Mock HR Interview	CO2, CO4
5.	Human Resource Control and special topics	Practical Sessions on Group Discussions and Mock Group Discussions	CO2, CO4

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term	30 (Project)
End Term	40 (Written)
TA	30 (Class Mock Activities, Assignment, Quiz)
Total	**100**

Project Based Learning:

Students, in groups of 3-4, are required to select a company that has come for Campus placement at JIIT, Noida. Students have to study the Recruitment and Selection process of the Company selected. The information can be collected with the help of an interview or some kind of questionnaire pertaining to the Recruitment and Selection process from seniors who have been placed in the given company.

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.	Joshi, Campus to Corporate, Your Roadmap to Employability, Sage Publications India Pvt. Ltd., 2015
2.	Mathur, Mastering interviews and group discussions, CBS Publishers& Distributors Pvt. Ltd., New Delhi, 2018
3.	Mitra, Personality Development and soft skills, Oxford University Press, New Delhi, 2011

4.	Pareek and Purohit, Training Instruments in HRD and OD, Sage Publications India Pvt. Ltd., 2018
5.	Pande and Basak, Human Resource Management- Text and Cases, Pearson, 2012
6.	Dessler and Varkkey, Human Resource Management, 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	**16B1NHS634**	**Semester E**ven **(specify Odd/Even)**	**Semester Session** 2020 -2021 **Month from** Jan 2021 to June2021
Course Name	**Theatre and performance(Value added)**		
Credits	**2**	**Contact Hours**	**1-0-2**

Faculty (Names)	**Coordinator(s)**	Dr Nilu Choudhary
	Teacher(s) (Alphabetically)	Dr Nilu Choudhary

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C304-14.1	Demonstrate problem solving ability and effective life skills through theatre performances.	Understanding level(C2)
C304-14.2	Develop awareness of the role of these arts in human life	Understanding level(C2)
C304-14.3	Apply skills of listening, articulation, awareness and collaboration through the creation of performance.	Applying level(C3)
C304-14.4	Design and present an original performance alone or in collaboration with other artists.	Creating level(C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction of Theatre	History of theatre: role of theatre in human culture with special reference to India	2
2.	Characterization	Tips for developing character, thinking about thoughts, Flash –back, Performance	2
3.	Script Writing	Turning a story into a play , How to write a one Act , setting the scene ,character , stage direction , Dialogues	3
4.	School of Drama	Natya-Shastra, Stanislavsky and Brecht	3
5.	Text and its interpretation	Mother Courage ,Galileo , Aadhe Adhure (any one)	3
6.	Back-stage work	Management, planning, execution	1
		Total number of Lectures	**14**

Module No.	Title of the Module	List of Experiments/Activities	CO
1.	Moving in Space.	Students will be moving around the room, filling up the space, changing pace, changing direction, being aware of other people but not touching them. Find new ways of moving, with a different emphasis each time – smooth, jagged, slow, fast, heavy, light, high up, low down and so on. Every now and again Teacher will shout “Freeze! And	**C30**4-14**.1**

		Students need to freeze every muscle in your body. Absolutely NO LAUGH, LOOKING AROUND, OR MOVING. You will be out.	
2.	Mirror Activity	A great way to get students aware of body movement and working together.	**C30**4-14**.1**
3.	Characterization	Developing and analyzing characters to reveal the special qualities and personalities of the characters in a story, making character believable.	**C304-14.2**
4.	Script Writing	The more passionate you feel about your idea, the more attractive your play will be. Divide the idea into a beginning, middle and end.	**C304-14.3**
5.	Role Assignment	No acting or movement at this point – just sit together to speak and hear the script carefully. Discuss and clarify any confusing aspects of the script and any apparent challenges in bringing the script to the stage. Division of script into small "units" and rehearsed separately	**C304-14.3**
6.	Turning story into a play	Read thru each episode or unit separately "on its feet".Actors moving around the stage space. Set blocking for each episode. Use ideas generated from Mini-Episodes, and Staging with Images. Make sure the gestures, movements, and stage pictures tell the story clearly.	**C304-14.3**
7.	Stage blocking	Practice the blocking and the lines so that everyone knows what happens when and what their performance responsibilities are. Memorize lines. Work on making characters, relationships, and dialogue clear. This is a good place in which to use the Creating the Character lessons. Pay attention to vocal projection and articulation. Generate ideas about any technical elements you want to incorporate using the Transformation of Objects.	**C304-14.3**
8.	Script to performance	Finalize and run the entire play from beginning to end without stopping to check any additional rehearsal required to get everything running smoothly or not. Finally Perform!!	**C304-14.4**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30
End Term	40
TA	30 (Script writing, End term stage performance)
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.	Eric Bentley, ed., The Theory of the Modern Stage: An Introduction to Modern Theatre and Drama, Penguin Books, 1968
2.	Mark Fontier, Theory/ Theatre: An Introduction, New York: Routledge, 2002
3.	Michael Holt, Stage Design and Property, Oxford: Phaidon, 1986
4.	Michael Holt, Costume and Make-up, Oxford: Phaidon, 1988
5.	Natyashastra, tr. by Adya Rangacharya, New Delhi: Munshiram Manoharlal, 2006,

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH632	**Semester** EVEN	**Semester 6th Session** 2020 -2021 **Month from January to May**
Course Name	SOLID STATE ELECTRONIC DEVICES		
Credits	3	**Contact Hours**	3+1
Faculty (Names)	**Coordinator(s)**	Dr. Dinesh Tripathi	
	Teacher(s) (Alphabetically)	Anuj Kumar	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Define terminology and concepts of semiconductors with solid state electronic devices.	Remembering (C1)
CO2	Explain various electronic, optical and thermal properties of semiconductors; various techniques used in device fabrication.	Understanding (C2)
CO3	Solve numerical problems based on solid state electronic devices.	Applying(C3)
CO4	Examine the impact of various parameters on semiconductor devices and their performances.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Energy band and charges carriers in conductors	Bonding forces and energy bands in solids, charge carriers in semiconductors, carries concentrations, drift of carriers in electric and magnetic fields, Invariance of the Fermi level at equilibrium, optical absorption, Luminescence, Carrier lifetime and photoconductivity, diffusion of carriers	12
2.	Junctions	Fabrication of p-n junctions, equilibrium conditions, steady state conditions, reverse bias breakdown, recombination and generation in the transition region, metal semiconductor junctions, heterojunctions,	10
3.	Transistors	Field effect transistor (FET), Metal-insulator FET, Metal-insulator-semiconductor FET, MOS FET, Bipolar junction transistors	08
4.	Devices	Photodiodes, solar cell, light emitting diodes, semiconductor lasers, Negative conductance Microwave devices: Tunnel diode, IMPATT diode, Gunn diode	10
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (7), Attend. (7), PBL (6) and Class performance (5)]
Total	**100**

Project based learning: To make a better understanding about the subject, groups of 4-5 students will be formed and a project on semiconductor devices viz. Gauss meter, Photodiode, Light Emitting Diode, Solar cell, Tunnel Diode, FET, MOSFET etc. will be allotted to each of the groups. The students will collect all the information's and understand about the basic principle, fabricationprocess and current research activities going on in the particular field. The students will also be encouraged to explore the field and create interactive simulations based on these devices.	
Recommended Reading material:	
1.	Donald A Neamen&Dhrubes Biswas, Semiconductor Physics and Devices, McGraw Hill Education
2.	S. M. Sze, Physics of Semiconductor devices, Wiley-Interscience
3.	Streetman and Banerjee, Solid State Electronic devices, PHI
4.	Umesh Mishra and Jasprit Singh, Semiconductor Device Physics and Design,

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH633	**Semester:Even**	**Semester:** VI **Session:**2020 -2021 **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
Lecture-wise Breakup

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+1
Faculty (Names)	**Coordinator(s)**	Dr Manoj Tripathi	
	Teacher(s) (Alphabetically)	Dr Manoj Tripathi	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
CO2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
CO3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
CO4	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, Radioisotopes, Radiotracers;	09
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
Total	**100**

Project Bad Learning: Different groups of students with 5-6 students in each group may be formed and these groups may be given to complete a task like identifying common applications to nuclear science, recent developments in medical applications, etc. These problem domains (elemental and content analysis, materials modification, radiation gauging, solid/liquid Interface, and heart imaging) may be also chosen because of their potential interest to students. Within each of these problem domains, the students will learn to work in a team. It will improve their analytical skills and the students will learn to achieve their common goal through mutual discussion and sharing of knowledge, information & understanding.

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

Statistics (16B1NMA633)

Course Description

Course Code	16B1NMA633	**Semester:** Even	**Semester** VI **Session** 2020-21 **Month from** Jan 2021 - June 2021
Course Name	Statistics		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Himanshu Agarwal	
	Teacher(s) (Alphabetically)	Dr. Himanshu Agarwal, Dr. Anuj Bhardwaj, Dr. Pinkey Chauhan	

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.

Applicational Aspects of Differential Equations (20B12MA311)

Course Description

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

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.

Operations Research (18B12MA611)

Course Description

Course Code	18B12MA611	**Semester** Even	**Semester** VI **Session** 2020-21 **Month from** Jan 2021 - June 2021
Course Name	Operations Research		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Neha Singhal	
	Teacher(s) (Alphabetically)	Dr. Neha Singhal, Dr. Pato Kumari, Dr. Amita Bhagat	

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	Definition, Hungarian Method, Traveling	4

	Problems	Salesmen Problems.	
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.

Numerical Aptitude (16B19MA691)

Course Description

Course Code	16B19MA691	**Semester** Even	**Semester** VI **Session** 2020-21 **Month from** Jan 2021 - Jun 2021
Course Name	Numerical Aptitude		
Credits	2	**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Trapti Neer	
	Teacher(s) (Alphabetically)	Dr. Trapti Neer, Dr. Neha Ahlawat, Dr. Sarfaraz	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C305-5.1	explain basics of mathematical aptitude.	Understanding Level (C2)
C305-5.2	explain set, functions and representation of numbers.	Understanding Level (C2)
C305-5.3	solve problem on probability theory, quadratic equations and complex numbers.	Applying Level (C3)
C305-5.4	explain inequalities, mensuration, data interpretation and errors.	Understanding Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Mathematical Aptitude	Fractions, simplification, HCF and LCM, ratio and proportion, percentage, partnership, age, average, profit and losses, simple interest and compound interest, time and work, time and distance.	10
2.	Set Theory and Representation of Numbers	Basics, identities, Venn diagram, addition principle, Pigeon hole principle, Functions-types of functions, some special functions, hashing function, characteristics function, Ackermann's function, Representation of numbers in binary, octal, hexadecimal, floating point representation of numbers.	08
3.	Probability	Probability, binomial theorem, linear equations, quadratic equations, complex numbers, logarithms.	06
4.	Geometry and Data Interpretation	Surds and indices, inequalities, mensuration, geometry, data interpretation, errors- types of errors, error propagation, errors in series approximation.	06
Total number of Lectures			**30**

Evaluation Criteria

Components **Maximum Marks**

Mid Term Examination	30
End Semester Examination	40
TA	30 (Assignments)
Total	**100**

Project based learning: Students are divided in a group of 4-5 to do a survey on the questions that are available in the GMAT or GATE exams. The student can recognize the problems that appear in competitions and do good practice to the said problems as learned in this course.

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

1.	**Aggarwal, R.S.**, Quantitative Aptitude, S. Chand & Co., 2008
2.	**Praveen, R. V.**, Quantitative Aptitude and Reasoning, 3rd Edition, Prentice Hall India, 2016.
3.	**Prakasa Rao, B.L.S.,** A First Course in Probability and Statistics, World Scientific, 2009.
4.	**Rosen & Kenneth H,** Discrete Mathematics and Its Applications, Tata Mc-Graw Hill, New Delhi, 2007.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B19BT692	**Semester Even (specify Odd/Even)**	**Semester VI Session 2020-21** **Month from** Jan - May
Course Name	**Applied Mushroom Biology**		
Credits	2	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Dr. Manisha Singh
	Teacher(s) (Alphabetically)	Dr. Manisha Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO692.1	Define mushroom biology	Remembering Level (C1)
CO692.2	Experiment with mushroom cultivation	Applying Level (C3)
CO692.3	Explain environmental and medicinal aspects of mushroom	Understanding Level (C2)
CO692.4	Analyze economics of mushroom cultivation	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Principles of Mushroom Biology	Introduction, concepts, types, uses of mushrooms, Edible and poisonous mushrooms	2
2.	Global production	Agribusiness involving mushrooms, global status, opportunities, and constraints	2
3.	Mushroom cultivation	Cultivation: Culturing, preservation methods, spawn production, quality attributes, storage, transport of commercially important mushrooms Lab: Bed preparation, use of different types of substrates (straw, cotton mill waste, water hyacinth etc.) for cultivation of oyster, white button, shiitake, and caterpillar mushrooms	8
4.	Mushroom biotechnology	Constraints in transformation, production of new varieties, genomic and proteomic approaches	4
5.	Environmental & Medicinal aspects	Bioremediation using mushrooms, Production of nutraceuticals & value-added products. Lab: Quality checks in cultivation process, processing, and preservation	8
6.	Economics	Economics of setting up a commercial mushroom production unit. Lab: Report on economics of production	4

Total number of Lectures	**28**

Evaluation Criteria

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

Project Based Learning:

The course is designed and aimed to train the students about mushroom production for Self or industrial - employment and they succeed in acquiring knowledge after exposure to training on mushroom production and its varied use in different sectors. The students get to know the in-depth concept for utilising modern technologies in mushroom cultivation to ensure high yield, low cost of production and round the year production. Many mushroom culture industries have been setup in India where good employment opportunities exists for persons trained in mushroom culture and employment can be created for self and other persons by establishing mushroom cultivation units, cottage / small scale industry with limited resources. Hence, equips the students to venture in this industry that has remarkably high employment generation and foreign exchange earning potential.

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.	SHU-TING CHANG , PHILIP G. MILES: MUSHROOMS: *Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact,* SECOND EDITION, CRC Press, 2011
2.	R. Gogoi, Y. Rathaiah, T.R. Borah, Mushroom Cultivation Technology, Scientific Publishers, 2019
3.	T.R Borah et al, Spawn Production and Mushroom Cultivation Technology, ICAR manual, 2018, India