Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12EC311	**Semester** Even **(specify Odd/Even)**	**Semester** 6th **Session** 2019 -2020 **Month from** Jan to June
Course Name	Advanced Radio Access Networks		
Credits	3	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Pankaj Yadav, Dr. Bajrang Bansal
	Teacher(s) (Alphabetically)	Dr. Pankaj Yadav, 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**
Assignment/Viva	20
Practical	20
Practical	50

TA	10
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	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	15B11CI518	**Semester -** ODD	**Semester** VI **Session** 2019 -2020 **Month from** Jan ′20 to Jun ′20
Course Name	Data Structures & Algorithms		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Sarishty Gupta, Dr. Tribhuwan Tewari
	Teacher(s) (Alphabetically)	Amanpreet Kaur, Pawan Kumar Upadhyay, Prantik Biswas, Sarishty Gupta, Tribhuwan Tewari

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Apply fundamental operations on data structures such as linked-lists, trees, binary search trees, AVL trees, heap trees, graphs, and hash-tables.	Apply Level (Level 3)
CO2	Analyze and compare different sorting algorithms - Merge Sort, Quick sort, Shell sort and Bucket Sort.	Analyze Level (Level 4)
CO3	Identify suitable data structure and develop solution for the given problem.	Apply Level (Level 3)
CO4	Formulate solutions for programming problems or improve existing code using algorithms such as, Backtracking, Branch and Bound, Greedy algorithm and Dynamic programming.	Apply Level (Level 3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction to data structures, lists, Doubly linked list, circular linked list, multi linked list, Applications - sparse matrix representation, Stack and queue (array and linked list representation)	8
2.	Algorithm Complexity	Abstract data type, Growth of function, Space-Time tradeoffs, Complexity analysis of algorithms - Asymptotic analysis	2
3.	Sorting & Searching	Merge Sort, Quick sort, Shell sort, Bucket Sort, Median search, Interpolation search	6
4.	Trees	Binary Tree, Binary Search tree, AVL Tree, B Tree, B+ Tree	7
5.	Heaps	Introduction to heaps, Binary heap	2
6.	Graph	Introduction to graphs, Representation – adjacency list, adjacency matrix, Traversal – BFS, DFS, Minimum spanning tree – Prims and Kruskal's algorithm,	4
7.	Hashing	Introduction to hashing, Collision resolution – open and closed hashing methods	3

8.	Algorithm	Introduction to Backtracking Algorithm, Branch and Bound, Greedy algorithm, Problems on Greedy algorithm (0-1 Knapsack), Dynamic programming, Problems on Dynamic Programming (Fractional Knapsack, Longest Common Subsequence) Graph Algorithms- Shortest path using Dijkstra algorithm and Floyd–Warshall algorithm	10
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance = 07, Class Test/Quiz= 07, Internal assessment = 05 Assignments in PBL mode = 06)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.

Text Books

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

References

1.	Yedidyah Langsam, Moshe J., Augenstein and Aaron M. Tenenbaum: Data Structures Using C and C++, 2nd Edition, PHI, 2001
2.	Kurt Mehlhorn: Data Structures and Algorithms 3, Springer, 1984
3.	Dinesh P Mehta, Sartaj Sahani: Handbook of Data Structure and Applications, Chapman & Hall, 2004
4.	Mark Allen Weiss: Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson
5.	Sahni: Data Structures, Algorithms and applications in C++, Universities press, Hyderabad, 2005
6.	Kruse, Tonso, Leung: Data Structures and Program Design in C, 2rd Edition, Pearson Education Asia, 2002
7.	Weiss, Mark Allen: Data Structures and Algorithm Analysis in C/C++, 2nd Edition, Pearson Education Asia, 2003
8.	Cormen et al: Introduction to Computer Algorithms, 2nd edition , PHI New Delhi 2003
9.	Aho, Hopcraft, Ullman: Data Structures and Algorithms, Pearson Education Asia (Adisson Wesley), New Delhi, 2001
10.	Standish: Data Structures in Java, Pearson Education Asia (Adisson Wesley), New Delhi, 2000
11.	Knuth: The Art of Computer programming Vol I, Vol III, 2nd edition , Pearson Education Asia (Adisson Wesley), New Delhi, 2002

Course Description

Subject Code	15B11EC611	Even-Semester	Semester: 6th Session 2019-20 Month from Jan 2020 to June 2020
Subject Name	Telecommunication Networks		
Credits	4	Contact Hours	40

Faculty (Names)	Teacher(s) (Alphabetically)	Dr. Bhagirath Sahu, Ms. Bhavna Gupta, Dr. Juhi Gupta, Dr. Neeti Singh, Dr. Sajal Agarwal

Course Outcomes:

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

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	Basic Principles of Transport Layer and	6

	description	TCP/UDP description. Congestion control and Quality of Service (QoS)	
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**

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

Evaluation Scheme:

- **T1 Exam: 20 Marks**
- **T2 Exam: 20 Marks**
- **T3 Exam: 35 Marks**
- **Internal Assessment: 25 Marks** (Distribution as follows)
  - Attendance: 10 Marks
  - Assignment: 10 Marks
  - Quiz: 5 Marks

Total: 100 Marks

Detailed Syllabus
Lecture-wise Breakup

Course Code	**15B11EC613**	**Semester: Even**	**Semester:** 6th **Session:** 2020 **Month from: Jan-May**
Course Name	Control Systems		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Kirmendra Singh, Megha Agarwal
	Teacher(s) (Alphabetically)	Kirmendra Singh, Megha Agarwal, Raghvendra Singh, Ruby Beniwal, Shamim Akhter, Varun Goel

COURSE OUTCOMES		**COGNITIVE LEVELS**
C316.1	Classify the open loop and closed loop control systems and construct mathematical model for physical systems.	Applying (Level III)
C316.2	Solve complex systems through block diagram reduction method and signal flow graph technique.	Applying (Level III)
C316.3	Determine transient response and steady state response of the systems using standard test signals.	Evaluating (Level V)
C316.4	Analyze the stability of the system and select suitable controllers and compensators for linear time invariant system.	Analyzing (Level IV)
C316.5	Apply time domain and frequency domain techniques to identify the stability of control systems.	Applying (Level III)
C316.6	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.	Modeling 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	Bodes plot and Nyquist plot , Gain Margin & Phase Margin, stability analysis	7

	and Design		
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
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.	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

Subject Code	15B17CI578	**Semester:** EVEN **(specify Odd/Even)**	**Semester 6 Session** 2019-2020 **Month from** Jan'20 **to** Jun'20
Subject Name	Data Structures & Algorithms Lab		
Credits	0-0-1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Amanpreet Kaur, Prantik Biswas, Akanksha Mehndiratta
	Teacher(s) (Alphabetically)	Sec 62 -Dr. Archana Purwar, Dr. Bharat Gupta, Mahendra Gurve, Dr. Pawan Upadhyay, Purtee Kohli, Shardha Porwal, Dr. Vimal Kumar, Dr. Vivek Kumar Singh Sec 128- Dr. Ashish Tripathi, Dr. Raju Pal, Ambalika Sarkar, Bansi Dhar Joshi, Gaurav Nigam

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

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction & Algorithm Complexity	**Lab Assignment 1:** Conversion from one number system to another; Manipulation with arrays and strings, structures; **Lab Assignment 2 and 3:** Manipulation with a single Linked lists of integers;	CO1, CO2, Understanding Level (C2)

		Lab Assignment 4: Stacks and Queues Finding Complexity: Big O, Big Omega Cost Analysis	
2.	Sorting, Searching & Trees	**Lab Assignments 2 and 3:** Doubly Linked List, Circular Linked List **Lab Assignments 4:** Multi-Linked Lists **Lab Assignments 5 and 6**: Sorting, Searching, Application based. **Lab Assignments 7, 8, 9**: Binary Tree, Binary Search Trees, AVL Tree , Case-study: Priority Queue with Binary Trees, B Trees	CO1 Understanding Level (C2) CO3 Apply Level (C3)
3.	Heaps, Graph	**Lab Assignments 10:** Heaps **Lab Assignment 11 and 12**: Directed and undirected graphs, weighted graphs, etc.	CO4 Apply Level (C3)
4.	Hashing & other Algorithms	**Lab Assignments 13:** Hashing, Backtracking, Branch and Bound, Greedy Algorithms, Dynamic Programming.	CO5 Apply Level (C3)

Evaluation Criteria

Components	**Maximum Marks**
Lab Test 1	20
Lab Test 2	20
Day-to-Day Evaluations	15
Project	15
Day-to-Day - Attendance	15
Assignment	15
Total	**100**

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

Text Books

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

References

4	Yedidyah Langsam, Moshe J., Augenstein and Aaron M. Tenenbaum: Data Structures Using C and C++, 2nd Edition, PHI, 2001

5	Kurt Mehlhorn: Data Structures and Algorithms 3, Springer, 1984
6	Dinesh P Mehta, Sartaj Sahani: Handbook of Data Structure and Applications, Chapman & Hall, 2004
7	Mark Allen Weiss: Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson
8	Sahni: Data Structures, Algorithms and applications in C++, Universities press, Hyderabad, 2005
9	Kruse, Tonso, Leung: Data Structures and Program Design in C, 2rd Edition, Pearson Education Asia, 2002
10	Weiss, Mark Allen: Data Structures and Algorithm Analysis in C/C++, 2nd Edition, Pearson Education Asia, 2003
11	Cormen et al: Introduction to Computer Algorithms, 2nd edition , PHI New Delhi 2003
12	Aho, Hopcraft, Ullman: Data Structures and Algorithms, Pearson Education Asia (Adisson Wesley), New Delhi, 2001
13	Standish: Data Structures in Java, Pearson Education Asia (Adisson Wesley), New Delhi, 2000
14	Knuth: The Art of Computer programming Vol I, Vol III, 2nd edition , Pearson Education Asia (Adisson Wesley), New Delhi, 2002
15	Heileman: Data Structures, Algorithms and Object Oriented Programming, Tata Mc-Graw Hill, New Delhi, 2002
16	Sorenson and Tremblay: An Introduction to Data Structures with Algorithms, 2nd Edition, Tata Mc-Graw Hill, New Delhi, 2003

Detailed Syllabus

Lecture-wise Breakup

Subject Code	**15B19EC691**	**Semester Even**	**Semester 6**th **Session** 2019-20 **Month from** Jan 20 to Jun 20
Subject Name	**Minor Project - II**		
Credits	**5**	**Contact Hours**	**NA**

Faculty (Names)	**Coordinator(s)**	Dr. Neetu Singh, Mr. 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 3]
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.	Analysing [Level 4]
C351.3	Survey the available literature and gain knowledge of the State-of-Art in the chosen field of study.	Analysing [Level 4]
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 5]
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 [Level 6]

Evaluation Criteria

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

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS631	**Semester Even**	**Semester 6th Session** 2019 -2020 **Month from January 2020 to May 2020**
Course Name	PROJECT MANAGEMENT		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Santoshi Sengupta (Sec-62), Dr. Deepak Verma (Sec-128)
	Teacher(s) (Alphabetically)	Dr. Deepak Verma, Dr. Santosh Dev, Dr. Santoshi Sengupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
304-5.1	Apply the basic concepts of project management such as features, objectives, life cycle, model and management, in a given context	Apply Level (C3)
304-5.2	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)
304-5.3	Evaluate the stages of project management and identify and determine correct techniques for planning and scheduling	Evaluate Level (C5)
304-5.4	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**

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
2.	Timmothy Kloppenborg, Contemporary Project Management, 5th[t] Edition, Cengage Learning, 2017
3.	Vohra, N. D., Quantitative Techniques in Management, 5th Edition, Tata McGraw Hill Publishing Company, 2017

Department of Humanities & Social Science
AY: 2019-20 (Even Semester)
Course Opening Report

Program Name: B.Tech
Semester: VI
Course Name & Code: Cognitive Psychology 16B1NHS632

Course Outcomes:
At the completion of the course, students will be able to,

COURSE OUTCOMES		COGNITIVE LEVELS
304-4.1	Understand and apply the concepts of cognitive psychology in everyday life	(C3)
304-4.2	Analyze the different models of various cognitive processes	(C4)
304-4.3	Evaluate cognitive psychology issues and recommend possible solutions	(C5)
304-4.4	Evaluate interventions/solutions for self-development through cognitive processes	(C5)

CO-PO and CO-PSO Mapping:

													Biotech PSOs			CSE PSOs		ECE PSOs		IT PSOs	
COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**	**PSO1**	**PSO2**	**PSO1**	**PSO2**	**PSO1**	**PSO2**
304-4.1		1	2	1		2		1	3	2		3		1	1	2	2		1		
304-4.2			1	1		1			2	1		2				2			1		
304-4.3		1	2	2		1		2	2	1		3				1					
304-4.4		1	2	1		2			3	2		3		1	1	2	2				
Avg.		1	2	1		2		2	3	2		3		1	1	1.8	2		1		

3. Identified gaps in Syllabus/ Course Description (If Any):

Topics to be introduced	Strengthens CO	Strengthens PO, PSO	Method of Identification

4. Modifications in Syllabus/ Course Description (If Any):

Details of Modification (Addition/ Removal)	Justification	Strengthens POs/PSOs

5. Actions for Improving CO Attainments: (CSE)

COs	Attainments in 2018-19	Action to be taken in 2019-20 to improve CO attainment	Strengthens POs/PSOs
304-4.1	**2.4**		
304-4.2	**1.8**		
304-4.3	**2.1**		
304-4.4	**1.9**		

Actions for Improving CO Attainments: (ECE)

COs	Attainments in 2018-19	Action to be taken in 2019-20 to improve CO attainment	Strengthens POs/PSOs
304-4.1	**2.4**		
304-4.2	**2.0**		
304-4.3	**2.1**		

304-4.4	**2.1**		

Actions for Improving CO Attainments: (BT)

COs	Attainments in 2018-19	Action to be taken in 2019-20 to improve CO attainment	Strengthens POs/PSOs
304-4.1	**2.4**		
304-4.2	**1.8**		
304-4.3	**2.4**		
304-4.4	**1.7**	Expose students to discussions on efficacy of various interventions/solutions for self development through cognitive psychology	Strengthen attainment of CO4

Actions for Improving CO Attainments: (IT)

COs	Attainments in 2018-19	Action to be taken in 2019-20 to improve CO attainment	Strengthens POs/PSOs
304-4.1	**1.8**		
304-4.2	**2.4**		
304-4.3	**2.4**		
304-4.4	**1.5**	Expose students to discussions on efficacy of various interventions/solutions for self development through cognitive psychology	Strengthen attainment of CO4

6. Innovative Teaching and Learning Method to be used:

7. Strategies for

- **Weak Learners:** Give them case studies requiring use of cognitive psychology concepts for finding solutions
- **Bright Students:** Students will be asked to collect data and do real projects using variables of cognitive psychology

8. Innovative Evaluation Strategy to be used:

Signature:

Module Coordinator: Santoshi Sengupta

Signature:

Course Coordinator: Dr. Badri Bajaj and Dr. Ruchi Gautam

Detailed Syllabus
Lecture-wise Breakup

Course Code	**15B1NHS634**	**Semester E**ven **(specify Odd/Even)**	**Semester Session** 2019 -2020 **Month from** Jan 2020 to June2020
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
C305-7.1	Demonstrate problem solving ability and effective life skills through theatre performances.	Understanding level(C2)
C305-7.2	Develop awareness of the role of these arts in human life	Understanding level(C2)
C305-7.3	Apply skills of listening, articulation, awareness and collaboration through the creation of performance.	Applying level(C3)
C305-7.4	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	**C305-7.1**

		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.	**C305-7.1**
3.	Characterization	Developing and analyzing characters to reveal the special qualities and personalities of the characters in a story, making character believable.	**C305-7.2**
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.	**C305-7.3**
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	**C305-7.3**
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.	**C305-7.3**
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.	**C305-7.3**
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!!	**C305-7.4**

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, 1996,

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS635**	**Semester: Even**	**Semester: VI Session: 2019 -2020** **Month: Jan 2020 to June 2020**
Course Name	**Organizational Behavior**		
Credits	**3**	**Contact Hours**	**3(2-1-0)**

Faculty (Names)	**Coordinator(s)**	**Ms Puneet Pannu (Sec 62) & Dr Anshu Banwari (Sec 128)**
	Teacher(s) (Alphabetically)	**Dr Anshu Banwari** **Ms Puneet Pannu**

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	6

		Terry and Bill 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**

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** 2019 -2020 **Month: January 2020 to June 2020**
Course Name	**Literature & Adaption**		
Credits	**3**	**Contact Hours**	**2-1-0**

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
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 (Assignment, Seminar/Presentation , Oral Questions)
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

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NMA633	**Semester :** Even	**Semester** VI **Session** 2019 -2020 **Month from** Jan 2020 to June 2020
Course Name	Statistics		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. Himanshu Agarwal	
	Teacher(s) (Alphabetically)	Dr. Anuj Bhardwaj, Dr. Himanshu Agarwal, 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, Tutprials)
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.	**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, 6th edition, Pearson Education Asia, 2002.
8.	**Meyer, P.L**, Introductory Probability and Statistical Applications Addison-Wesley Publishing Company, 1965.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH631	**Semester: Even (specify Odd/Even)**	**Semester: VI Session** 2019 -2020 **Month from: Jan-June**
Course Name	Computational Physics		
Credits	**04**	**Contact Hours**	04

Faculty (Names)	**Coordinator(s)**	Vikas Malik
	Teacher(s) (Alphabetically)	Vikas Malik

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Define key concepts used in Monte Carlo Simulation, Random walks, percolation and Numerical methods	Remember Level (C1)
CO2	Explain basics of numerical analysis, statistical mechanics, Monte Carlo simulations, percolation, random walks.	Understand Level (C2)
CO3	Model and simulate magnetic systems, polymers and networks; interpret simulation data	Apply Level (C3)
CO4	Develop advanced Monte Carlo techniques to solve Optimization problems. Simulate percolation of complex networks.	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Numerical Methods	Locating Roots of Equations, Interpolation and Numerical Differentiation, Numerical Integration, Systems of Linear Equations, Ordinary Differential Equations, Fourier Transform Techniques.	10
2.	Simulation Techniques	Random Number Generation and Monte Carlo Methods, Equilibrium Statistical mechanics, Importance sampling, Metropolis algorithm.	10
3.	Applications of Computer Simulations in Physics	Ising Model Simulations of Magnetic Solids and Phase Transitions, Monte Carlo Intergration, Random Walk and its Applications to Polymers, Cluster Identification algorithms, Percolation and Fractal Phenomena, Chaos and Non-Linear Systems.	15
4.	**Advanced Simulation Techniques**	Cluster Algorithms, Variational Methods and Optimization Techniques.	05
		Total number of Lectures	**40**

Evaluation Criteria

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

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall India, 2005.
2.	Kerson Huang, Statistical Mechanics, 2nd Edition, John Wiley, 2009.
3.	K. Binder & D. Heermann, Monte Carlo Simulation in Statistical Physics, **2nd Edition,**Springer, 2013.
4.	Newman & Barkema, Monte Carlo Methods in Statistical Physics, Clarendon Press, 1999.
5.	Landau & Binder, A guide to Monte Carlo Simulations in Statistical Physics, Cambridge University Press, 2014.
6.	M. H. Kalos and P. A. Whitlock, *Monte Carlo Methods,* John Wiley and Sons, 2009.

Detailed Syllabus and Evaluation Scheme

Solid State Electronic Devices (16B1NPH632)

Course Code	16B1NPH632	**Semester: Even**	**Semester: VI Session** 2019 -2020 **Month from: January to June**
Course Name	Solid State Electronic Devices (16B1NPH632)		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Sandeep Chhokar & Dr. Dinesh Tripathi
	Teacher(s)	Dr. Sandeep Chhokar & Dr. Dinesh Tripathi

COURSE OUTCOMES: Upon the completion of this subject, students will be able to

S.N.	**DESCRIPTION**	**COGNITIVE LEVEL**
C302-7.1	Define terminology and concepts of semiconductors with solid state electronic devices.	Remembering (C1)
C302-7.2	Explain various electronic, optical and thermal properties of semiconductors; various techniques used in device fabrication.	Understanding (C2)
C302-7.3	Solve numerical problems based on solid state electronic devices.	Applying (C3)
C302-7.4	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/Class Tests (07 M), Attendance (07 M) Internal Assessment (05 M) Assignment in PBL Mode (06 M)]
Total	**100**

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

1.	Semiconductor Physics and Devices, *by* Donald A. Neamen and Dhrubes Biswas; 4th Edison Mc GrawHill.
2.	Physics of Semiconductor devices, *by* S. M. Sze; Wiley-Interscience.
3.	Solid State Electronic devices *by* Ben G.Streetman; Prentice-Hall.
4.	Semiconductor Devices, *by*Mauro Zambuto; Mc GrawHill

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH633	**Semester:Even**	**Semester:**VI **Session:**2019 -2020 **Month: January to June**
Course Name	Photovoltaic Techniques		
Credits	4/3	**Contact Hours**	4/3

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, Photovoltaic safety.	08
		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (…)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (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 and Evaluation Scheme

Medical and Industrial Applications of Nuclear Radiation (16B1NPH636)

Course Code	16B1NPH636	**Semester: Even**	**Semester: VI Session** 2019 -2020 **Month from: January to June**
Course Name	Medical and Industrial Applications of Nuclear Radiation		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Manoj Tripathi
	Teacher(s)	Dr. Papia Chowdhury & Dr. Manoj Tripathi.

Course Name: Medical & Industrial Applications of Nuclear Radiation (16B1NPH636)
COURSE OUTCOMES: Upon the completion of this subject, students will be able to

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

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Nuclear Structure	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	17

		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;	
2.	Radioactive Dating	Dosimetry and applications: Interaction of Radiation of matter: Biological effects of radiations; dosimetry, working principles, Tools and radiotherapy, Doses, Radioisotopes, Radiotracers;	09
3.	Nuclear Magnetic Resonance	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	Dosimetry and applications	Nuclear Medicine and Nuclear imaging techniques, preclinical imaging, detector designing, photon counting, Medical imaging using $\beta+\gamma$ coincidences, SPECT AND PET: Radiation tomography	05
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz/Class Tests (07 M), Attendance (07 M) Internal Assessment (05 M) Assignment in PBL Mode (06 M)]
Total	**100**

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

1.	Basic Sciences of Nuclear Medicine; Magdy M K halil, Springer.
2.	Gopal B Saha, Physics and Radibiology of Nuclear Medicine; Springer.
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.

4.	Radionuclide Techniques in Medicine, JM McAlister (Cambridge University Press, 1979).
5.	S.N.Ghosal, Nuclear Physics.

Detailed Syllabus

Lecture-wise Breakup

Course Code	**16B19BT692**	**Semester** Even **(specify Odd/Even)**	**Semester 6th Session 2019-2020** **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**
T2	20
End Semester Examination	35
TA	45
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.	SHU-TING CHANG , PHILIP G. MILES: MUSHROOMS: *Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact*, SECOND EDITION, CRC Press, 2011
2.	Research papers and manuals

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B19EC691	**Semester** Even **(specify Odd/Even)**	**Semester** 6th **Session** 2019 -2020 **Month from** Jan-June
Course Name	Renewable Energy		
Credits	0	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Shivaji Tyagi, Vinay Anand Tikkiwal
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-4.1	Overview of Energy use, Major Energy options, Global climate change issues, effects on ecology and biodiversity	Remembering, Understanding (Level I & II)
C305-4.2	Basics of Solar radiation and Solar Photovoltaics, Solar Resource Assessment, Solar Cell structures and working	Understanding, Applying, Analysis (Level II, III, IV)
C305-4.3	Basics of Wind resource, Aerodynamics, Fundamental Power Equations, Design of Wind Energy Generators	Understanding, Applying, Analysis (Level II, III, IV)
C305-4.4	Biomass Resource, Extracting Biomass Energy, Landfill gas,Fuel Crops, Anaerobic Digestion, Biomass Gasifiers	Remembering, Understanding (Level I & II)

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, Necessity of energy storage, major energy options, issues of supply and demand, energy conversions, global climate change issues, effects on ecology and biodiversity, major energy alternatives.	6
2.	Solar Energy & their sources	Solar cell fundamentals and characteristics, Solar Resource Assessment, Solar Photovoltaic technologies and Solar Thermal systems.	8
3.	Electric grid	Working and performance related issues. New developments and challenges in the electric grid.	6
4.	Wind Energy & their sources	Wind resource, basic aerodynamics, fundamental power equation, Basic	4
5.	Biomass sources	Biomass resource, photosynthesis process and usable form of biomass, extracting biomass energy, fuel crops, landfill gas, waste to energy, energy balances and economics.	6
		Total number of Lectures	**30**

Evaluation Criteria

Components **Maximum Marks**

T2	30
End Semester Examination	40
TA	30 (Assignment = 15, Quiz = 10, Attendance = 05)
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.	Chetan Singh Solanki, Solar Photovoltaics: Fundamental, technologies and applications. Prentice Hall of India, 2015
2.	James Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley-IEEE Press, 2012.
3.	Ahmed, Wind Energy: Theory and Practice, PHI
4.	Jenny Nelson, Physics of Solar Cell, World Scientific

Course Description

Course Code	16B19MA691	**Semester** Even	**Semester** VI **Session** 2019-2020 **Month from** Jan 2020 to June 2020		
Course Name	Numerical Aptitude				
Credits	2		**Contact Hours**	2-0-0	
Faculty (Names)	**Coordinator(s)**	Dr. Trapti Neer			
	Teacher(s) (Alphabetically)	Dr. Mohd. Sarfaraz			

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
CO1	explain basics of mathematical aptitude.	Understanding Level (C2)
CO2	explain set, functions and representation of numbers.	Understanding Level (C2)
CO3	solve problem on probability theory, quadratic equations and complex numbers.	Applying Level (C3)
CO4	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.	08
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.	10
4.	Probability	Probability, binomial theorem, linear equations, quadratic equations, complex numbers, logarithms.	06
5.	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**

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	16B19PH692	**Semester Even**	**Semester:** 6th **Session** 2019 -2020 **Month from:** January to July
COURSE NAME	LIGHT EMITTING DEVICES: BASICS & APPLICATIONS		
Credits	3	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Bhubesh Chander Joshi
	Teacher(s) (Alphabetically)	Dr. Bhubesh Chander Joshi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-6.1	Recall the basic concepts of semiconducting materials, working of p-n junction diode and light emitting diodes.	Remembering (C1)
C305-6.2	Explain the various physical parameters involved in designing and fabrication of LEDs.	Understanding (C2)
C305-6.3	Solve various problems related to efficiency, emission intensity and spectrum of LEDs.	Applying (C3)
C305-6.4	Analyze the problems in designing & fabricating blue, white and green high brightness LEDs.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	History of LEDs	History of SiC, GaAs, GaAsP, GaInP, GaN, and InGaN LEDs.	4
2.	Theory of Recombination's	Radiative and non-radiative recombination's, Low-level and high-level excitations, Bio-molecular rate equation for quantum well structure, Van Roosbroeck-Shockley Model, Einstein Model.	6
3.	LED Basics	Electrical properties: I-V characteristics, parasitic resistances, carrier distribution in homo and hetero junctions, carrier losses, carrier overflow in heterojunctions, Optical properties: Internal, external, extraction and power efficiencies, Emission spectra, escape cone and temperature dependency	6
4.	Growth & Fabrications	LED materials, Organic LEDs, Growth, Fabrication and Characterization Techniques	4
5.	Applications	Solid state lighting, White LEDs, HB LEDs, Color Mixing and Rendering, LED Drivers, Display Devices, AMOLED, Communication, High Voltage LEDs	10
		Total number of Lectures	**30**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40

TA	30 (Presentations/projects/Attendance)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	**Text 1:** Light-Emitting Diodes, Schubert E. Fred, Cambridge University Press, 3rd Edition 2018.
2.	**Reference:** Introduction to Light Emitting Diode Technology and Applications, Held Gilbert, Auerbach Publications, 2008.
3.	**Reference:** Light-Emitting Diodes; Materials, Processes, Devices and Applications, Editors: Jinmin Li, G. Q ZHANG, Springer, 2019

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS611	**Semester EVEN (specify Odd/Even)**	**Semester** VI **Session** 2019 -2020 **Month from :Jan - June**
Course Name	Marketing Management		
Credits	**3(2-1-0)**	**Contact Hours**	28

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

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)
C305-7.4	To appraise the importance of marketing ethics and social responsibility	Evaluating(C5)
C-305-7.5	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. Designing the business Portfolio Discuss the Strategic Planning Process and Strategic Marketing Process.	5
4	**Consumer and**	Consumer Markets and consumer buyer behaviour.	5

	Business Buyer Behaviour	The buying decision process. Business Markets and business buyer behaviour. Discuss the modern ethical standards.	
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 behaviour 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 (Assignment Viva…)
Total	**100**

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

1.	Grewal and Levy, Marketing, 5th Edition, Mc Graw Hill Education,2017
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	Dalrymple, Douglas J ., and Leonard J. Parsons, 2nd Edition, Wiley Publication, 2000.

Detailed Syllabus

Lecture-wise Breakup

Course Code	18B12MA611	**Semester** Even	**Semester** VI **Session** 2019 -2020 **Month from** Jan 2020 - June 2020	
Course Name	Operations Research			
Credits	4		**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. NehaSighal		
	Teacher(s) (Alphabetically)	Prof. PatoKumari Dr. AmitaBhagat		

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

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

7.	Non Linear Programming	Introduction to NLP, convex functions and graphical solution, Unconstrained Problem, Constrained Problems - Lagrange Method for equality constraints, Kuhn-Tucker Conditions for inequality constraints, Quadratic Programming -Wolfe's Method	8
Total number of Lectures			**42**

Evaluation Criteria

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

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, 2005.
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.
6.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2005.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	18B12MA612	**Semester** Even	**Semester** VI **Session** 2019-2020 **Month from** Jan 2020 to June 2020
Subject Name	Applied Mathematical Methods		
Credits	4	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Dr. PuneetRana	
	Teacher(s) (Alphabetically)	Dr. PuneetRana, Dr. NehaAhlawat	

COURSE OUTCOMES		
After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
C302-4.1	explain the functional and its variations required to optimize the physical problem.	Understanding Level (C2)
C302-4.2	apply different forms of Euler–Lagrange equation on the various variational problems with fixed boundaries.	Applying Level (C3)
C302-4.3	explain different types of integral equations including their conversions from IVP and BVP.	Understanding Level (C2)
C302-4.4	solveVolterra and Fredholm integral equations using various analytical methods.	Applying Level (C3)
C302-4.5	explain various numerical methods along with their stability analysis.	Understanding Level (C2)
C302-4.6	apply different numerical methods for solving differential equations.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Functional and its Variation	Introduction, problem of brachistochrone, problem of geodesics, isoperimetric problem, variation and its properties, comparison between the notion of extrema of a function and a functional.	8
2.	Variational Problems with Fixed Boundaries	Euler's equation, the fundamental lemma of the calculus of variations, examples, functionals in the form of integrals, special cases contaning only some of the variables, examples, functionals involving more than one dependent variables and their first derivatives, the system of Euler's equations,	5
3.	Variational Problems (continued)	Functionals depending on the higher derivatives of the dependent variables, Euler- Poisson equation, functionals containing several independent variables, Ostrogradsky equation, Variational problems in parametric form, applications to differential equations.	5
4.	Fredholm and Volterra Integral	Introduction and basic examples, Classification, Conversion of Volterra Equation to ODE, Conversion of IVP and BVP to integral equation,	8

	Equations	decomposition, direct computation, successive approximation, successive substitution methods for Fredholm and Volterra integral equations.	
5.	Numerical Methods I	Classification of PDEs, Finite difference approximations to partial derivatives. Solution of one dimensional heat conduction equation by Explicit and Implicit schemes (Schmidt and Crank Nicolson methods), stability and convergence criteria.	8
6.	Numerical Methods II	Laplace equation using standard five point formula and diagonal five point formula, Poisson equation, Iterative methods for solving the linear systems. Hyperbolic equation, explicit / implicit schemes, method of characteristics. Solution of wave equation. Solution of I order Hyperbolic equation. Von Neumann stability.	8
Total number of Lectures			**42**

Evaluation Criteria

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

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

1.	**Hilderbrand, F.B.,** Methods of Applied Mathematics, 2ndEdition, Prentice Hall, 1969.
2.	**Gupta, A.S.,** Calculus of Variations with Applications, Prentice Hall of India, 2003.
3.	**Gelfand, I.M.,** Fomin, S.V. Calculus of Variations, Prentice Hall, 1963.
4.	**Elsgolts, L.,** Differential Equations and the Calculus of Variations, Mir Publishers, Moscow, 1973.
5.	**Petrovsky, I.G.,** Lectures on the Theory of Integral Equations, Mir Publishers, Moscow, 1971.
6.	**Smith, G. D.**., Numerical solution of partial differential equations: finite difference methods. Oxford University Press, 1985

Detailed Syllabus

Lecture-wise Breakup

Course Code	**18B13HS612**	**Semester Even (specify Odd/Even)**	**Semester VI Session 2019 -2020 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 Evaluation and 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**

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.	Mathur, Mastering interviews and group discussions, CBS Publishers& Distributors Pvt. Ltd., New Delhi, 2018
2.	Mitra, Personality Development and soft skills, Oxford University Press, New Delhi, 2011
3.	Pareek and Purohit, Training Instruments in HRD and OD, Sage Publications India Pvt. Ltd., 2018
4.	Pande and Basak, Human Resource Management- Text and Cases, Pearson, 2012
5.	Dessler and Varkkey, Human Resource Management, Pearson, 2011

Lecture-wise Breakup

Course Code	19B12HS611	**Semester : EVEN (specify Odd/Even)**	**Semester** : VI **Session** 2019 -2020 **Month from:** January- June
Course Name	Econometric Analysis		
Credits	2-1-0	**Contact Hours**	03

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 Relartionship	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+ Assignment+Viva -Voce)
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.	Gujarati, D.N. (2002), Basic Econometric (4th ed.), New York: McGraw Hill.
2.	Greene, W.H. (2003), Econometric Analysis, New Jersey: Prentice Hall.
3.	Madala, G.S. (1992), Introduction to Econometrics (2nd ed.), New York: Macmillan.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS612	Semester : Even	**Semester** VI **Session** 2019 -2020 **Month from** Jan 2020 to June 2020
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 (Assignment , Class Test 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 ,Seema Gupta,First Edition ,Mc Graw Hill Education (India) Private Limited ,2018
2.	Social Media Marketing A Strategic Approach, Melissa Barker,Donald Barker,Second Edition Cengage Learning ,2017.
3.	Digital Marketing, Vandana Ahuja, First Edition, Oxford University Press, 2015
4.	Social Media Marketing, Liana "Li" Evans,First Edition , Pearson, 2011.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS613	**Semester:** Even	**Semester** VI **Session** 2018 -2019 **Month from:** Jan 2019-June 2019
Course Name	International Trade and Finance		
Credits	03	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Amba Agarwal
	Teacher(s) (Alphabetically)	Dr. Amba Agarwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C304-8.1	Explain the foundations of international trade and finance in the era of globalisation.	Understanding Level (C2)
C304-8.2	Analyze the major models and theories of international trade.	Analyzing Level (C4)
C304-8.3	Identify the effects of tariffs, quotas and technical progress on economic growth.	Applying Level (C3)
C304-8.4	Examine the equilibrium in the Balance of Payments (BOP) and measures to correct disequilibrium.	Analyzing Level (C4)
C304-8.5	Compare the fixed and flexible exchange rate, monetary policy, foreign trade multiplier & trade policy.	Analyzing Level (C4)
C304-8.6	Analyze the working of regional blocks & international organization.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	International trade and globalisation.	2
2.	Theory of International Trade	The pure theory of international trade -Theories of absolute advantage, comparative advantage and opportunity costs, modern theory of international trade; Theorem of factor price equalization; Theory of absolute cost and comparative cost.	4
3.	Economic Growth and International Trade Policy	Terms of trade, Technical progress: Neutral, Labour Saving and Capital Saving, Trade Restrictions: Tariffs, General equilibrium analysis of a tariff in a small and large country, Optimum tariff. Non-Tariff Barriers: Import Quota, Dumping, Voluntary Export Restraints, Export Subsidy.	5
4.	Balance of Payments	Meaning and components of balance of payments; balance of trade, equilibrium and disequilibrium in the balance of payments; Measuring Deficit or Surplus in BOP, Measures to correct it.	4
5.	Fixed and Flexible Exchange Rate	Fixed exchange rates and flexible exchange rates; Internal and External Balance, IS-LM-BP Model, Expenditure-reducing and expenditure-switching policies.	4
6.	International Economic Integration	Foreign Trade Multiplier, Devaluation, Theory of Custom Unions, Trade policy.	3

7.	The Theory of Regional Blocs & International organisation	Rationale and economic progress of SAARC/SAPTA and ASEAN regions. Regionalism (EU, NAFTA); Functions of GATT/WTO (TRIPS, TRIMS), IMF and World Bank.	6
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignment, 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.	**Krugman, Paul.**, International Economics: Theory and Policy, 10th edition, Pearson, 2017
2.	**Kindleberger, C.P.,** International Economics, 6th edition, R.D. Irwin, Homewood, 1978
3.	**Salvatore, D.**, International Economics, 13th edition , Prentice Hall, Upper Saddle River, N.J., New York, 2016
4.	**Soderston, Bo**, International Economics, 3rd edition,The Macmillan Press Ltd., London, 1999
5.	**Roy Malbika and Sinha, Saket,** International Trade and Finance, 1st edition, Springer, 2017

Detailed Syllabus
Lecture-wise Breakup

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Course Code	19B13HS611	**Semester**: Even	**Semester: VI Session**: 2019 -2020 **Month From** Jan 2020 to June 2020
Course Name	Morality of Everyday Living and Moral Decision Making		
Credits	2	**Contact Hours**	1-0-2

Faculty (Names)	**Coordinator(s)**	Ms Puneet Pannu
	Teacher(s) (Alphabetically)	Ms Puneet Pannu

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-3.1	Apply and Analyze morality in all facets of personal and professional life	Analyze (C4)
C305-3.2	Discover ways to address moral dilemmas by deliberating on the pros and cons to find the best possible outcome	Analyze (C4)
C305-3.3	Justify and Formulate morally correct decisions and stand by them	Evaluate (C5)
C305-3.4	Adapt and develop a character respected by peers and superior alike	Create (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	The Big Questions: Origins of Morality	What is **morality? Universal aspects** of morality, **Evolution** of Morality, **Development** of Morality**, Morality Theories, Everyday Dilemmas and Decision Making**	4
2.	Compassion/ Empathy	**Reason/Emotion**; Where does concern for others come from? **Empathy**—and is more empathy necessarily a good thing? And what can we learn from the study of those who seemingly lack normal moral feelings, such as violent psychopaths?	3
3.	Moral Differences	How does **culture influence our moral thought** and moral action? What role does **religion** play? Why are some of us conservative and others liberal, and how do political differences influence our sense of right and wrong?	2
4.	Moral Circles: Family, Friends, and Strangers	**Moral feelings**: Family, Friends, and allies. Reciprocal Altruism, The Morality of Group Preference, Morality of racial and ethnic bias. **:** Stereotypes, How Do We Treat Strangers	2
5.	Moral Decision Making	Contemporary Everyday Ethical Issues	3
		Total number of Lectures	**14**

Module No.	Title of the Module	List of Experiments/Activities	CO
1.	The Big Questions: Origins of Morality	Experiential Sharing: Morality & its significance to them Case Study: No such thing as free drink.	C305-3.1
2.	The Big Questions: Universal Aspects of Morality	Universal Aspects of Morality: Big Questions: Why be good? Universal Aspects of Morality: Big Questions: Is it permissible to lie? Universal Aspects of Morality: Big Questions: Is it good to gossip??	C305-3.1
3.	The Big Questions: Everyday Dilemmas and Decision Making	UPSC Case Study Ethical Dilemma of a Marketing Manager	C305-3.2 C305-3.3
4.	Evolution & Development of Morality	Ethical Analysis: A young Professor's Career	C305-3.1 C305-3.2 C305-3.3
5.	Compassion/ Empathy: Reason v/s Emotion	Discussion: Can we do better than the Golden Rule Discussion: Obligation to Others/ Is jealousy & Resentment always bad?	C305-3.1 C305-3.4
6	Compassion/ Empathy	EI Assessment Discussion on Reading: What's the matter with Empathy?	C305-3.1 C305-3.4
7	Moral Differences	Case Study: Difference in Morality Experiential Exercise: Country/ Org/ Home Moral Culture	C305-3.4
8	Moral Circles: Family, Friends, and Strangers	Experiential Sharing: Moral Circles and their influence on us Stereotyping in Morality	C305-3.4
9	Moral Decision Making	Contemporary Real World Scenario: Analyzing it through CATWOE	C305-3.1 C305-3.2 C305-3.3 C305-3.4

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30 (Project Presentation)
End Semester Examination	40 (End Term Written Paper)
TA	30 (Case Studies, Assignment)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	**Martin, Clancy,** "Moral Decision Making: How to approach everyday Ethics", The Great Courses, USA, 2014
2.	**Shukla T., Yadav A.& Chauhan G.S**., "Human Values & Professional Ethics", Cengage Learning India Pvt Ltd, 2018
3.	**Khanka S.S**., "Business Ethics & Corporate Governance (Principles & Practices)", S. Chand, 2014
4.	**Mruthyunjaya H.C**., "Business Ethics & Value systems", PHI Learning Pvt Ltd, 2013
5.	**Jennings, Marianne M.,** " Cases in Business Ethics", Cengage Learning India Ltd, 2013

Detailed Syllabus

Lecture-wise Breakup

Course Code	19M12MA611	**Semester** - Even **(specify Odd/Even)**	**Semester** VI **Session** 2019 -2020 **Month from** January 2020 to June 2020
Course Name	Mathematical Foundations of Geographic Information System		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Mohd. Sarfaraz
	Teacher(s) (Alphabetically)	Dr. Mohd. Sarfaraz

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-5.1	Understand the concept of Trigonometry, Coordinate systems and Geometric Transformations and then its applications for Geographic information system.	Applying Level (C3)
C302-5.2	Identify basic set operations and database technology based on predicates, quantifiers and predicate Logic.	Understanding Level (C2)
C302-5.3	Describe Geo-statistical methods, used for Geographic information system.	Understanding Level (C2)
C302-5.4	Explain quantitative aspects for image analysis by using analytic and numerical methods.	Analyzing Level (C4)
C302-5.5	Understand the concepts of space and time in spatial information systems and spatiotemporal data models.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Trigonometry	Trigonometric functions, allied angles, compound angles.	4
2.	Coordinate Systems	Cartesian rectangular coordinate system, distance formula, section formula, Straight lines, slopes, types of straight lines, Application in solving life science problems.	4
3.	Geometric Transformations	Geometric Transformations and its applications for Geographic information system	2
4.	Set Theory	Review of Set Theory, Overlay operations in Geoinformatics	3
5.	Propositional and Predicate Logic	Relational database technology based on Predicates, Quantifiers and Predicate Logic.	5
6.	Geo-statistical methods	Principle of Least Squares, Fitting of straight line and parabola, Correlation - Karl Pearson's coefficient of correlation and Spearmann's rank correlation	6
7.	Regression and ANOVA	Linear regression, One way and two way classification of ANOVA.	6
8	Image analysis and	Quantitative aspects in decision making for image analysis,	6

	Map Algebra	Tools available for image analysis –analytical and numerical-Fourier series, Fourier Transforms, Map Algebra.	
9	Spatial Modeling and Database Design	Spatial Data and Information, Concepts of Space and Time in Spatial Information Systems, Database Design, Spatial Data Models, Spatio-temporal Data Models.	6
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.	**Edward, B.**, Introduction to Mathematics for life scientist – Springer, 1979.
2.	**Burrough, P. A. and McDonnell R. A.,** Principles of Geographical Information Systems. Oxford University Press, 1998.
3.	**Leung, Y.**, Intelligent Spatial Decision Support Systems. Springer-Verlag, Berlin, Heidelberg, 1997.
4.	**Mackenzie, A.**, Mathematics and Statistics for Life Scientists, Taylor & Francis, New York, 2005.
5	**Leung, Y.**, Intelligent Spatial Decision Support Systems. Springer-Verlag, Berlin, Heidelberg, 1997.
6.	**Gupta, S. C. and Kapoor, V. K.**, Fundamentals of Applied statistics, Sultan Chand and sons, 2003.

Detailed Syllabus

Course Code	20B12HS311	**Semester** Even **(specify Odd/Even)**	**Semester VI Session** 2020 **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
C01	Demonstrate an understanding of the meaning and nature of globalization by addressing its political, economic, cultural and technological dimensions	Understanding (C2)
C02	Analyzing the significance of contemporary global issues such as the proliferation of nuclear weapons, ecological issues, international terrorism, and human security to global governance.	Analyze (C4)
C03	Analyze how the global politics shapes domestic politics	Analyze (C4)
C04	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, WTO, World Bank, TNCs • Global resistances (Global Social Movement and NGOs)	6
3.	Contemporary Global Issues-I	• Ecological Issues: historical overview of international environmental agreements • climate change, global commons debate • Proliferation of Nuclear Weapons	8
4.	Contemporary Global Issues-II	• International Terrorism: non-state actors and state	8

		terrorism; war on terror • Migration and Human Security	
		Total number of Lectures	**28**

Evaluation Criteria

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

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

1.	Baylis, J. and Smith, S. (eds.) (2017). *The Globalization of World Politics: An Introduction to International Relations*. 7th edn. Oxford: Oxford University Press
2.	Gordon, L. & Halperin, S. (2000). Effective Resistance to Corporate Globalisation. in R.O'Brien, A.M. Goetz, J.C. Scholte & M.Williams. *Contesting Global Governance*. Cambridge: Cambridge University Press
3.	Halliday, F. (2004). Terrorism in Historical Perspective. *Open Democracy*. 22 April. [Online] http://www.opendemocracy.net/conflict/article_1865.jsp
4.	Hay, C. (ed.) (2010). *New Directions in Political Science: Responding to the Challenges of an Interdependent World.* UK: Macmillan Education
5.	Held, D. & McGrew, A. (2007). *Globalization/Anti-globalization: Beyond the Great Divide*. Cambridge: Polity Press
6.	Heywood, A. (2014). *Global Politics*. London: Palgrave Foundation
7.	Jindal, N & Kumar. K (2019). *Global Politics Issues and Perspectives*. Delhi:Sage Publications
8.	Lamy, S.L. & Masker, J.S. (2018). *Introduction to Global Politics*. New York: Oxford University Press
9.	Shahrbanou, T. & Chenoy, A. (2007). *Human Security*. London: Routledge
10.	Thomas, C. (2008). Globalization and Development in the South. in J. Ravenhill (ed.) *Global Political Economy*. Oxford: Oxford University Press

Course Code	**20B12MA311**	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2019 -2020 **Month from** Jan 2020-June2020
Course Name	Applicational Aspects of Differential Equations		
Credits	**4**	**Contact Hours**	3-1-0
Faculty (Names)	**Coordinator(s)**	Prof. Sanjeev Sharma	
	Teacher(s) (Alphabetically)	Prof. Sanjeev Sharma	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
CO 1	solve ordinary differential equations in LCR and mass spring problems.	Applying Level (C3)
CO 2	explain orthogonality of functions and apply it to solve Sturm-Liouville boundary value problems.	Applying Level (C3)
CO 3	apply matrix algebra to find the solution of system of differential equations.	Applying Level (C3)
CO 4	formulate and solve first and second order partial differential equations.	Applying Level (C3)
CO 5	evaluate solution of differential equations arises in the field of 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, 10thEdition, John Wieley& Sons, Inc. 2013.

Java Programming (20B16CS322)

Detailed Syllabus

Course Description with CO

Course Code	**20B16CS322**	**Semester** Even	**Semester VI** **Session** 2019 -2020 Month from Jan to Jun
Course Name	**Java Programming**		
Credits	0	**Contact Hours**	[1- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Dr. Shruti Jaiswal, Mr. Mahendra Kumar Gurve
	Teacher(s) (Alphabetically)	Mr. Mahendra Kumar Gurve, Dr. Shruti Jaiswal

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**

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** 2019 -2020 Month from January to June
Course Name	Problem Solving using C and C++		
Credits	2	**Contact Hours**	[1- 0 - 2]

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

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, Alt 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
Total	**100**

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

Course Code	**20B16CS324**	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2019 -2020 Month from Jan 2020 to Jun 2020
Course Name	**Non-linear Data Structures & problem solving**		
Credits	2	**Contact Hours**	1- 0 - 2

Faculty (Names)	**Coordinator(s)**	Dr. Mohit Kumar
	Teacher(s) (Alphabetically)	Dr. Amarjeet Prajapati, Ankita Wadhwa, Dr. Mohit Kumar, Dr. Pawan Singh Mehra, Vikas Hassija

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, Mini Project – 20)
Total	**100**

Recommended Reading material:

Text Books

1.	Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
2.	Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Second Edition.

References

3.	Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.
4.	Handbook of Data Structures and Applications, 2nd Edition by Sartaj Sahni, Dinesh P. Mehta, CRC Press
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	**20B16CS326**	**Semester EVEN**	**Semester** VI **Session** 2019 -2020 **Month from JAN-JUN**
Course Name	Front End Programming		
Credits		**Contact Hours**	1-0-2 (3 hrs per week)

Faculty (Names)	**Coordinator(s)**	Dr. Megha Rathi
	Teacher(s) (Alphabetically)	Dr. Megha Rathi, Mr. Prashant Kaushik , Ms. Sonal, Dr. Suma Dawn

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, Lab Records , Quiz/ Mini-Project/Assignment**)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	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.
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
Lab-wise Breakup

NOTE: All the entries (…) must be in Times New Roman 11.

Course Code	**10B11EC611/ 15B11EC611**	**Semester** VI (Even) **(specify Odd/Even)**	**Semester** 6th **Session** 2019 -2020 **Month from** Jan.-June 2020
Course Name	**TELECOMMUNICATION NETWORKS LAB**		
Credits	4	**Contact Hours**	40

Faculty (Names)	**Coordinator(s)**	Juhi Gupta and Sajal aggarwal
	Teacher(s) (Alphabetically)	Juhi Gupta, Neeti Singh, Pankaj K. Yadav, Ruby Beniwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Learn about network simulator, and building/installing NS2 for conducting network simulation and summarizing OSI, TCP & UDP	**Level-2** (Understanding)
CO2	Set up and anlaysis of the wired and LAN networks and understanding UDP/TCP agents with CBR/FTP traffic source respectively	**Level- 4** (Analyzing)
CO3	To create and analyze the mobile ad-hoc network and heterogenous networks and routing algorithm.	**Level-4** (Analyzing)
CO4	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

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.	NS2 for Beginners
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