Course Description
Detailed Syllabus

Course Code	18B12CS428	**Semester : EVEN**	**Semester : VIII Session** 2018 -2019 *Month:* **from Jan- May, 2019**
Course Name	Introduction to Deep Learning		
Credits	04	**Contact Hours**	04

Faculty (Names)	**Coordinator(s)**	Satish Chandra
	Teacher(s) (Alphabetically)	Bharat Gupta

Sr. No.	**Description**	**Cognitive Level (Bloom's Taxonomy)**
C434-3.1	Identify and express the motivation behind and need of Deep Learning.	Understanding (Level-2)
C434-3.2	Comprehend the basic theory of learning, probability in learning, error minimization and regularization techniques.	Understanding (Level-2)
C434-3.3	Design and Model Convolution Neural Networks for Image recognition and Computer Vision.	Apply (Level-3)
C434-3.4	Apply Recurrent Neural Networks and LSTM for temporal data	Apply (Level-3)
C434-3.5	Assess the Deep Learning techniques on the basis of performance measures such as training speed, classification error, kappa coefficient, precision, recall and F-Measure.	Evaluate (Level-5)

Lecture Plan:

Sr. No.	**Module**	**Topic**	**No. of Lectures**
1.	Introduction	Course overview: What is deep learning? DL successes; DL versus Shallow Networks	**02**
2.	Mathematics for Machine Learning	Math review : Gradient descent, logistic regression. Probability, continuous and discrete distributions; maximum likelihood. PAC.	**04**
3.	Neural Network Fundamentals	Neural networks : cost functions, hypotheses and tasks; training data; maximum likelihood based cost, cross entropy, MSE cost; feed-forward networks; MLP, sigmoid units. Back propagation by Gradient Descent Optimization	**04**
5.	Deep Neural Network-1	Deep learning strategies: GPU training, regularization, RELU, dropouts etc.	**04**
6.	Deep Neural Network-2	Convolutional neural networks: HPC in Deep Learning	**06**
7.	Deep Neural Network-3	CNN Architectures LeNet, AlexNet, VGG Net, GooleNet: a comparative analysis	**06**
8.	RNN-1	Recurrent neural networks : architecture, application and performance evaluation	**06**
9.	RNN-2	LSTM and gated networks: architecture, application and performance evaluation	**06**
10.	Unsupervised Deep learning	Unsupervised deep learning (autoencoders)	**04**

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35

TA	25
(Attendance = 07, Class Test, Quizzes, etc = 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, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Nikhil Buduma, Fundamentals of Deep Learning, Shroff Publishers , 2018
2	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Pess , 2017
3.	FRANÇOIS CHOLLET, Deep Learning with Python, Manning Publications, 2018

Detailed Syllabus
Lecture-wise Breakup

Course Code	**18B12HS811**	Semester: EVEN	Semester: VIII Session: 2020 Month from: January-May
Course Name	**Industrial Sociology**		
Credits	3-0-0	Contact Hours	3

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-9.1	Understand the scope of industrial sociology and major theories on labour and work	Understand (C2)
C402-9.2	Analyzing the contemporary issues related to industry in the post-LPG era	Analyze (C4)
C402-9.3	Evaluating work in its social aspects such as gender, caste, class and unpaid work, as different from its better known economic dimension.	Evaluating (C5)
C402-9.4	Evaluate and interpret information about emerging issues in the industry through various sources like print and electronic media, film, documentary and other information technologies	Evaluate (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introductio n	• Scope and importance of the study of Industrial Sociology • Nature and type of industrial society	3

		• Study of industrial relations	
2.	Theoretical Orientation	• Functional theory of labour (Durkheim) • Conflict/Marxian theory of labour • Weberian Theory of labour	5
3.	Social dimensions of work (I)	• Types of work: Unpaid Domestic and Volunteer work/ Service sector work/ managerial and white collar work/ blue collar work- Sectors of employment	5
4.	Social dimensions of work (II)	• Gendered Organization: Feminization of Labour and Poverty • Discrimination and Harassment (gender, racial, ethnic) • Caste system as a tool to stratify the labour force	8
5.	Industrialization in India	• Trade Union: Concept, Functions and Types, History of Trade Union Movement in India Trade • Socialism- LPG era India • Unions and Challenges of Privatization, risks and hazards, Law and work, Decline of Trade Unions, Disputes & Conciliation.	8
6.	Contemporary Issues	• Globalization and Technology: Criteria for measuring Globalization • Automation of work and its Impact (Reference: AI technologies) • Employment trends	8
7.	New initiatives in India	• Indian Endeavors- Make in India/ Start up India, Skills India programme	5
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (project/movie review/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.	Bhattacharjee. S. (2016). *Industrial Sociology*. Aavishkar Publications. Jaipur
2.	Edgell, S. (2006). "Unpaid Work-Domestic and Voluntary work". *The Sociology of Work: Continuity and Change in Unpaid Work.* NewDelhi:Sage
3.	Freeman. C. (2009). 'Feminity and Flexible labour: Fashioning Class through gender on the global assembly line'. Massimiliano Mollona, Geert De Neev and Jonathan parry (eds.) *Industrial Work And life:An Anthropological Reader*.Berg: Oxford
4.	Grint, K.(2005)."Classical Approaches to Work: Marx, Durkheim and Weber". *The Sociology of Work: An Introduction*. Polity Press. Cambridge.
5.	Mishra. R (2016). *Industrial Sociology*. Laxmi Publications. New Delhi
6.	Prasad. J (2013). *Industrial Sociology*.Vayu Education of India: Delhi
7.	Singh. Y. & Sharma. R (2016). *Industrial Sociology*. AITBS Publishers: Delhi
8.	Sinha, P.N.R. (2006). *Industrial relations, Trade Unions and Labour legislations*. Pearson: New Delhi
9.	Watson, T.J. (2003). *Sociology, Work and Industry.* Routledge: London and New York

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS815	**Semester Even**	**Semester 8th Session 2019 -2020** **Month from January 2020 to May 2020**
Course Name	QUALITY ISSUES IN ENGINEERING		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Santoshi Sengupta
	Teacher(s) (Alphabetically)	Dr. Santoshi Sengupta

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-11.1	Apply the concepts of quality within quality management systems by understanding various perspectives, historical evolution; and contributions of key gurus in the field of quality	Apply Level (C3)
C402-11.2	Determine the effectiveness of acceptance sampling using single and double sampling plans and operating characteristic curves	Evaluate Level (C5)
C402-11.3	Determine quality by employing a wide range of basic quality tools, lean concepts and process improvement techniques such quality function deployment	Evaluate Level (C5)
C402-11.4	Examine the importance of six sigma, various quality standards, awards, certifications	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fundamentals of Quality	Perspectives and Definitions of Quality, Dimensions Of Quality for Product and Service, History of Quality, Phases of Quality Assurance, Alignment, Linkage, Reengineering, Contribution of Gurus – Shewhart, Deming, Ishikawa, Juran	6
2.	Cost of Quality and Quality Function Deployment	Cost of Quality, Voice Of Customers: Kano's Model, House Of Quality, QFD Process	6
3.	Basic Tools of Quality	Checksheets, Cause and Effect Diagrams, Histograms, Flowcharts, Pareto Analysis, Scatter Diagrams, Run Charts	9
4.	Statistical Thinking And Applications	Acceptance Sampling, Single Sampling Plan, Double Sampling Plan, Statistical Process Control, Specification And Control Limits, Control Charts For Attributes, Control Charts For Variables	9
5.	Six Sigma, Benchmarking and Lean Concepts	Six Sigma, Capability Of A Process/Product/Service, DMAIC Process, Benchmarking Meaning, Process, Methods; JIT, Andon, Kanban, Kaizen, Poka-Yoke, 5-S, 7 Mudas	9
6.	Quality Standards and Awards	ISO Standards, MBNQA, RGNQA, Deming Prize	3

Total number of Lectures	**42**

Evaluation Criteria

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

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

1.	NVS Raju, Total Quality Management, 1st Edition, Cengage Learning, 2018
2.	Kanishka Bedi, Quality Management, 1st Edition, Oxford University Press, 2006
3.	D.H. Besterfield, Total Quality Management, Revised 3rd Edition, Pearson Education, 2011

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH811	**Semester Even (specify Odd/Even)**	**Semester VIII Session** 2019 -2020 **Month from** January to June
Course Name	Photonics and Applications		
Credits	3	**Contact Hours**	3

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-3.1	Recall the fundamental properties of light and the processes involved in the generation of light	Remember Level (C1)
C402-3.2	Interpret the theory of fiber optics	Understand Level (C2)
C402-3.3	Apply the fundamentals of various nonlinear optical effects in technology; make use of holography and its applications	Apply Level (C3)
C402-3.4	Compare the operational principles, characteristics and trade-offs of optical detectors and modulators of light	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Lasers	Review of different types of laser systems. LEDs, Semiconductor lasers, Quantum well lasers, Modes of laser cavity, Q-switching and Mode locking in lasers.	8
2.	Fiber Optics	Numerical aperture, Step and graded index multimode fibers, attenuation and dispersion, modes in optical fibers. Single mode fiber, mode cutoff and mode field diameter. Connector and splice losses, Erbium doped fiber amplifier and Characterization techniques including OTDR.	10
3.	Photo detectors	Semiconductor photo detectors.	5
4.	Optical Electronics	Wave propagation in anisotropic media, Electro-optic effect: phase and amplitude modulation. Acousto-optic effect: modulators, deflectors and tunable filters, Magneto-optic effect: modulators.	4
5.	Optical devices	Electro-optical device, Acousto-optical device, Magneto-optical device, Voice communication, Optical communication.	2
6.	Nonlinear Optics	SHG, Sum and Difference frequency generation, parametric amplification, wavelength converters, Self focusing with lasers.	6
7.	Holography	Recording and Reproduction of Hologram, Applications of holography.	4
8.	Applications of Photons in Memory devices	CD, VCD, DVD.	1

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.	R. P. Khare, *Fiber Optics and Optoelectronics*, Oxford University Press.
2.	A. K. Ghatak and K. Thyagarajan, *Optical Electronics*, Cambridge university Press.
3.	A. K. Ghatak and K. Thyagarajan, *An Introduction to Fiber Optics*, Cambridge university Press.
4.	B. B. Laud, *Lasers and Nonlinear Optics*, New Age International.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B1NHS812	**Semester- Even**	**Semester** 8th **Session** 2019 -2020 **Month from** January 2020 to June 2020
Course Name	**International Finance**		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Dr. Mukta Mani
	Teacher(s) (Alphabetically)	Dr. Mukta Mani

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-12.1	Explain the global market scenario, its imperfections and risks which affect the multinational businesses trade.	Understanding level (C2)
C402-12.2	Analyze the international transactions of balance of payments and understand their relationship with key macroeconomic indicators	Analyzing level (C4)
C402-12.3	Apply the concepts of foreign exchange market and currency derivatives for making transactions and risk hedging in foreign exchange market	Applying level (C3)
C402-12.4	Analyze the role of parity conditions and other factors in exchange rate determination.	Analyzing level (C4)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Financial Globalization and Risk, Global financial Marketplace, Eurocurrency market and LIBOR, Theory of comparative advantage, Globalization process	4
2.	Balance of Payments	BOP transactions, accounting, Accounts of BOP, Capital and Financial Accounts, BOP and key macroeconomic variables	4
3.	Exchange Rates	Foreign Exchange market, functions, participants, types of transactions: spot, forward and swap transactions, Methods of stating exchange rates, quotations and changes in exchange rates	6
4.	Foreign Exchange rate determination and forecasting	Exchange rate determination theories, Currency market intervention, disequilibrium, forecasting, *Article on Recent Downfall of the Indian Rupee	7
5.	Forward Exchange	Forward foreign exchange, premiums and discounts, forward rates vs future spot rates, payoff profile, swaps, forward quotations	6

6.	Currency Futures and options market	Foreign currency futures, Currency options, Forwards, futures and options compared	6
7.	International Parity Conditions	Purchasing Power Parity and Interest Parity Prices and Exchange rates, Exchange rate pass-through, Forward rate, Prices, Interest rates and exchange rates in equilibrium, **Case study on Japanese Yen Carry Trade	6
8.	Transaction Exposure	Types of foreign exchange exposure, understanding of transaction exposure and its hedging	3
		Total	**42**

Evaluation Criteria

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

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

1.	Eiteman, D K., Stonehill, A.I. and Moffett, M.H. (2018), Multinational Business Finance, 14th Ed., Pearson India Education
2.	Levi, M.D. (2009), International Finance, 4th Ed., Routledge Publication.
3.	Jain, P K., Peyrard, J. and Yadav, S.S. (1999), International Financial Management, Macmillan India
4.	Desai, M.A. (2007), International Finance- A Casebook, Wiley India
5.	Shapiro, Alan C. (2003), Multinational Financial Management, 7th Ed., John Wiley and Sons Inc.
6.	Pal, P and Ray, P. (2018), "Recent Downfall of the Indian Rupee", *Economic and Political Weekly*, Vol. 53 No. 41, October.
7.	Eiteman, D K., Stonehill, A.I. and Moffett, M.H. (2018), "Mrs Watanabe and the Japanese Yen Carry Trade", Multinational Business Finance, 14th Ed., Pearson India Education, pp. 187-190.

Detailed Syllabus

Course Code	19B12CS412	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2019 -2020 **Month from** January to June
Course Name	Advanced Java Programming		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Deepti Singh(62)+Shariq Murtaza(128)
	Teacher(s)	Deepti Singh(62)+Shariq Murtaza(128)
Prerequisites	1. Basic Knowledge of Programming & Data Structure. 2. Experience in object-oriented programming and knowledge of core Java concepts. 3. Experience of Programming Projects would help but is not mandatory.	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-1.1	Explain threads, synchronization and need of handling concurrency issues in applications.	Understand Level (Level 2)
C434-1.2	Apply synchronization utilities to solve concurrency issues in given problem.	Apply Level (Level 3)
C434-1.3	Build Java Programs using JDBC Connectivity with SQL Database.	Create Level (Level 6)
C434-1.4	Demonstrate and implement web application using Java Servlets.	Understand Level (Level 2)
C434-1.5	Build Java Programs using Java Server Pages technology.	Create Level (Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Course description and course outcome discussion, Overview of Java as a language.JVM internals, Java modules- J2SE, J2EE and J2ME.	2
2.	Concurrency in Java	Multithreading basic concepts- Threads, Java Thread Model,Thread Priorities, Thread Synchronization-I (synchronized, wait, notify) Producer/Consumer, Concurrency Thread Synchronization (Lock, Condition) Producer/Consumer problem, Thread Synchronization Utilities- Semaphore, Countdownlatch, CyclicBarrier, Thread Exceutors, Concurrent collection.	11
3.	Learning JDBC (Java Database Connectivity)	Introduction to JDBC- What is JDBC, Components of JDBC, JDBC Specification., JDBC Architecture, JDBC API- java.sql Package, JDBC API- javax.sql Package, JDBC Drivers & its Types, Type-1 Driver, Type-2 Driver, Type-3 Driver, Type-4 Driver, Comparison of all JDBC Drivers, Driver Interface , DriverManager Class, Connection Interface, Statement Interface, PreparedStatement Interface, ResultSet Interface, Implementing JDBC Processes with java.sql Package - Basic JDBC Steps, Prepare, send and execute SQL Query, basic CRUD operations with some examples.	9
4.	Knowing Java Servlets	Introduction to Servlet, Web App Architecture: high-level overview, Mini MVC Tutorial: hands-on MVC, Servlet:	9

		request and response, Web Application: attributes and listeners, Session management	
5.	Java Server Pages	Introduction to JSP, Scriptless JSP, Custom tags library – JSTL, Custom tag development, Web app deployment, Web app security, Wrappers and Filters, Examples	8
6.	Applications	Building a complete Database Web Application using JDBC, JSP and Servlet.	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Mini Project(6), Attendance(7),Internal assessment (5), Quiz(7))
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	Schildt, Herbert. Java: *The Complete Reference, Ninth Edition*. US: McGraw-Hill Osborne Media, 2017.
2	Goetz, B., Peierls, T., Lea, D., Bloch, J., Bowbeer, J., & Holmes, D. *Java concurrency in practice*. Pearson Education. 2017.
3	Basham, Bryan, Kathy Sierra, and Bert Bates. *Head First Servlets and JSP*. " O'Reilly Media, Inc.", 2016 re-print.

Reference Books

1.	Core and Advanced Java, Black Book, Ninth Edition.Dreamtech press, 2018.

Detailed Syllabus

Course Code	15B1NHS832	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2019 -2020 **Month from** Jan - July
Course Name	International Studies		
Credits	3	**Contact Hours**	**3-0-0**

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

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

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

		conflicts and insurgencies; border disputes	
6.	Emergence of Other Power Centers of Power	• Japan • European Union (EU) • China • Russia	8
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment/ Class Test/ 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.	Appadorai, & Rajan, M. S. (eds.) (1985). *India's Foreign Policy and Relations*. New Delhi: South Asian Publishers.
2.	Baylis, J. & Smith, S. (eds.) (2011). *The Globalization of World Politics: An Introduction to International Relations*. Fifth Edition. Oxford: Oxford University Press,
3.	Calvocoressi, P. (2001). *World Politics: 1945—2000*. Essex: Pearson
4.	Carr, E.H. (2004). *International Relations between the Two World Wars: 1919-1939*. New York: Palgrave
5.	Chatterjee. A (2018). *International Relations Today*. Noida: Pearson
6.	Ganguly, S. (ed.) (2019). *India's Foreign Policy: Retrospect and Prospect*. New Delhi: Oxford University Press
7.	Goldstein, J. and Pevehouse, J.C. (2009). *International Relations*. New Delhi: Pearson
8.	Hobsbawm, E. (1995). *Age of Extreme: The Short Twentieth Century, 1914—1991*. London: Abacus
9.	Mewmillians, W.C. and Piotrowski, H. (2001). *The World Since 1945: A History of International Relations*. Fifth edition. London: Lynne Rienner Publishers.
10.	Pant, H.V. (2009). *India's Foreign Policy in the Unipolar World.* Delhi: Routledge

Course Code	15B29CI891	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2019 -2020 **Month from** Jan 2020 to June 2020
Course Name	**Project Part – II**		
Credits	12	**Contact Hours**	…

Faculty (Names)	**Coordinator(s)**	Dr. Mukta Goyal Prashant Kaushik
	Teacher(s) (Alphabetically)	Entire Department

COURSE OUTCOMES		**COGNITIVE LEVELS**
C451.1	Summarize the contemporary scholarly literature, activities, and explored tools for hands-on in the respective project area	Understand Level (Level 2)
C451 .2	List out the specific requirements to develop the workable solution for the identified computing problem.	Analyze Level (Level 4)
C451 .3	Develop a workable computing solutions for the identified problem	Apply Level (Level 3)
C451 .4	Evaluate the performance of the developed solution	Evaluate Level (Level 5)
C451 .5	Compile the results and findings of the project in written and verbal formats	Create Level (Level 6)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	…	…	…
2.	…	…	…
3.	…	…	…
4.	…	…	…
5.	…	…	…
...	…	…	…
***n*.**	…	…	…

Evaluation Criteria

Components	**Maximum Marks**
Mid Semester Viva	20
Final Viva	30
Project Report	20

Day to Day Work	30
Total	**100**

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

Detailed Syllabus
Lecture-wise Breakup

Subject Code	16B1NHS832	Semester (specify Even)	Semester Session 2019-2020 Month from Jan-June
Subject Name	Service Marketing and Management		
Credits	3-0-0	Contact Hours	3

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-1.1	Understand service products, consumers and markets	C2
C402-1.2	Apply 4P's of marketing to service	C3
C402-1.3	Determine and Interpret the customer Interface	C5
C402-1.4	Create and design profitable service strategies	C6

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

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction to Services	Product to Services—The Challenges • The Gaps Model • The Services Marketing Mix	5
2.	Consumer Behavior In Services	Managing Customer Behavior— The three stage model of Service Consumption	5
3.	Delivering Quality Service	Challenges of Measuring Service Quality • Measures of Service Quality • Dimensions of Service Quality SERVQUAL	5
4.	Positioning Services in Competitive Markets	Focus Strategies Developing effective positioning strategies	4
5.	Creating value in a competitive market and service promotion	Positioning a service in the market Value addition to the service product Planning and branding service products New service development.	6

7	Culture and Service	National Cultures, Managing and marketing of Service across boundaries	5
6.	Technology & Service Strategy	Introduction to e services Electronic Commerce Models, Types of E services Value Chains in E Service	6
7	Planning and managing service delivery	Creating delivery systems in price, cyberspace and time The physical evidence of the service space. The role of intermediaries, enhancing value by improving quality and productivity.	6
		Total number of Lectures	42

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Valarie A.Zeithaml & Mary Jo-Bitner: Services Marketing-Integrating Customer Focus Acros the Firm, 7/e, TMH, 2018.
2.	Christopher Lovelock: Services Marketing People, Technology, Strategy, Fourth Edition, Pearson Education, 2011
3.	Rao, Services Marketing, Pearson Education, 2/e,2011
4.	Thomas J.Delong & Asish Nanda: Managing Professional Servies-Text and Cases, McGraw-Hil International, 2002
5	Roland T. Rust and P.K. Kannan, e-Service New Directions in Theory and Practice, Prentice-Hal of India Pvt. Ltd., 2002

Optimization Techniques (16B1NMA831)

Lecture-wise Breakup

Course Code	16B1NMA831	**Semester** Even	**Semester** VIII **Session** 2019-2020 **Month from** Jan 2020 to June 2020
Course Name	Optimization Techniques		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Prof. A. K. Aggarwal	
	Teacher(s)	Prof. A. K. Aggarwal	
	(Alphabetically)	Dr. Pankaj Srivastava	

COURSE OUTCOMES — **COGNITIVE LEVELS**

After pursuing the above mentioned course, the students will be able to:

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

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

		Total number of Lectures	**40**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, 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. Taha H. A., Operations Research: An Introduction, 7th edition, PHI, 2002.
2. Rao, S. S. - Engineering Optimization, Theory and Practice, Third Edition, New Age International Publishers, 2010.
3. Wagner, H. M., Principles of Operations Research with Applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd., 1975.
4. Hillier F. and Lieberman G. J., Introduction to Operations Research, 6th edition, McGraw-Hill, 1995.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B1NCI735**	**Semester (Even)**	**Semester VIII Session Month from Jan to June**
Subject Name	**High Performance Web and Mobile Applications**		
Credits	**3 0 1**	**Contact Hours**	**3 0 1(Lectures)**

Faculty (Names)	**Coordinator(s)**	1. Prashant Kaushik
	Teacher(s) (Alphabetically)	

S. No	DESCRIPTION	COGNITIVE LEVEL (BLLOMS TAXONOMY)
C433-3.1	Analyze differentiating aspects of high performance and regular web applications.	Analyze Level (Level 4)
C433-3.2	Explain the design goals of high performance web & mobile applications.	Understand Level (Level 2)
C433-3.3	Design and develop Server and mobile applications for Multi threaded environment	Create Level (Level 6)
C433-3.4	Build the performance metrics for evaluating the application load.	Evaluate Level (Level 6)
C433-3.5	Make use application testing suite for performance testing	Apply Level (Level 3)
C433-3.6	Analyze the crash reports for various types of crashes due to multiple platforms of mobile devices in a consolidated manner.	Apply Level (Level 4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	High Performance protocols like MQTT, COAP and Details.	8
2.	New high performance protocols	The QoS levels of the new protocols , design issues and architectuires	6
3.	Tomcat and mysql large scale	Large scale configurations for tomcat and mysql	6

4.	Java Vs Nodejs	Memory performance ,clustering and scaling best practices, disk, cpu, gpu based optimizations	6
5.	Web server Nodejs	Nodejs based Apps	6
6.	Containers and its virtualization	Various types of containers and its scaling and perfoamances.	6
7.	Deploying containers	Deployment issues and its details	6
		Total number of Lectures	**44**

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.	Hands-On Mqtt Programming with Python By Gaston C Hillar
2.	Tomcat: The Definitive Guide, 2nd Edition by Ian F. Darwin, Jason Brittain, O'Reilly
3.	Learn Docker - Fundamentals of Docker 18.x: Everything you need to know about... By Gabriel N. Schenker - Publisher: Packt Publishing

Teaching Methodology	The course shall be a combination of interactive lecture sessions, regular assignments and Project **Lectures** Classes will be fully Demonstration Oriented; students will be encouraged to bring their devices for understanding the Mobile application.	
Evaluation Schème	Test 1 Test 2 Test 3 Project Surprise Lecture Test Attendance Total	**20** **20** **35** **15** **5** **5** **100**

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B25CI743	**Semester** Even **(specify Odd/Even)**	**Semester** 8th **Session** 2019 -2020 **Month from** Jan 2020 – June 2020
Course Name	Cryptography and Network Security		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Shardha Porwal
	Teacher(s) (Alphabetically)	Shardha Porwal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C432-4.1	Describe classical encryption methods based on Substitution and Permutation	Understand (Level 2)
C432-4.2	Implement and apply modern block and stream cipher techniques like DES, AES and RC4	Apply (Level 3)
C432-4.3	Analyse the role of prime number theory and quadratic congruence in cryptography	Analyse (Level 4)
C432-4.4	Implement and apply asymmetric encryption algorithms of RSA , ElGamal and Elliptic Curve Cryptography	Apply (Level 3)
C432-4.5	Criticize hashing algorithms like SHA-512 and SHA – 1024	Analyse (Level 4)
C432-4.6	Compare and Choose cryptographic techniques for using Digital Signatures and certificates in existing applications	Evaluate (Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Classical Encryption Techniques	Modular Arithmetic , Substitution Ciphers: Shift , Playfair, Vernam, Vignere, Affine, Hill, Rail fence, Transposition Ciphers	6
2.	Modern Block Ciphers	Fiestel and Non Fiestel Encryptions, Data Encryption Standard, polynomial modular arithmetic, fields, generators, Advanced Encryption Standard	8
3.	Modern Stream Ciphers	Linear Feedback Shift Registers and RC4	4
4.	Mathematics for Public Key Cryptography	Prime number theory, Euler's theorem, Fermat's theorem Chinese Remainder Theorem, quadratic congruence, discrete logarithm, fast exponentation	6
5.	Public Key Cryptography	RSA, Knapsack, Rabin , ElGamal and Elliptic Curve Cryptography	10
6.	Hashing Algorithms	Requirements of Hashes for Cryptography, Message Digests,SHA-1	4
7.	Digital Signatures	Elgamal Signatures, Digital Signature Standards, X.509	4

	and Certificates	Certificates, Kerberos	
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Quiz + 5 Assignment+ 5 Attendance+10 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.	William Stallings, *Cryptography and Network Security*, Prentice Hall, 7th Edition, 2017.
2.	B A Forouzan and Debdeep Mukhopadhyay, *Cryptography and Network Security*, Mc Graw Hill, 3rd Edition, 2015.
3.	William Stallings, *Network security essentials: applications and standards*, Prentice Hall, , 3rd Edition ,2013.
4.	Hsiao DK, Kerr DS, Madnick SE, Computer security, Academic Press; 2014 Jun 20.
5.	Gupta B, Agrawal DP, Yamaguchi S, editors, Handbook of research on modern cryptographic solutions for computer and cyber security, IGI global; 2016 May 16.

Detailed Syllabus

18B12BT414 Machine Learning tools in Bioinformatics

Semester & Session	**VIII Semester 2019-20**	**Credits**	**3**	**Contact Hours L T P**	**3 3 0 -**

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

NBA Code: C402-13

Code	CO	**Level**
C402-13.1	Explain about the machine learning principle biological complexities and resources	C2
C402-13.2	Apply Pattern Identification methods for motif discovery	C3
C402-13.3	Apply machine learning in solving biological problems.	C3
C402-13.4	Analyzing the use of machine learning in disease-drug discovery	C4

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

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

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment-1, Assignment-2, Quiz, Case study)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Papers, Reports, Websites etc. in the IEEE format)	
1.	Pierre Baldi and Søren Brunak "Bioinformatics The Machine Learning Approach" , February 1998, 371 pp., 62 illus.,
2.	Thomas H. Cormen "Introduction to Algorithms" , 2nd edition McGraw-Hill Science, 1056 pages.

CO-PO and CO-PSO Mapping: (Biotech)

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	PSO 1	PSO 2	PSO 3
C402-13.1	**2**	**2**		**1**		**1**			**1**			**2**	**2**		
C402-13.2	**2**	**2**	**2**	**1**	**1**	**2**						**2**	**2**		
C402-13.3	**2**	**2**	**3**	**2**	**1**	**2**	**1**		**1**	**1**		**2**	**3**		**1**
C402-13.4	**2**	**2**	**2**	**1**	**1**	**1**	**1**		**1**	**1**		**2**	**1**	**1**	**1**
Avg.	**2**	**2**	**2**	**1**	**1**	**2**	**1**		**1**	**1**		**2**	**2**	**1**	**1**

B Tech CSE

Programme Specific Outcomes:

PSO 1:Able to identify suitable data structures and algorithms to design, develop and evaluate effective solutions for real-life and research problems.

PSO 2:Able to excel in various programming/project competitions and technological challenges laid by professional societies.

CO-PO and CO-PSO Mapping: (B Tech CSE)

COs	PSO1	PSO2
C402-13.1	1	
C402-13.2	1	1
C402-13.3	1	1
C402-13.4	1	1
Avg.	**1**	**1**

B Tech IT

Programme Specific Outcomes:

PSO 1:Able to acquire practical competency with emerging technologies, programming languages and open source platforms.

PSO 2:Able to assess hardware and software aspects necessary to develop IT based solutions.

CO-PO and CO-PSO Mapping: (B Tech IT)

COs	PSO1	PSO2
C402-13.1		
C402-13.2	1	
C402-13.3	2	

C402-13.4	2	
Avg.	**2**	

B Tech (ECE)

Programme Specific Outcomes:

PSO 1: To identify the engineering problems and develop solutions in the area of communication, signal processing, VLSI and embedded systems.

PSO2: To demonstrate proficiency in utilisation of software and hardware tools along with analytical skills to arrive at appropriate solutions.

CO-PO and CO-PSO Mapping: (B Tech ECE)

COs	PSO1	PSO2
C402-13.1		
C402-13.2		1
C402-13.3		1
C402-13.4		1
Avg.		**1**

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18B12CS412	Semester: (specify Odd/Even)	**Semester** Even **Session** 2019-2020 **Month from** Jan'20 **to** June'20
Course Name	**Autonomous Decision Making (NBA Code:** C434)		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. Shikha Jain
	Teacher(s) (Alphabetically)	Dr. Shikha Jain

COURSE OUTCOMES		COGNITIVE LEVEL
C434-4.1	Comprehend and represent the type of agents and environment	Understanding (Level 2)
C434-4.2	Apply various search techniques in partially-observable and dynamic environment and optimizing path.	Applying (Level 3)
C434-4.3	Develop exact and approximate reasoning models for uncertain input and uncertain environment.	Applying (Level 3)
C434-4.4	Construct temporal, utility-based, temporal-utility-based and multi-agents based models for reasoning in uncertain environment.	Applying (Level 3)
C434-4.5	Examine and analyse the application of various techniques in different scenario of uncertain environment.	Analyzing (Level 4)
C434-4.6	Evaluate and compare the performance of different techniques on the basis of complexity.	Evaluating (Level 5)

Module No.	Title of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Formulating problem solving as state-space search, Analysis of uninformed search (BFS and DFS)	2
2.	Exploring Roadmaps and Paths	Exploring Roadmaps: configuration space, combinatorial Planning (visibility graph, voronoi diagram, exact cell, approximate cell, fixed cell), Sampling based planning (probabilistic roadmap, rapidly exploring random tree); Exploring paths: informed search	6
3.	Search in Dynamic Environments	Agent centered search (Learning Real-Time A*, Real-Time Adaptive A*), Anytime search (repeated weighted A*, Anytime Repairing A*), Incremental Search (Lifelong Planning A*), Anytime and incremental search (Anytime D*), Path optimization	7
4.	Reasoning in an Uncertain World	Bayes rule, Bayesian Network, Markov Blanket, Utility Theory	2

5.	Probabilistic Reasoning	Probabilistic Reasoning using uncertain evidence, unreliable evidence; Exact inference in uncertain environment using BN by enumeration and variable elimination; Approximate Inference in uncertain environment using BN by direct sampling, rejection sampling, Likelihood weighting and Markov Chain Monte Carlo algorithm	7
6.	Simple decision making	Simple decision making considering belief and desire in uncertain environment, utility based agent, decision network.	2
7.	Inference in temporal Model	Markov Model; Reasoning over time using Hidden Markov Model (HMM); Exact and approximate inferencing using Dynamic Bayesian network;	5
8.	Complex decision making	Complex decision making for a temporal utility based agent in uncertain environment using MDP and POMDP	5
9.	Multi-agent and Reinforcement Learning	Decision making multi-agent environment in game theory, Nash equilibrium; Reinforcement Learning	4
10.	Handling uncertain input	Handling uncertain input using fuzzy systems.	2
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance = 07, Class Test, Quizzes, etc = 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, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Book:

1.	Russell, Stuart J., and Peter Norvig. Artificial intelligence: a modern approach. Malaysia; Pearson Education Limited, 2016

Reference Book

1.	Barber, David. Bayesian reasoning and machine learning. Cambridge University Press, 2012.
2.	Durrett, Rick. Probability: theory and examples. Vol. 49. Cambridge university press, 2019.
3.	Mykel J. Kochenderfer. Decision Making Under Uncertainty: Theory and Application, MIT Press, 2015

Detailed Syllabus
Lecture-wise Breakup

Course Code	**18B12CS415**	**Semester** EVEN **(specify Odd/Even)**	**Semester VIII Session** 2018 -2019 **Month from January** 2019 – June 2019
Course Name	**Search-Based Software Engineering (SBSE)**		
Credits	3-1-0	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Amarjeet Prajapati
	Teacher(s) (Alphabetically)	…

S.N.	DESCRIPTION	COGNITIVE LEVEL (BLOOM TAXONOMY)
C434-2.1	Explain the concepts of search-based software engineering and various types of optimization problems in the context of different software engineering problems.	Remember Level (Level 1)
C434-2.2	Identify and define/formulate various software engineering activities/tasks as search-based optimization problem.	Understand Level (Level 2)
C434-2.3	Design and develop methods for encoding the software engineering problems for finding optimal solutions from larger search space using search-based techniques	Create Level (Level 6)
C434-2.4	Implement and apply different optimization techniques on various forms of software optimization problems using different SBSE Tools	Apply Level (Level 3)
C434-2.5	Analyze the behavior of different optimization techniques corresponding to different forms of software optimization problems.	Analyze Level (Level 4)
C434-2.6	Evaluate the performance of different single and multi-objective optimization techniques using different quality indicators	Evaluate Level (Level 5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures

			for the module
1.	Introduction	Search-based Software Engineering (SBSE), why SBSE, architecture of SBSE, commonly used search techniques, Optimization Problems, Metaheuristic Algorithms, software engineering problem as a search-based optimization problem	4
2.	Optimization	Various types of optimization problems (e.g., linear and non-linear, convex and non-convex, single and multi-objective, etc.) in the context of software engineering	3
3	Problem Formulation	Define and formulate various software engineering activities/tasks e.g., requirement analysis, software design and software restructuring as search-based optimization problem	6
4.	Meta-heuristics	Tailoring various optimization methods and algorithms used in search-based software engineering., according to their suitability with respect to various classes of software engineering problems	6
5.	Application to software engineering problem	Apply and Implement different optimization techniques on various forms of software optimization problems e.g., Requirement analysis, software design software architecture recovery, software refactoring, and software remodularization	6
6.	Statistical Analysis	Statistical hypothesis testing, parametric and nonparametric statistical tests for the analysis of the search-based software engineering solutions	6
7.	Evaluation	Evaluate the performance of different single and multi and many-objective search-based optimization techniques using different quality indicators such as Generational Distance (GD), Inverted Generational Distance (IGD), hyper-volume (HV), Error Ratio, Set Coverage Metric, Spacing and Spread	7
8.	SBSE Tools	Tools for SBSE include OpenPAT, JMetal, EvoSuite and Coverage a code coverage measurement tool for Python, etc.	4
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [Attendance = 07 , Class Test, Quizzes, etc = 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, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
	Reference Book
1.	Nature-Inspired Optimization Algorithms, by Xin-She Yang Publisher: Elsevier *Release Date: February 2014,* ISBN: 9780124167438
2.	Search-based software engineering, by Myra B. Cohen Publisher:Springer-verang Berlin and Heidelberg, 2015
3.	Search and Optimization by Metaheuristics: Techniques and Algorithms Inspired by Nature, by Ke-Lin Du and M. N. S. Swamy, July 2016, Springer International Publishing G Switgerland
	Text Book
4.	Object-Oriented Modeling and Design with UML (2nd Edition) Michael R. Blaha; James R Rumbaugh, 2005, Pearson publication
5.	Head First Object-Oriented Analysis and Design A Brain Friendly Guide to OOA&D, By Brett McLaughlin, Gary Pollice, David West, *Publisher*: O'Reilly Media; 1 edition (November 27, 2006)
6.	OBJECT-ORIENTED ANALYSIS AND DESIGN With applications Third EDITION Grady Booch Rational Santa Clara, California

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18B12CS419	**Semester (Even)**	**Semester** Even **Session** 2019 - 20 **Month from** January **to** May
Subject Name	Distributed Computing		
Credits	**3+1**	**Contact Hours**	**3 Lectures +1 Tutorial**

Faculty (Names)	**Coordinator(s)**	Dr. Parmeet Kaur
	Teacher(s) (Alphabetically)	1. Dr. Parmeet Kaur 2. Dr. Prakash Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-2.1	Identify and solve event ordering related problems occurring due to various synchronization related issues in distributed systems (e.g., using Lamport, Vector, Matrix clock implementations).	Identify, Solve Level 3
C433-2.2	Compare and explain the solutions for mutual exclusion and deadlock related issues for various application specific scenarios that may occur in distributed environments (e.g., using token and non-token based techniques). [Level 2]	Compare Level 2
C433-2.3	Examine and distinguish data consistency and replication related issues for various distributed scenarios.	Examine and Distinguish Level 4
C433-2.4	Evaluate and assess fault tolerance related issues for perceiving reliable systems in distributed environments.	Evaluate Level 5
C433-2.5	Show how the concepts of distributed computing have been applied in existing distributed database systems, distributed file systems and cloud based systems.	Show Level 1

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Review of principles, concepts foundation to Distributed Systems.	Review of Operating Systems principles, Introduction to Distributed Systems.	2
2.	Consistency and Replication Issues	Data-centric consistencies, Client-centric consistencies. Epidemic Protocols and Implementation Issues, Distributed Hash Tables	8

		and Distributed Lookup Services	
3.	Fault Tolerance and Reliability	Fault Tolerance, Reliability in Distributed Systems, group communications, and Distributed commit. Two Phase commit and Three Phase commit. Failure Recovery.	7
4.	Synchronization mechanisms	Resource models. Clock synchronization, Inherent limitations of distributed operating systems. Event ordering. Timestamps. Global state collection mechanisms. Termination Detection, Bully Algorithm. Ring Algorithm.	6
5.	Mutual Exclusion and Deadlock handling	Process deadlocks in DS. Distributed mutual exclusion. Token and non-token based algorithms. Comparative performance analysis.	9
6.	Agreement Protocols	System Model, Classification, Byzantine Problems and solutions.	3
7.	Distributed Computing Vs Cloud Computing.	Introduction, Challenges, Cloud Computing architectures, Virtualization in Cloud Computing, Building applications and Infrastructures in the cloud, Security Issues.	2
8.	Self Stabilizing Systems	System model, Self-Stabilization design issues and methodologies, Theoretical Foundations, Stabilizing DMEs, Stabilizing protocols, and Stabilizing Synchronization, Limitations etc.	3
9.	Case Studies	Distributed File Systems and Distributed Databases	2
			42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance = 07,Class Test, Quizzes, etc = 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, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Text Books

1 Sukumar Ghosh,. *Distributed systems: an algorithmic approach*. Chapman and Hall/CRC, 2014.

2. M. van Steen and A.S. Tanenbaum, Distributed Systems, 3rd ed., distributed-systems.net, 2017.

Reference Books

1. Ajay Kshemkalyani and Mukesh Singhal. *Distributed computing: principles, algorithms, and systems*. Cambridge University Press, 2011.

2 M. Singhal, N. G. Shivaratri, Advanced Concepts in Operating Systems, 1st Ed., Tata

McGraw-Hill, 1994.

3. "Introduction to Cloud Computing Architecture" Sun's White Paper, 1st Edition, June, 2009.

4. IEEE, ACM Transactions, Journals and Conference papers on "Distributed and Cloud Computing."

5. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'REILLY publication.

6. "Virtualization Overview", White paper, VM Ware.

7. "Implementing Virtualization" White paper, Intel virtualization Technology

8. Tulloch, Mitch, Understanding Microsoft virtualization solutions: From the Desktop to Data Center, Microsoft Press.