

Detailed Syllabus

Course Code	15B1NHS832	Semester: Even	Semester: VIII Session: 2020 -2021 Month from Jan 2021 to June 2021
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	Understand level (C2)
C402-8.2	Compare the changes in India's foreign policy in the Cold War era and the post Cold War era	Apply level (C3)
C402-8.3	Analyze the major political developments and events since the 20 th century	Analyze level (C4)
C402-8.4	Demonstrate an understanding of the rise of new power centers in the changing world order	Understand level (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Basic Concepts	Balance of power and Collective security National Interest and its instruments	4
2.	An Overview of Twentieth Century International Relations History	World War I: Causes and Consequences Significance of the Bolshevik Revolution Rise of Fascism / Nazism World War II: Causes and Consequences	8
3.	Cold War Politics	Origin of the Cold War Evolution of the Cold War Collapse of the Soviet Union Causes of the End of the Cold War	8
4.	India's foreign policy during the Cold War era	Basic Determinants (Historical, Geo-Political, Economic, Domestic and Strategic) India's Policy of Non-alignment	6
5.	India's foreign policy in the Post-Cold War era	India and SAARC India and the Look East policy Impediments to regional co-operation: river water disputes; illegal cross-border migration; ethnic conflicts and insurgencies; border disputes	8
6.	Emergence of Other Power Centres	European Union Rise of Asia Powers- Russia, China and Japan	8
Total number of Lectures			42

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

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	A. Chatterjee, <i>International Relations Today</i> . Noida, India: Pearson, 2019
2.	Appadorai, & M.S.Rajan, <i>India's Foreign Policy and Relations</i> . New Delhi, India: South Asian Publisher, 1985
3.	E.H. Carr, <i>International Relations between the Two World Wars: 1919-1939</i> . New York, USA: Palgrave, 2009
4.	J. Baylis & S. Smith, Ed. <i>The Globalization of World Politics: An Introduction to International Relations</i> . Oxford, UK: Oxford University Press, 2011
5.	P. Calvocoressi, <i>World Politics: 1945—2000</i> . Essex, UK: Pearson, 2009

Detailed Syllabus

Course Code	15B29CI891	Semester: Even	Semester: VIII Session: 2020 -2021 Month from Jan 2021 to June 2021
Course Name	Project Part – II		
Credits	12	Contact Hours	...

Faculty (Names)	Coordinator(s)	Dr. Raju Pal, 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 solution 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)

Evaluation Criteria	
Components	Maximum Marks
Mid Semester Viva	20
Final Viva	30
Project Report	20
Day to Day Work	30
Total	100

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS832	Semester: Even	Semester: VIII Session: 2020-2021 Month from Jan 2021 to June 2021
Subject Name	Service Management Marketing		
Credits	3	Contact Hours	3-0-0

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

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

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	3
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	Developing and positioning a service in the market Applying the 4 Ps of Marketing to services Value addition to the service product Planning and branding service products Crafting the service environment New service development.	8

7	Culture and Service	People 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

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Viva and Oral Quiz)
Total	100

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

1.	Valarie A. Zeithaml & Mary Jo-Bitner: Services Marketing-Integrating Customer Focus Across 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 Services-Text and Cases, McGraw-Hill International, 2002
5	Roland T. Rust and P.K. Kannan, e-Service New Directions in Theory and Practice, Prentice-Hall of India Pvt. Ltd., 2002

Detailed Syllabus
Lecture-wise Breakup

Course Code	16BINMA831	Semester: Even	Semester: VIII Session: 2020-2021 Month from Jan 2021 to June 2021
Course Name	Optimization Techniques		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Prof. Amrish K. Aggarwal	
	Teacher(s) (Alphabetically)	Prof. Amrish K. Aggarwal	
COURSE OUTCOMES			COGNITIVE LEVELS
C402-2.1	apply generalized, revised and dual simplex method for linear programming problems (LPP).		Apply Level (C3)
C402-2.2	apply graphical, algebraic and linear programming techniques for pure and mixed strategy problems in game theory.		Apply Level (C3)
C402-2.3	classify and solve the problems on queuing and inventory models.		Analyze Level (C4)
C402-2.4	solve and analyze the network scheduling and sequencing problems.		Analyze Level (C4)
C402-2.5	make use of dynamic programming technique to solve complex linear programming problems.		Apply Level (C3)
C402-2.6	determine numerical solution of nonlinear multidimensional problems.		Evaluate 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 $2 \times n$, $3 \times n$, $m \times 2$, $m \times 3$ and $m \times n$ 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, 8th edition, PHI, 2011.		
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: 2020-21 Month from Jan 2021 to June 2021
Subject Name	High Performance Web and Mobile Applications		
Credits	4	Contact Hours	3-0-1

Faculty (Names)	Coordinator(s)	Prashant Kaushik
	Teacher(s) (Alphabetically)	Prashant Kaushik

COURSE OUTCOMES		COGNITIVE LEVEL
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 architectures	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 performances.	6
7.	Deploying containers	Deployment issues and its details	6
Total number of Lectures			44

Evaluation Schème	Test 1	20
	Test 2	20
	Test 3	35
	Project	15
	Surprise Lecture Test	5
	Attendance	5
	Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Hands-On Mqtt Programming with Python By <u>Gaston C Hillar</u>
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

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NHS732	Semester: Even	Semester: VIII Session: 2020 -2021 Month from Jan 2021 to June 2021
Course Name	Indian Financial System		
Credits	3	Contact Hours	3-0-0

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

Course Outcomes		Cognitive Level
C402-31.1	Understand the inter-linkage of components of financial system and financial instruments of Money market and Capital market.	Understand Level (Level 2)
C402-31.2	Analyze ways of fund raising in domestic and international markets	Analyse Level (Level 4)
C402-31.3	Understand functioning of Stock market and evaluate securities for investment.	Evaluate Level (Level 5)
C402-31.4	Apply the knowledge of Mutual Funds and Insurance in personal investment decisions	Apply Level (Level 3)
C402-31.5	Apply knowledge of Income tax for calculation of tax liability of individual.	Apply Level (Level 3)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Meaning, Importance, and functions of Financial system. Informal and Formal financial system, Financial markets, Financial Institutions, Financial services and Financial instrument	3
2.	Money Market	Features of money market Instruments: Treasury bills, commercial bills, commercial papers, certificates of deposit, call and notice money, Functions of money market, Linking of money market with Monetary policy in India	3
3.	Capital Market	Features of Capital market instrument: Equity shares, Bonds. Fund raising through Initial Public Offering, Rights issue, Preferential allotment and Private Placement. Process of IPO-Intermediaries in IPO, Book building process and allotment of shares	3
4.	Foreign investments in India	Fund raising from foreign market through: Foreign direct investment and foreign institutional investment, ADR, GDR, ECB, and Private equity.	3

5.	Stock Market	Trading in secondary market- Stock exchanges, regulations, demutualisation, broker, listing of securities, dematerialisation, trading, short selling, circuit breaker, stock market indices- methods of calculation of indices.	3
6.	Stock Valuation and Analysis	Investing basics: Consideration of Risk and Return, Stock Valuation and Analysis- Fundamental analysis: Economy, industry and company analysis; Technical Analysis of stocks using technical charts	7
7.	Investing in Mutual Funds and Insurance	Mutual Funds: Basics, Types of funds, risk and return considerations in selection of funds; Insurance: Basics, Life insurance and health insurance, types of policies	6
8.	Overview of Income Tax	Basics of Income tax- Concept of previous year, assessment year, person, income. Calculation of Income tax liability for individuals: Income from salaries- basic, DA, HRA, leave salary, Gratuity, Pension, Allowances and Perquisites; Income from Capital Gain, Deductions under section 80C to 80U.	14
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Project, Class participation and Attendance)	
Total		100	

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

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

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B2NCI743	Semester: Even	Semester: VIII Session: 2020 -2021 Month from Jan 2021 to June 2021
Course Name	Cryptography and Network Security		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Sangeeta Mittal, Himanshu Agrawal
	Teacher(s) (Alphabetically)	Himanshu Agrawal, Sangeeta Mittal, SulabhTyagi

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	Understand the role of prime number theory and quadratic congruence in cryptography	Understand (Level 2)
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 exponentiation	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 and Certificates	Elgamal Signatures, Digital Signature Standards, X.509 Certificates, Kerberos	4
Total number of Lectures			42
Evaluation Criteria			

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (5 Tutorial/Assignment+ 10 Attendance+10 Project)
Total	100

Project Based Learning: Mini Project is an important part of teacher's assessment component. Students will make applications that will make use of main cryptographic libraries available in various languages like Java and Python. Through project, they will also implement digital signatures to demonstrate secure and dependable communication in mobile apps and websites. Newer forms of encryption like homomorphic, searchable and adversarial neural cryptography that are more suited to applications in current scenario can also be worked upon.

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 7 th Edition, Prentice Hall 2018
2.	B A Forouzan and DebdeepMukhopadhyay, Cryptography and Network Security, 3 rd Edition, Mc Graw Hill, 2015
3.	D Stinson, Cryptography: Theory and Practice, 4 th Edition , CRC Press, 2019,
4.	Network security essentials: applications and standards by William Stallings.,5/e, Prentice Hall,2013
5.	ACM Transactions on Information and system security
6.	IEEE Press Computer Security and Privacy

Detailed Syllabus
Lecture-wise Breakup

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

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

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

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Overview of machine learning methods and scope in bioinformatics	Fundamentals of machine learning, algorithms, introduction to biological problem and mapping, gene and genome, Structure, function and organization, biological database, Scope of machine learning in bioinformatics (Genomics, proteomics, transcriptomics etc.)	7
2.	Pattern identification	Pattern and motif, domain, profile in Bioinformatics, Search algorithms, String search, Boyer moore, Robin Karp algorithm KMP algorithm, Dynamics programming and greedy approach etc. case studies	4
3.	Data classification: Clustering and tree algorithm	Gene finding tools, Discrimination analysis ; LDA, Clustering methods: Hierarchical , K mean, Normalization, similarity measure (distances), Basics of tree, suffix tree and its applications in Bioinformatics , validations, statistical inferences and biological interpretation (Gene ontology and microarray data)	8
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, Quiz, Case study, Project based evaluation)	
Total		100	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Papers, Reports, Websites etc. in the IEEE format)	
1.	Pierre Baldi and Søren Brunak “Bioinformatics The Machine Learning Approach” , February 1998, 371 pp., 62 illus.,
2.	Thomas H. Cormen “Introduction to Algorithms” , 2nd edition McGraw-Hill Science,2001, 1056 pages.
3	Yang, Zheng Rong, “ Machine :Learning Approaches to Bioinformatics”, New Delhi world Scientific, Pp 336, 2017
4	Research papers and manuals

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12CS415	Semester: Even	Semester: VIII Session: 2020 -2021 Month from Jan 2021 to June 2021
Course Name	Search-Based Software Engineering		
Credits	4	Contact Hours	3-1-0

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

COURSE OUTCOMES		COGNITIVE LEVEL
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	6

		remodularization	
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 (10) + Assignment/Quiz/Mini-project (15)
Total	100

Project based learning: Each student in a group of 3-4 have to work on a mini-project, in which they will identify a real-life problem and develop the solution by applying their knowledge of search-based software engineering approach. The project implementation can be in any programming language preferably along with well documentation on different aspects of the software. This enhances the understanding of students towards different concepts of search-based software engineering approach and also help them during their employability.

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	Nature-Inspired Optimization Algorithms, by Xin-She Yang Publisher: Elsevier <i>Release Date: February 2014</i> , ISBN: 9780124167438
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Reference Books

2	Practical Optimization, Book by Philip E. Gill
3	Practical Methods of Optimization, Book by R. Fletcher
4	Object-Oriented Modeling and Design with UML (2nd Edition) Michael R. Blaha; James R Rumbaugh
5	Head First Object-Oriented Analysis and Design A Brain Friendly Guide to OOA&D By Brett McLaughlin, Gary Pollice, David West
6	OBJECT-ORIENTED ANALYSIS AND DESIGN With applications Third EDITION Grady Booch Rational Santa Clara, California

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12CS419	Semester: Even	Semester: VIII Session: 2020-2021 Month from Jan 2021 to June 2021
Subject Name	Distributed Computing		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr Parmeet Kaur, Dr Rashmi Kushwaha
	Teacher(s) (Alphabetically)	Dr Parmeet Kaur, Dr Rashmi Kushwaha

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).	Apply 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]	Understand Level 2
C433-2.3	Examine and distinguish data consistency and replication related issues for various distributed scenarios.	Analyze 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.	Remember 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 and Distributed Lookup Services	8
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	6

		Algorithm. Ring Algorithm.	
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 = 10, Assignment/ Quizzes/Mini-Project = 15)
Total	100

Recommended Reading material:

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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12CS428	Semester: Even	Semester: VIII Session: 2020-21 Month from Jan 2021 to June 2021
Course Name	Introduction to Deep Learning		
Credits	4	Contact Hours	3-1-0

Faculty (Names)	Coordinator(s)	Dr. Satish Chandra
	Teacher(s) (Alphabetically)	Dr. Satish Chandra

COURSE OUTCOMES		COGNITIVE LEVELS
C434-3.1	Identify and express the motivation behind and need of Deep Learning.	Understand level (Level-2)
C434-3.2	Comprehend the basic theory of learning, probability in learning, error minimization and regularization techniques.	Understand level (Level-2)
C434-3.3	Design and Model Convolution Neural Networks for Image recognition and Computer Vision.	Apply level (Level-3)
C434-3.4	Apply Recurrent Neural Networks and LSTM for temporal data	Apply level (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 (Level-5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	What is deep learning? DL successes; DL versus Shallow Networks	02
2.	Math review	Gradient descent, logistic regression. Probability, continuous and discrete distributions; maximum likelihood. MSE cost	03
3.	Neural networks	Cost functions, hypotheses and tasks; training data; maximum likelihood based cost, cross entropy;; feed-forward networks; MLP, sigmoid units.	03
4.	Learning in neural networks	Output vs hidden layers; linear vs nonlinear networks;	03
5.	Backpropagation learning	Gradient descent; recursive chain rule, bias-variance tradeoff, Regularization; output units: linear, softmax; hidden units: tanh	06
6.	Convolutional neural networks	Convolutional neural networks, different CNN-based models and their architectures	06
7.	Deep learning strategies	GPU training, regularization, RELU, dropouts etc.	06
8.	Recurrent neural networks	Recurrent neural networks, different RNN models and applications	07
9.	Unsupervised deep learning	Unsupervised deep learning models, different types of autoencoders	06
Total number of Lectures			42

Evaluation Criteria	
Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 Attendance (10) + Assignment/Quiz/Mini-project (15)
Total	100

Project based learning: Each student in a group of 3-4 have to work on a mini-project, in which they will design and implement different deep learning models for problems computer vision, speech, computer aided diagnosis, financial decision making etc. The results will be compared with the state of art models and reported. To increase the employability, real datasets will be used in the projects from various online repositories.

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.	Ian Goodfellow, YoshuaBengio, Aaron Courville , “Deep Learning”, MIT Press book.
2.	Francois Chollet, “Deep Learning with Python ”, Manning.
3.	Adam Gibson and Josh Patterson, “Deep Learning: A Practitioners Approach”,O’ Reilly.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH811	Semester: Even	Semester: VIII Session: 2020 -2021 Month from Jan 2021 to June 2021
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

Project based learning: Each student in a group of 4-5 students will opt a topic and will do the theoretical study in detail. The students will submit their report. To make the subject application based, the students analyze the optical fiber applications, holography applications and use of photons in memory devices. This shall improve the skills and employability of the students in laser and photonic industries.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	R. P. Khare, <i>Fiber Optics and Optoelectronics</i> , Oxford University Press.
2.	A. K. Ghatak and K. Thyagarajan, <i>Optical Electronics</i> , Cambridge university Press.
3.	A. K. Ghatak and K. Thyagarajan, <i>An Introduction to Fiber Optics</i> , Cambridge university Press.
4.	B. B. Laud, <i>Lasers and Nonlinear Optics</i> , New Age International.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH812	Semester: Even	Semester: VIII Session: 2020 -2021 Month from Jan 2021 to June 2021
Course Name	Astrophysics		
Credits	3	Contact Hours	3

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

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

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1	Introduction to Astrophysics	Historical development of astrophysics (from mythology to contemporary astrophysics), Mass, length and time scales in astrophysics, sources of astronomical information (effect of discovery of spectroscopes and photography), astronomy in different bands of electromagnetic radiation (e.g. Optical astronomy, infra-red astronomy radio astronomy, X-ray astronomy. Gamma-ray astronomy etc. with specific mention of Hubble space telescope). Kirchoff's law, Doppler effect and Hubble's law.	8
2.	Stellar Astrophysics	Classification and nomenclature of stars. Basic equations of stellar structure, main sequence, red giants and white dwarfs, HR diagram, stellar evolution, supernovae, extra solar planets.	8
3.	Death of a star	End states of stellar collapse: degeneracy pressure of a Fermi gas, structure of white dwarfs, Chandrasekhar mass limit, neutron stars pulsars and black holes.	6
4.	Our galaxy	The shape and size of Milky way and its interstellar mater	2
5.	Extragalactic astrophysics	Normal galaxies, active galaxies, cluster of galaxies, large-scale distribution of galaxies.	6
6.	GTR and Models of Universe	Qualitative idea of general theory of relativity (without using tensor calculus) and its implications. Different models of universe. Specific attention to the ideas related to big bang, cosmological constants, dark matter and dark energy.	6

7.	Astrobiology	Drake equation and related questions.	2
8.	Conclusion	Review of the present status of Astrophysics and open questions.	2
Total number of Lectures			40

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quizes (10 M), Attendance (10 M) and Class performance (5 M)]
Total	100

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

1.	Astrophysics for Physicists, Arnab Rai Choudhuri, Cambridge University Press, Delhi, 2010.
2.	Astrophysics: Stars and Galaxies, K D Abhyankar, University Press, Hyderabad, 2009.
3.	Facts and Speculations in Cosmology, J V Narlikar and G Burbidge, Cambridge University Press, Delhi, 2009.
4.	The Cosmic Century, Malcolm Longair, Cambridge University Press, Cambridge, 2006.
5.	An Introduction to Astrophysics, Baidyanath Basu, Prentice Hall of India, Delhi 1997.
6.	Fundamentals of Equations of State, S. Eliezer, A Ghatak and Heinrich Hora, World Scientific, Singapore, 2002. Only Chapter 15.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH814	Semester: Even	Semester: VIII Session: 2020 -2021 Month from Jan 2021 to June 2021
Course Name	Plasma Physics		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Anuraj Panwar
	Teacher(s)	Dr. Anuraj Panwar

COURSE OUTCOMES		COGNITIVE LEVELS
C402-34.1	Define terminology and concepts of plasma physics with various natural phenomena and engineering applications.	Remember Level (C1)
C402-34.2	Summarize plasma and explain its electric, magnetic, dielectric and thermal properties.	Understand Level (C2)
C402-34.3	Develop magneto-hydrodynamic fluid and kinetic models to explain various phenomena taking place in homogeneous, isotropic and anisotropic plasma conditions.	Apply Level (C3)
C402-34.4	Analyze and formulate mathematical / analytical expressions for various nonlinear processes in plasmas.	Analyze Level (C4)
C402-34.5	Evaluate physical problems, estimate their numerical solutions and draw inferences from the results.	Evaluate Level (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to the Plasma State	Elementary concepts, definition of temperature Debye Shielding, plasma parameters, applications of Plasma Physics, Production of Plasmas in the laboratory, Drifts of charged particles under the effect of different combinations of electric and magnetic fields and Mirror Machine.	10
2.	Fluid description of plasmas	Relations of Plasma Physics to ordinary electromagnetics, dielectric constant of a plasma, collisions, equation of continuity, macroscopic parameters of plasma, two and one fluid equations for plasma.	04
3.	Nonlinear Waves in Plasmas	Plasma oscillations, space charge waves of warm plasma, ion-acoustic waves and electromagnetic waves in magnetized plasma.	08
4.	Diffusion and Resistivity	Decay of Plasma by diffusion, diffusion across a magnetic field, single fluid MHD equations, Diffusion in fully ionized Plasmas, Bohm diffusion and Neoclassical diffusion.	06
5.	Stability of fluid plasma	The equilibrium of plasma, classification of plasma instabilities, stability analysis: Two stream instability and Gravitational instability or Rayleigh Taylor instability (Plasma supported against gravity by magnetic field).	04
6.	Nonlinear effects	Ponderomotive force, Parametric instabilities, decay instability, two plasmon decay, stimulated Raman scattering and stimulated Brillouin scattering, non linear Landau damping.	06

7.	Controlled thermo-nuclear fusion	Magnetic and inertial confinement schemes, ITER, TOKAMAK.	02
Total number of Lectures			40
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Quiz + Attendance + Class performance)	
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.	F. F. Chen., <i>Introduction to Plasma Physics</i> , Springer (2016).
2.	Krall and Trievelpiece, <i>Principles of Plasma Physics</i> , McGraw-Hill (1973).
3.	W. L. Kruer, <i>The Physics of laser plasma interactions</i> , Addison Wesley (1988).
4.	Liu and Tripathi, <i>Interaction of electromagnetic waves with electron beams and plasmas</i> , World Scientific (1994).

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12CS412	Semester: Even	Semester: VIII Session: 2020-21 Month from Jan 2021 to June 2021
Course Name	Advanced Java Programming		
Credits	3	Contact Hours	4

Faculty (Names)	Coordinator(s)	Prantik Biswas(62), Dr. Raju Pal(128)
	Teacher(s)	Prantik Biswas, Dr. Raju Pal

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 Executors, 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: request and response, Web Application: attributes and listeners, Session management	9
5.	Java Server Pages	Introduction to JSP, Scriptless JSP, Custom tags library – JSTL, Custom tag development, Web app deployment,	8

		Web app security, Wrappers and Filters, Examples	
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)

1	Schildt, Herbert. Java: <i>The Complete Reference, Ninth Edition</i> . US: McGraw-Hill Osborne Media, 2017.
2	Goetz, B., Peierls, T., Lea, D., Bloch, J., Bowbeer, J., & Holmes, D. <i>Java concurrency in practice</i> . Pearson Education. 2017.
3	Basham, Bryan, Kathy Sierra, and Bert Bates. <i>Head First Servlets and JSP</i> . " O'Reilly Media, Inc.", 2016 re-print.
4	<i>Core and Advanced Java, Black Book, Ninth Edition</i> . Dreamtech press, 2018.