Detailed Syllabus
Lecture-wise Breakup

Course Code	15B1NHS832	**Semester:** Even	**Semester:** VIII **Session:** 2021-2022 **Month from** Feb to Jun
Course Name	International Studies		
Credits	3	**Contact Hours**	3-0-0

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

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 20th century	Analyze level (C4)
C402-8.4	Demonstrate an understanding of the rise of new power centres 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**

Project Based Learning: Each student would form a group of 3-4 and submit projects on India's foreign policy and rise of new power centres. This project would help the students' research about the India's relations- economic, political and diplomatic and also consider a variety of perspectives and interpretations of current world events.

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

1.	A. Chatterjee, *International Relations Today*. Noida, India: Pearson, 2019
2.	Appadorai, &M.S.Rajan, *India's Foreign Policy and Relations*. New Delhi, India: South Asian Publisher, 1985
3.	E.H. Carr,*International Relations between the Two World Wars: 1919-1939*. New York, USA: Palgrave, 2009
4.	J. Baylis &S. Smith, Ed. *The Globalization of World Politics: An Introduction to International Relations*. Oxford, UK: Oxford University Press, 2011
5.	P. Calvocoressi, *World Politics: 1945—2000*. Essex, UK: Pearson,2009
6.	P.Zelikow, *The Road less travelled: The secret battle to end the great war,1916-17*. New York, USA: Public Affairs, 2021
7.	R,Cooper, *The Ambassadors: thinking about diplomacy from Machiavelli to modern times*. London,UK: Weidenfeld & Nicolson, 2021

Detailed Syllabus

Course Code	15B29CI891	**Semester:** Even	**Semester:** VIII **Session:** 2021-2022 **Month from** Feb to Jun
Course Name	Major Project Part – 2 (IT)		
Credits	12	**Contact Hours**	…

Faculty (Names)	**Coordinator(s)**	Prashant Kaushik
	Teacher(s) (Alphabetically)	Entire Department
COURSE OUTCOMES		**COGNITIVE LEVELS**
C451.1	Summarize the contemporary literature and explore 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 working model for the identified problem	Apply Level (Level 3)
C451 .4	Inspect the developed solution using exhaustive test cases and evaluate its performance using statistical methods and relevant metrics	Evaluate Level (Level 5)
C451 .5	Report 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.	…	…	…
...	…	…	…
***n*.**	…	…	…

Evaluation Criteria

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

Project based learning: Each student in a group of 2-3 will have to develop a Major Project based on different real-world problems using any open-source programming language. Students have to study the state-of-the-art methods before finalizing the objectives. Project development will enhance the knowledge and employability of the students in IT sector.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NMA831	**Semester:** Even	**Semester:** VIII **Session:** 2021-2022 **Month from** Feb to Jun	
Course Name	Optimization Techniques			
Credits	3		**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Shruti		
	Teacher(s) (Alphabetically)	Dr. Shruti		

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.	8
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.	6
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.	8
4.	Sequencing & Scheduling	Processing of Jobs through Machines, CPM and PERT.	6
5.	Dynamic Programming	Discrete and Continuous Dynamic Programming, Simple Illustrations.	6
6.	Nonlinear Programming	Unimodal function, One Dimensional minimization problem, Newton's Method Golden Section, Fibonacci Search, Bisection, Steepest Descent Method, Multidimensional Newton's method.	8
		Total number of Lectures	**42**

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

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

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

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

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B1NHS732	**Semester: Even**	**Semester:** VIII **Session:** 2021 -2022 **Month from** Feb to Jun
Course Name	Indian Financial System		
Credits	3	**Contact Hours**	3-0-0

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

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 (C2)
C402-31.2	Analyze ways of fund raising in domestic and international markets	Analyze level (C4)
C402-31.3	Understand functioning of Stock market and evaluate securities for investment.	Evaluate level (C5)
C402-31.4	Apply the knowledge of Mutual Funds and Insurance in personal investment decisions	Apply level (C3)
C402-31.5	Apply knowledge of Income tax for calculation of tax liability of individual.	Apply level (C3)

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

	in India	ECB, and Private equity.	
5.	Stock Market	Trading in secondary market- Stock exchanges, regulations, demutualization, broker, listing of securities, dematerialization, 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, *Indian Financial System,* 5th Edition, Pearson Education, 2018
2	Madura Jeff, *Personal Finance*, 6th Ed, Pearson Education, 2017.
3	Machiraju H R, *Indian Financial System*, 4th Ed, Vikas Publication, 2010
4	Bhole L M, *Financial Institutions and Markets*, 4th ed. Tata McGraw Hill Publication, 2006.
5	Singhania & Singhania, Students Guide to Income Tax, Taxmann Publication, 2019.
6	*How to Stimulate the Economy Essay* [Online]Available: https://www.bartleby.com/essay/How-to-Stimulate-the-Economy-FKJP5QGATC
7	Reserve Bank of India, 'Money Kumar & the Monetary Policy', 2007
8	Ashiwini Kumar,Sharma,' De-jargoned: Book building process, Live Mint,2015.

9	Madhavan, N. “Pushing the accelerator instead of brakes: Can Subhiksha make a comeback?”, Business Today, 28th June 2009.
10	Kaul, Vivek, “Master Move: How Dhirubhai Ambani turned the tables on the Kolkata bear cartel”, The Economic Times, July 1, 2011.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS811	**Semester**: EVEN	**Semester**: VIII **Session**: 2021-22 **Month from**: Feb to Jun
Course Name	Industrial Sociology		
Credits	3	**Contact Hours**	(3-0-0)

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-38.1	Understand the scope of industrial sociology and major theories on labour and work	Understand level (C2)
C402-38.2	Analyzing the contemporary issues related to industry in the post-LPG era	Analyze level (C4)
C402-38.3	Evaluating work in its social aspects such as gender, caste, class and unpaid work, as different from its better known economic dimension.	Evaluate level (C5)
C402-38.4	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 level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	● Scope and importance of the study of Industrial Sociology ● Nature and type of industrial society ● Study of industrial relations	3
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**
T1	20 (Project based)
T2	20
End Semester Examination	35
TA	25 (project/movie review/quiz)
Total	**100**

Project Based Learning: Student in a group of 4-5 will submit a project on New initiative in India- (a)make in India/(b)start up India.

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:** VIII **Session: 2021-22** **Month from Feb** to June 2022
Course Name	Quality Issues In Engineering		
Credits	3	**Contact Hours**	3-0-0

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-32.1	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)
C402-32.2	Determine the effectiveness of acceptance sampling using single and double sampling plans and operating characteristic curves	Evaluate Level (C5)
C402-32.3	Determine quality by employing a wide range of basic quality tools, lean concepts and process improvement techniques such quality function deployment	Evaluate Level (C5)
C402-32.4	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 and Evolution of Quality	Introduction, Dimensions of Quality, Fundamentals, History Of TQM, Contemporary Influences	6
2.	Quality Tools and The Improvement Cycle	Various Costs, Juran's Coq Accounting Statement, Voice of Customers: Kano's Model, House of Quality, QFD Process, Seven Tools for Quality Management	9
3.	Benchmarking	Meaning, Process, Methods	3
4.	Quality Gurus	Contribution of Quality Gurus	3
5.	Six Sigma	Six Sigma, Capability of A Process/Product/Service, DMAIC Process	6
6.	Lean Concepts	Kaizen, Poka-Yoke, Andon, Kanban, JIT, 5-S, 7 Mudas	3
7.	Statistical Thinking and Applications	Statistical Process Control, Acceptance Sampling, Specification and Control Limits, Control Charts for Variables, Control Charts for Attributes	6
8.	Quality Awards and Certifications	MBNQA, RGNQA, Deming Prize, ISO Standards	3
9.	Quality Strategy for	India's Quality Journey, Quality Management in India	3

	Indian Industry		
		Total Number of Lectures	**42**

Project-based Learning: Students are required to visit any business organization to observe the brief about the organization; its products; its suppliers; its operations; its processes, Quality control system and techniques followed by the company, Quality standards met by the company, application of quality tools or lean manufacturing system, Sigma capability of products or processes, DMAIC methodology, application and relevance of the quality concepts studied in the course. Collecting information on quality systems, quality standards, quality certifications or awards received, and sigma capability will upgrade students' knowledge and strengthen their skills to tackle multiple quality engineering issues along with employability

Evaluation Criteria

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

Recommended Reading material:

1.	Besterfield D. H., Besterfield-Michna C., Besterfield G. H., Besterfield-Sacre M. *Total quality management*, Prentice Hall, 1999.
2.	Evans, J. R., Dean J. W. *Total quality management, organization and strategy*, Thomson, 2003. 399 p.
3.	Kanji G. K., Asher M. *100 Methods for Total Quality Management*. London: SAGE Publications, 1996.
4.	Oakland G. F. *Total Quality Management*, Oxford, 1995.
5.	Goetsch D. L., Davis S. B. *Quality management. Introduction to TQM for production, processing and services*. New Jersey: Prentice Hall, 2003.
6.	John S. Oakland. *Total Quality Management and Operational Excellence*: Text with cases, Fourth edition, 2014
7.	Dale H. Besterfield. *Total Quality Management*, (Revised Edition). India: Pearson, 2011.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH811	**Semester: Even**	**Semester:** VIII **Session:** 2021 -2022 **Month from** Feb to Jun
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**
C402-33.1	Recall the fundamental properties of light and the processes involved in the generation of light	Remember Level (C1)
C402-33.2	Interpret the theory of fiber optics	Understand Level (C2)
C402-33.3	Apply the fundamentals of various nonlinear optical effects in technology; make use of holography and its applications	Apply Level (C3)
C402-33.4	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 [Attendance (07 M), Class Test, Quizzes, etc (07 M), Assignments in PBL mode (06 M) and Internal assessment (05 M)]
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, *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	22B12CS413	**Semester:** Even	**Semester:** VIII **Session:** 2021-2022 **Month from** Feb to Jun
Course Name	Data Analytics using R and Python		
Credits	3	**Contact Hours**	3-0-0
NBA Code	C433-9		

Faculty (Names)	**Coordinator(s)**	Dr. Megha Rathi (J62) & Dr. Raju Pal(J128)
	Teacher(s) (Alphabetically)	Dr. Megha Rathi (J62) & Dr. Raju Pal(J128)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-9.1	Explain the fundamental concepts of data analytics.	Understand Level (C2)
C433-9.2	Demonstrate the concepts of R & Python for data analytics.	Apply Level (C3)
C433-9.3	Apply advanced methods and their quantitative analysis for real-world problems.	Apply Level (C3)
C433-9.4	Apply statistical methods for hypotheses testing and inference problems.	Apply Level (C3)
C433-9.5	Analyze, visualize and interpret the results for useful insights.	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Data Definitions and Analytical Programming Techniques	Introduction to Data Analytics, Elements, Variables, and Data categorization, Levels of Measurement, Introduction to analytical programming languages R & Python, and Installing Software's & Setting up, Lists & Dictionaries, Functions & Packages, Data frame, Import and Export data , Data Preprocessing.	7
2.	Parametric &Non Parametric Tests	Hypothesis Testing, Assumption Testing, T-Test, Power Analysis, ANOVA, Fitting ANOVA Model in Python & R, Wilcoxon Tests, Mann-Whitney U Test, Fisher Exact Test	6
3.	Correlation &Association Analysis	Pearson Correlation, Spearmen Correlation, Kendall Tau Correlation, Affinity Analysis & Market Basket Analysis, APriori Algorithm, Association Rules, Frequent Pattern AnalysisCase Study-I.	7
4.	Data Analysis Techniques	Analysis of Streaming Data, Applications of ML Library in R & Python for Supervised & Unsupervised Learning, Basic Neural Network, Transfer Function Models, Multivariate Time Series Analysis, Case Study-II.	10

5.	Decision Making & Data Visualization	Introduction to decision system, Bayesian Theory, Fuzzy Logic, Building a simple decision system based on Bayesian Theory & Fuzzy Logic, Plotting with R & Python Libraries, Statistical Inference, Volatility Analysis, Case Study-III.	8
6.	Model Evaluation Techniques	Model Evaluation Measures for Classification Task, Decision Cost/ Benefit Analysis, Rationale for measuring Cluster Goodness, Silhoutte Method, Pseudo F-Statistic	4
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based learning: Each student in a group of 3-4 has to work on a mini-project, in which they will identify a real-life problem and develop the solution by utilizing skills learned throughout the course. The project implementation should be in python or R preferably along with well documentation on different aspects of the software. This enhances the understanding of students towards different concepts of data analytics and also helps them during their employability as data engineer or data analyst.

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(s)

1.	Haider, M. (2015). Getting Started with Data Science: Making Sense of Data with Analytics. IBM Press.
2.	Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, Prentice Hall of India, 2014.
3.	Douglas C. Montgomery, Cheryl L. Jennings, Murat Kulahci, Introduction to Time Series Analysis and Forecasting, Second Ed., Wiley, 2016.
4.	David J. Pine, Introduction to Python for Science and Engineering, CRC Press, 2019.
5.	Jake vanderPlas, Python Data Science Handbook – Essential Tools for Working with Data, O'Really Media, 2017
6.	Glenn J. Myatt, Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, John Wiley Publishers, 2007
7.	Kabacoff, Robert I. R in action: data analysis and graphics with R. Simon and Schuster, 2015.
8.	Fandango, A. (2017). Python Data Analysis. Packt Publishing Ltd.

Reference Books

1.	Doing Data Science, Straight Talk From The Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly (2014).
2.	Gibbons, J.D., Non-Parametric Statistical Inference, 2/e,Marckel Decker, 1985.
3.	Robert Johansson, Numerical Python – Scientific Computing and Data Science Applications with NumPy, SciPy and Matplotlib, Apress, 2019
4.	Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-

	disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016
5.	Nelli, F., Python Data Analytics: with Pandas, NumPy and Matplotlib, Apress, 2018.
6.	Wickham, H., &Grolemund, G. (2016). R for data science: import, tidy, transform, visualize, and model data. " O'Reilly Media, Inc.".

Detailed Syllabus
Lecture-wise Breakup

Course Code	22B12CS414	**Semester:** Even	**Semester**: VIII **Session**: 2021 -2022 **Month from** Feb to Jun
Course Name	Agile Software Development Process		
Credits	3	**Contact Hours**	3-0-0

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-10.1	Interpret the trade-offs between traditional and agile software development methods.	Understand level (Level 2)
C433-10.2	Apply appropriate agile software engineering approach for a software development project.	Apply Level (Level3)
C433-10.3	Apply refactoring techniques on source code for improved design	Apply Level (Level3)
C433-10.4	Apply appropriate tools for testing agile projects using various testing strategies	Apply level (Level3)
C433-10.5	Estimation and monitoring of agile projects.	Analyze level (level4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures**
1.	Introduction	Traditional software development methods, Introduction to Agile software development methods and Agile development Frameworks. Lean software development	3
2.	Agile Fundamentals	Agile manifesto, Agile principles, Characteristics of Agile processes, an iterative development process, Pros and cons of incremental development and software prototyping.	3
3.	Scrum Framework	Introduction, Scrum - Prioritizing, Estimating, and Planning, The Scrum Experience (hands-on exercise)	5
4.	Extreme Programming (XP)	Extreme Programming Values, Principles and Practices, Pair programming, Embracing change, incremental change	5
5.	Crystal Framework	Crystal methodologies: project categories, complexity, family members, Crystal's seven properties, Crystal clear development process cycle, Crystal yellow, crystal orange and crystal orange web.	4
6.	Kanban Framework	The principles of Kanban, Improving process with kanban, Measure and manage flow, Emergent behavior	4
7.	Feature-Driven Development	Processes of feature driven development, practices and progress in FDD	2
8.	Refactoring in Agile	Bad smells in code, properties of refactoring, refactoring examples, benefits, cost and risk of refactoring	7
9.	Agile Testing	Agile testing strategy, Agile test plan, automated unit test, test driven development (TDD), alpha, beta and acceptance	5

		testing. Exploratory testing.	
10.	Estimation and Monitoring of Agile Projects	Agile estimation, Story point estimation, Sprint velocity estimation, team capacity, Planning and controlling agile projects.	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T1	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. It enhances the understanding of students towards different concepts of search-based software engineering approach and also helps 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)

1.	Cohn, Mike. Agile estimating and planning. Pearson Education
2.	Beck, Kent. Extreme programming explained: embrace change. Addison-wesley professional
3.	Martin, Robert C. Agile software development: principles, patterns, and practices. Prentice Hall.
4.	Shore, James. The Art of Agile Development: Pragmatic guide to agile software development. " O'Reilly Media, Inc.".
5.	Schwaber, Ken. Agile project management with Scrum. Microsoft press
6.	Stellman, Andrew, and Jennifer Greene. Learning agile: Understanding scrum, XP, lean, and kanban. " O'Reilly Media, Inc."
7.	Cohn, Mike. User stories applied: For agile software development. Addison-Wesley Professional

Detailed Syllabus
Lecture-wise Breakup

Course Code	22B12CS419	**Semester:** Even	**Semester:** VIII **Session:** 2021 -2022 **Month from** Feb to Jun
Course Name	Cryptocurrency Technologies		
Credits	**3**	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Kapil Madaan
	Teacher(s) (Alphabetically)	Dr Kapil Madaan

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-5.1	Define all the basic terminologies related to Cryptography and Cryptocurrencies.	Remember Level (Level 1)
C434-5.2	Explain the security features and distributed consensus in decentralized networks.	Understand Level (Level 2)
C434-5.3	Determine the feasibility of applying and storing bitcoin in real-world scenarios.	Apply Level (Level 3)
C434-5.4	Examine the strategies of bitcoin mining incentives and anonymity.	Analyze Level (Level 4)
C434-5.5	Compare the different altcoins along with their strengths and weaknesses.	Analyze Level (Level 4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Introduction to Cryptography and Cryptocurrencies – Introduction to cryptographic hash functions; Hash pointers and data structures; Digital signatures; Public keys as identities; A simple cryptocurrency.	3
2.	Bitcoin	How Bitcoin achieves decentralization; Distributed consensus; Consensus without identity using Blockchain; Incentives and Proof of Work (PoW); Attacks on PoW; Advantages and Limitations of PoW; Bitcoin – NG.	3
3.	Mechanics of Bitcoin	Bitcoin transactions; Bitcoin scripts; Applications of Bitcoinscripts; Bitcoin blocks; Bitcoin network; Limitations and improvements;	4
4.	Storing and Using Bitcoins	Simple local storage; Hot and cold storage; Splittingand Sharing Keys; Online wallets and exchanges; Payment services; TransactionFee; Currency Exchange Markets;	4
5.	Bitcoin as platform	Bitcoin as append only log; Bitcoin as smart property; SecureMulti party lotteries in Bitcoin; Bitcoin as public randomness source; Predictionmarkets and real world data feeds.	5
6.	Bitcoin Mining	Task of Bitcoin miners; Mining Hardware; Energy consumption and Ecology; Mining pools; Mining Incentives and strategies.	4
7.	Community, Politics, and Regulations	Consensus in Bitcoin; Bitcoin software; Stakeholders; Roots of Bitcoin; Governments and Bitcoin; Anti-money laundering; Regulation; New York's Bitcoin License proposal;	4

8.	Bitcoin and Anonymity	Anonymity basics; De-Anonymizing Bitcoin; Mixing – DecentralizedMixing; Zero coin and Zero hash.	4
9.	Alternative mining puzzles	Essential puzzle requirements; ASIC- resistant puzzles; Proof of Useful Work; Non-out-sourceable puzzles; Proof of Stake and virtual mining.	4
10.	Altcoins and the Cryptocurrency eco system	Creating a Cryptocurrency – Solidity basics; Meta mask framework; Remix IDE; Ethereum. Altcoins history and motivation; Few Altcoins in detailDogecoin, ADA Cardano, tether, Stellar, and Monero Ethereum; Relation between Bitcoin and Altcoin; Merge mining; Atomic cross-chain swaps; Bitcoin backed Altcoins; Ethereum and Smart contracts;	7
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	30
T2	40
TA	30(Attendance (5), Internal Assessment (5), PPT (10), Quiz (10))
Total	**100**

Project based learning: Each student works on different case study in Tutorial and Assignments. They utilize the concepts taught in lecture and develop project in a group of 3-4.

The course emphasized on the skill development for employability in software industry by engaging students on real life projects based on blockchain and game theory. Various activities are carried out to enhance the student's skills and real life problem solving using game theory. Some of them are study and application of distributed computing and game theory in various domains such as transportation, education, energy trading, etc.

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.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder. Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.
2.	Antonopoulos, Andreas M. "Mastering Bitcoin: unlocking digital cryptocurrencies", O'Reilly Media, Inc., 2014.
3.	Dannen, Chris. "Introducing Ethereum and Solidity", Berkeley: Apress, 2017.
4.	Prusty, Narayan. "Building Blockchain Projects", Packt Publishing Ltd, 2017.
5.	S Nakamoto, "Bitcoin: A peer-to-peer cash system", 2009. https://bitcoin.org/bitcoin.pdf
6.	Conti, Mauro, Sandeep Kumar, Chhagan Lal, and Sushmita Ruj. "A survey on security and privacy issues of bitcoin." IEEE Communications Surveys & Tutorials (2018).
7.	Khalilov, Merve Can Kus, and Albert Levi. "A Survey on Anonymity and Privacy in Bitcoin-like Digital Cash Systems." IEEE Communications Surveys & Tutorials (2018).

Detailed Syllabus
Lecture-wise Breakup

Subject Code	22B12CS422	**Semester:** Even	**Semester:** VIII **Session:** 2021 -2022 **Month from** Feb to Jun
Subject Name	Cloud computing essentials: Azure and AWS		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Deepti (J62), Dr. Shilpa Budhkar (J128)
	Teacher(s) (Alphabetically)	Deepti, Dr. Shilpa Budhkar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C434-7.1	Examine the fundamentals of Cloud Computing, its applicability and architecture.	Understand level (level 2)
C434-7.2	Examine the architecture and services of AWS (Amazon Web Services) cloud platform.	Analyze level (level 4)
C434-7.3	Examine the architecture and services of Azure cloud platform.	Analyze level (level 4)
C434-7.4	Examine the architecture and services of Google Cloud platform.	Analyze level (level 4)
C434-7.5	Develop the applications using appropriate cloud platforms.	Apply level (level 3)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Overview of Cloud Computing	Origin of Cloud Computing, Benefits and challenges, Parallel and distributed computing, Grids and HPCs, Data center design and management for clouds, Virtualization: Why virtualization, Benefits and shortcomings, comparison with cloud, Software Defined Networks and Storage (SDN and SDS) Cloud Computing Architecture: IaaS, PaaS, SaaS, Types of cloud, Interoperability and its challenges, Cloud security, stability and fault tolerance methods and challenges, Applications for cloud, Clouds for different applications, Service Level Agreements, Concurrent, high-throughput and data intensive computing.	10

2.	AWS Essentials	Introduction to Amazon Web Services, EC2: Compute services, Networking, infrastructure and reliability, Storage and database services, Amazon Elastic Block Store (Amazon EBS), Amazon Simple Storage Service (Amazon S3), Amazon Elastic File System (Amazon EFS), Amazon Relational Database Service (Amazon RDS), Amazon virtual private cloud (VPC), Identity and Access Management (IAM) and Security on AWS.	8
3.	Azure Essentials	Azure core concepts, Azure services, Describe core solutions and management tools on Azure, Describe general security and network security features, Describe identity, governance, privacy, and compliance features, Describe Azure cost management and service level agreements.	8
4.	GCP Essentials	Google Cloud Fundamentals: Core Infrastructure-Google App Engine, Google Compute Engine, Google Kubernetes Engine, Google Cloud Storage, Google Cloud SQL, and BigQuery. Google Cloud Resource Manager hierarchy and Google Cloud Identity and Access Management , Essential Google Cloud Infrastructure: Foundation, Essential Google Cloud Infrastructure: Core Services, Elastic Google Cloud Infrastructure: Scaling and Automation, Reliable Google Cloud Infrastructure: Design and Process	8
5.	Recent trends, Cloud Platforms Comparison & Project based learning	Serverless computing, Microservices, Usage of containers and Dockers, Kubernetes, Comparing the services and efficiency of AWS, Azure and GCP with respect to resource management. Discussing and Implementing a few web applications and system applications on the cloud platforms under different resource management scenarios. Analyzing and evaluating the platforms based on various parameters like security, load balancing, fault tolerance, resilience, cost-effectiveness, etc.	8
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based learning: Groups of 2-3 students will choose a project topic. They will use the concepts of cloud technology to execute their project. In a team, they will learn how to apply the concepts for problem solving in a meaningful way. The knowledge gained will enhance their employability in the IT sector.

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

	Text Books
1.	Cloud computing: principles and paradigms by Buyya, Raj kumar | Broberg, James Goscinski, Andrzej.
2.	Web applications on azure by Reagan, Rob.

3.	Building applications in the cloud: concepts, patterns, and projects
4.	Learning Amazon web services (AWS): a hands-on guide to the fundamentals of AWS cloud by Wilkins, Mark.
	Reference Books
1	Cloud computing bible by Sosinsky, Barrie | Shukla,G.D.
2.	Developing applications for the cloud: on the microsoft windows azure platform by Betts, Dominic | Densmore, scott | Dunn, Ryan
3	Cloud application architectures by Reese, George | Hill, Hattie.
4	Cloud data design orchestration, and management using Microsoft Azure by Diaz, Francesco.
5	https://docs.microsoft.com/en-us/learn/certifications/azure-fundamentals/