Course Description

Course Code	15B19CI891	Semester Even (specify Odd/Even)	Semester VIII Session 2023 -2024 Month from Jan to May 2024
Course Name	**Major Project Part – 2 (CSE)**		
Credits	8	Contact Hours	…

Faculty (Names)	Coordinator(s)	Prashant Kaushik, Dr. Himani Bansal
	Teacher(s) (Alphabetically)	Entire Department

COURSE OUTCOMES		COGNITIVE LEVELS
C451.1	**Summarize** the contemporary literature & tools for hands-on in the respective project area	Understand Level (Level 2)
C451 .2	**Develop** a working model for the identified problem	Apply Level (Level 3)
C451 .3	**Analyze** the specific requirements to develop the workable solution for the **identified** computing problem	Analyze Level (Level 4)
C451 .4	**Evaluate** the developed solution using test cases and performances	Evaluate Level (Level 5)
C451 .5	**Create** and **report** the results of the project in written 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.

Course Code	16B1NHS831	Semester: EVEN (specify Odd/Even)	Semester: VIII Session 2023 -2024 Month: JAN 2024–JUNE 2024
Course Name	Gender Studies		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Prof Alka Sharma
	Teacher(s) (Alphabetically)	Prof Alka Sharma Shikha Kumari

COURSE OUTCOMES		COGNITIVE LEVELS
C401-19.1	Demonstrate knowledge of the construct of gender and the way itintersects with other social and cultural identities ofrace, class, ethnicity andsexuality	Understand(C2)
C401 - 19.2	Apply feminist and gender theory in an analysis of gender including an examination of the social construct of femininity andmasculinity	Apply (C3)
C401- 19.3	Analyze the ways in which societal institutions and power structures such as the family, workplace impact the material and social reality of women‟s lives	Analyze (C4)
C401-19.4	Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporarysettings	Evaluate (C5)
C401- 19.5	Evaluate and interpret information from a variety of sources including print and electronic media, film, video and other information technologies	Evaluate (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introducing Gender Issues	• Sex andGender • Types ofGender • Gender Roles • Gender Division ofLabor • Gender Stereotyping and GenderDiscrimination	9
2.	Gender Perspectives of Body & Language	• Biological, Phenomenological and Socio-Cultural Perspectives ofbody • Body as a Site and Articulation of PowerRelations • Cultural Meaning of Female Body andWomen‟s Lived Experiences • The Other andObjectification	6
3.	Social Construction of Femininity &Feminism	• Bio-Social Perspective ofGender • Gender as AttributionalFact • Feminine &Feminist • Major Theorists of Feminism Challenging Cultural Notions of Femininity • Feminism Today: Radical, Liberal, Socialist, Cultural, Eco feminism & Cyberfeminism • Images of Women in Sports, Arts, Entertainment, Media and Fashion Industry ;Cultural Feminism&	9

		Celebrating Womanhood • Analysis of role women have played acrosscultures	
4.	**Social Construction of Masculinity**	• Definition and Understanding ofMasculinities • Sociology of Masculinity& itsTypes • Social Organization of Masculinity and Privileged Position ofMasculinity • Politics of Masculinity andPower • Major Theorists ofMasculinity • Masculine Identities in Literature, Cinema & Media.	9
5.	**Gender Sensitization Empowerment &Gender Inclusivity**	• Women & Women Rights InIndia • From Women's Studies to Gender Studies:A ParadigmShift • Gender Sensitization & Gender Inclusivity • Gender Studies & Media: Creating NewParadigms in Gender &Culture	9
		Total number of Lectures	**42**

Evaluation Criteria

Components	MaximumMarks
T1	20
T2	20
EndSemesterExamination	35
TA	25 (Project/ Assignment)
Total	**100**

Students will be given a project on the construction of gender and how does the major institution of the society have shaped their gender.

	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	Davis K., et al, "*Handbook of Gender and Women's Studies*. London: Sage. (2006)
2	Helgeson, Vicki S., "*The Psychology of Gender*", Pearson(2012)
3	Friedan B., "*The Feminine Mystique*", Penguin. (1971/1992)
4	DebeauvoirS. , "*The Second Sex*", Vintage (1953/1997)
5	Wharton Amy S., "*The Sociology of Gender: An Introduction to Theory & Research*", Wiley-Blackwell (2005)
6	Pachauri G.," *Gender, School & Society*", R.Lall Publishers(2013)
7	Connell R.W, "*Masculinities*", Cambridge: Polity. (1985)
8	MacInnes J., "The *End of Masculinity*". Buckingham: Open University Press. (1998)
9	Kaul A.& Singh M., "*New Paradigms for Gender Inclusivity*", PHI Pvt Ltd (2012)

Optimization Techniques (16B1NMA831)

Simplex method and variants, game theory, queuing models, inventory models, network scheduling, CPM and PERT, sequencing problems, discrete and continuous dynamic programming, nonlinear programming problems-numerical methods.

Course Description

Course Code	16B1NMA831	Semester Even	Semester VIII Session 2023-2024
			Month from Jan 2024 to June 2024
Course Name	Optimization Techniques		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Ram Surat Chauhan	
	Teacher(s) (Alphabetically)	Dr. Ram Surat Chauhan	

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the abovementioned course, the students will be able to:		
C402-2.1	explainthe basics oflinear, dynamic and non-linear programming.	Understanding (C2)
C402-2.2	applyoptimization techniques to solve problems related to linear programming, game theory, queuing and inventory models.	Applying (C3)
C402-2.3	analyze theproblemsrelated to dynamic programming, sensitivity analysis, sequencing and scheduling.	Analyzing (C4)
C402-2.4	determine numerical solutions of one dimensionaland multidimensional nonlinear problems.	Evaluating (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 method, simplex method and its variants, revised simplex method, Duality theory, dual simplex method, sensitivity analysis.	08
2.	Game Theory	Rectangular Games, Minmax Theorem, Graphical Solution of 2×n, 3×n, m×2, m×3 and m×n Games, Solution of games using LPP technique.	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 waiting space. Inventory Models: Deterministic and Probabilistic models.	08
4.	Sequencing & Scheduling	Processing of Jobs through Machines: Processing of n jobs through two machines, two jobs through m machines and n jobs through m machines. Project Scheduling: Network diagram, Critical Path Method (CPM), Project Evaluation and Review Technique (PERT).	07
5.	Dynamic	Discrete and Continuous Dynamic	06

	Programming	Programming: Bellman's principle of optimality, linear and nonlinear dynamic programming problems, Simple Illustrations.	
6.	Nonlinear Programming	Unimodal function, One Dimensional minimization problem: Newton's method, Golden section method, Fibonacci search method, Bisection method. Multidimensional minimization problem: Steepest descent method, Multidimensional Newton's method.	07
		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 collect literature on dynamic programming to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with aforementioned topic.

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

Subject Code	22B12CS422	Semester: Even	Semester 8th Session 2023 -2024
			Month from: Jan 2024 to June 2024
Subject Name	Cloud computing essentials: Azure and AWS		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Astha Singh (J128), Deepti Singh (J62)
	Teacher(s) (Alphabetically)	Astha Singh, Deepti Singh

COURSE OUTCOMES		COGNITIVE LEVELS
C434-7.1	Recall the fundamentals of Cloud Computing, its applicability and architecture.	Remember (level 1)
C434-7.2	Understand the architecture and services of AWS (Amazon Web Services), Azure and Google Cloud platforms.	Understand (level 2)
C434-7.3	Apply the AWS, Azure, and Google cloud platform to solve the real-world problems.	Apply (level 3)
C434-7.4	Analyze the AWS, Azure, and Google cloud platform to solve the real-world problems.	Analyze (level 4)
C434-7.5	Create the applications using appropriate cloud platforms.	Create (level 6)

Module No.	Subtitle 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 (10), Assignments (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)
	Text Books
1.	Buyya, Rajkumar et al. "Cloud Computing Principles and Paradigms." Wiley, 2011.
2.	Reagan, Rob. "Web Applications on Azure." *Apress,* 2017
3.	Moyer, Christopher M.. "Building Applications in the Cloud: Concepts, Patterns, and Projects." Pearson Education, 2011.
4.	Wilkins, Mark. "Learning Amazon web services (AWS): a hands-on guide to the fundamentals of AWS cloud". Addison-Wesley Professional, 2019
	Reference Books
5	Sosinsky, Barrie A.. "Cloud Computing Bible." (2010).
6.	Pace, Eugenio et al. "Developing Applications for the Cloud on the Microsoft Windows Azure Platform." (2010).
7	Reese, George. "Cloud Application Architectures - Building Applications and Infrastructure in the Cloud." (2009).
8	Diaz, Francesco and Roberto Freato. "Cloud Data Design, Orchestration, and Management Using Microsoft Azure." *Apress* (2018).

Subject Code	17B1NHS732	Semester: Even	Semester:8th Session: 2023 -2024 Month:January to June
Subject Name	**INDIAN FINANCIAL SYSTEM**		
Credits	3	Contact Hours	3 (3-0-0)

Faculty (Names)	Coordinator(s)	Dr Sakshi Varshney
	Teacher(s) (Alphabetically)	Dr Sakshi Varshney

NBA Code	Course Outcomes	Cognitive Level
C402-31.1	Understand the interlinkage of components of the financial system and financial instruments of the Money market and Capital market.	Understanding (Level 2)
C402-31.2	Apply knowledge of Mutual Funds and Insurance products in personal investment portfolio	Applying (Level 3)
C402-31.3	Apply knowledge of Income tax for the estimation of the tax liability of an individual.	Applying (Level 3)
C402-31.4	Compare the ways of fundraising in domestic and international markets	Analyzing (Level 4)
C402-31.5	Understand the functioning of the Stock market and evaluating the securities for investment.	Evaluating (Level 5)

Module No.	Subtitle of the Module	Topics in the module	No. of Hours
1.	Introduction to Financial System	Meaning, Importance, and functions of Financial system. Informal and Formal financial systems, Financial markets, Financial Institutions, Financial Services and Financial instrument	3
2.	Introduction to financial markets	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 Features of Capital market instruments: Equity shares, Bonds.	6
3.	Fund raising in financial markets	Fundraising through Initial Public Offering, Rights issue, Preferential allotment and Private Placement. Process of IPO-Intermediaries in IPO, Book building process and allotment of shares Fundraising from the foreign market through Foreign direct investment and foreign institutional investment, ADR, GDR, ECB, and Private equity.	6

4.	Stock Market	Trading in the secondary market- Stock exchanges, regulations, demutualization, broker, a listing of securities, dematerialization, trading, short selling, circuit breaker, stock market indices- methods of calculation of indices.	3
5.	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	6
6.	Investing in Mutual Funds and Insurance	Mutual Funds: Basics, Types of funds, risk and return considerations in the selection of funds; Insurance: Basics, Life insurance and health insurance, types of policies	6
7.	Overview of Income Tax	Basics of Income tax Concept of the 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 sections 80C to 80U.	12
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-BasedLearning: The students will form groups of 4-5 students. They will carry outa 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 the stock.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks, 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*, 5th Ed, Vikas Publication, 2019
4	Bhole L M and Mahakud, J., *Financial Institutions and Markets*, 5th ed. Tata McGraw Hill Publication, 2017.
5	Singhania & Singhania, Students Guide to Income Tax, 67th Edition, Taxmann Publication, August 2022.
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	AshiwiniKumar,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	18B12HS814	Semester Even	Semester VIII Session 2023 -2024 Month from Jan to June
Course Name	Knowledge Management		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. AnshuBanwari	
	Teacher(s) (Alphabetically)	Dr. AnshuBanwari	

COURSE OUTCOMES		COGNITIVE LEVELS
C402-30.1	Understand the way knowledge is embedded in an organization and the behavioral aspects involved in managing it.	Level-2-(Understanding)
C402-30.2	Identify appropriate methods or techniques to be used for capturing, sharing and managing knowledge.	Level-3 (Apply)
C402-30.3	Analyze the role of knowledge management for attaining organization goals.	Level-4 (Analyze)
C402-30.4	Assess the legal ramifications arising from knowledge sharing and an insight into the ethical concerns faced by individuals and organizations.	Level-5 (Evaluate)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Knowledge Management	Cognition and Knowledge Management, Data, Information and Knowledge, Types of Knowledge, Reasoning and Heuristics, Expert Knowledge, Human thinking and Learning, Knowledge Management myths	4
2.	Life Cycle of a knowledge Management System	Challenges in building Knowledge Management Systems, Conventional V/S Knowledge Management System Lifecycle, Knowledge Management System Life Cycle, System Justification, Role of Rapid Prototyping, Selecting an expert, Role of Knowledge developer	6
3.	Knowledge Creation and Knowledge Architecture	Models of Knowledge Creation and Transformation, Knowledge Architecture, The people Core, Identifying Knowledge centers, The technical core	5
4.	Capturing Tacit Knowledge	Evaluating the expert, Developing a Relationship with expert, Fuzzy reasoning and the quality of Knowledge capture, Interview as a tool, Knowledge capture	6

		techniques	
5.	Knowledge Codification and System Implementation	Codification Tools and Procedures, The knowledge Developer's Skill set, Quality assurance, Approaches to Logical testing and Acceptance testing, Issues related to deployment	6
6.	Knowledge Transfer and Knowledge Sharing	Transfer strategies, Inhibitors of Knowledge transfer, Role of Internet in Knowledge Transfer	5
7.	Managing Knowledge Workers	Business Roles in the Learning Organizations, Work adjustment and the Knowledge Worker, Technology and the Knowledge worker, Role of the CKO, Managing Considerations, Managing Knowledge Projects	5
8.	Ethical, Legal and Managerial Issues	Knowledge Owners, Legal Issues, Ethical Decision cycle, Major threats to Ethics, The Privacy factor	5
Total number of Lectures			**42**

Evaluation Criteria

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

Project based learning: Students have to form a group (maximum 5 students in each group) andhave to identify an organization who has successfully implemented knowledge management. Students have to analyze techniques, tools and methods adopted by organization to preserve, nurture, share and manage knowledge. Understanding of different methods, processes and techniques used by organizations for successful KM implementation enhances the students practical understanding on how knowledge management is integrated into different business functions.These days most of the organizations are using knowledge management in their various endeavors. This subject surely enhances student's employability in all those organizations where knowledge management has been implemented or where they are planning to implement knowledge management.

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

1	**D. Hislop,** Knowledge Management in Organizations, Oxford University Press, 2013
2.	**E. M. Awad and H. M. Ghaziri,** Knowledge Management, Pearson Education, 2007
3.	**S. Warier**, Knowledge Management, Vikas Publishing House, 2011
4.	**Tan, H., Carrillo, P. and Anumba, C.J**., Case study of knowledge management implementation in a medium-sized construction sector firm. Journal of Management in Engineering, 28 (3), pp. 338 – 347, 2012
5.	**RagsdelL, G., OrtollEspinet, E. and Norris, M.,** Knowledge management in the voluntary sector: a focus on sharing project know-how and expertise. Knowledge Management Research and Practice, 12(4), pp.351–361, 2014

| 6. | **K. North and G. Kumta,** Knowledge Management, 2nd ed. 2018 ed., Springer, 2018 |

Course Code	18B12PH812	Semester: Even	Semester: 8, Session : 2023 -2024 Month from: January to June
Course Name	Astrophysics		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof. Anirban Pathak
	Teacher(s) (Alphabetically)	Anirban Pathak

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Relate historical development of astrophysics with the modern concepts and recall the mathematical techniques used & definition of different units	Remembering (C1)
CO2	Explain the models of universe, ideas of stellar astrophysics, life cycles of stars, physical principles that rules galaxies, and general theory of relativity	Understanding (C2)
CO3	Apply mathematical principles and laws of physics to solve problems related to astrophysical systems	Applying (C3)
CO4	Compare different models of universe and decide which one is logically acceptable and why	Analyzing (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	Qualitative idea of general theory of relativity (without	6

	Universe	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.	
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
	(a) Quizes /class tests (06 M),
	(b) Attendance (05 M)
	(c) Internal Assessment (04)
	(d) Assignments in PBL mode (10 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.

Project based learning: Project report (5-7 pages in pdf format indicating Name, Enroll No. and Batch) is to be uploaded in google class room before starting of End Term Exam. Max 5 students can work on one topic given in the list (Dark Matter, Dark Energy, Expanding Space time, Merger of Black holes, Failed stars, Detection of Gravitational Waves, Light cone in GTR, Particle production radiation era, Did big bang happened ?, Discover life: ET etc.**), however, they may prepare different reports. Report should include introduction, definition, mathematics, principle, working, figures, applications etc.**

Course Code	18B12PH814	Semester: Even	Semester: VIII Session: 2023 -2024
			Month: January to June
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.	Remembering 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+PBL+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., *Introduction to Plasma Physics,* Springer (2016).
2.	Krall and Trievelpiece, *Principles of Plasma Physics*, McGraw-Hill (1973).
3.	W. L. Kruer, *The Physics of laser plasma interactions*, Addison Wesley (1988).
4.	Liu and Tripathi, *Interaction of electromagnetic waves with electron beams and plasmas*, World Scientific (1994).

Project based Learning (PBL): Students groups may be formed to submit project reports on natural and engineering applications of plasma physics. Students may be asked to make presentations on topics like mirror machine, plasma diffusion, Raman scattering and plasma fusion devices. Students may be asked to present recent published articles on plasma applications. Students may be asked to solve plasma physics problems by using their expertise computer language

Course Code	18B12PH813	Semester: EVEN	Semester: VIII Session 2023 -2024 Month from: January to June
Course Name	Bio-Physics		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof Papia Chowdhury
	Teacher(s) (Alphabetically)	Prof Papia Chowdhury

S.N.	DESCRIPTION	COGNITIVE LEVEL (BLOOMS TAXONOMY)
C402-5.1	Find the connections between physics and biology of living system, Physical processes in the living organisms	Remember (C1)
C402-5.2	Understand the idea of DNA computing with the construction of different DNA logic gates.	Understanding (C2)
C402-5.3	Apply the idea of different radiation sources to explain radiobiology to understand the effect of radiation on living system	Apply (C3)
C402-5.4	Analyzing the working of different bio-devices: Organic semiconductor, solar cell, OLED, PLED, AMOLED, biosensors.	Analyze (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Biophysics and DNA computation	Connections between physics and biology of living system, Physical processes in the living organisms. The need of study of physical processes in biological systems. Introduction to DNA computing, DNA structure, Hamiltonian path problem, Encoding information in DNA, Biooperations, DNA models of computation, DNA algorithms, Error rates in DNA computing DNA logic gates, Identity, NOT, OR, AND, NAND, XOR, HALF ADDER, FULL ADDER DNA logic gates, truth table, Technology of tic-tac toe game by DNA computation	14
2.	Radiation Biophysics	Atomic structure models: Constituents of atomic nuclei, Isotope, Radioactivity, Ionizing radiation, excitation, radiation sources, Alfa, Beta, Gamma rays, Properties of Electromagnetic radiation, Units of radioactivity, Particle flux, X & Gamma ray interaction with matter, Energy transfer processes, Nonionising radiation, Radiobiology: Radiolysis, Production of free radicals & their interactions, Radiation on living system, productions of radionuclides, Radio tracer techniques, Radio sensitisation and protection, Target theory, Cellular effects of radiation, Radiation damage, Genetic Effect	10

		of radiolysis, Early and late effects of radiation, Effect of Chronic exposure to radiation, Radiation detection, measurement and applications: Principles of radiation detection and measurement, Dosimeters and its Principles, Design & Working.	
3.	Photo Biophysics	Light sources, Molecular structure and excited states, Physical properties of excited molecules, Photophysical processes, fluorescence, phosphorescence, Internal conversion, Intersystem crossing, Optical activity, Photophysical kinetics of bimolecular processes. Optical bio-devices in electronic industry-Organic semiconductor, solar cell, OLED, PLED, AMOLED etc. Alternative energy sources-Hydrogen fuel cell.	6
4.	Bio-sensing systems	Piezoelectric and Luminescent biosensors, Theory, reaction, design and applications; Quantum dots: dimension, exciton, excited bohr radius, colour coding by quantum dots, experimental techniques for trapping quantum dots by micellization.	7
5.	Environmental biophysics	Ozone umbrella, green house effect, global warming.	3
		Total number of Lectures	**40**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (6M), Attendance (5M), project (10M), Class performance (4 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.	Biophysics, an Introduction, Rodney M. J. Cotterill, John Wiley & Sons.
2.	Methods in modern Biophysics, Bengt Nölting, Springer International Edition.
3.	Biophysics. Vasantha Pattabhi, N. Gautham, Narosa Publishing House.
4.	Biophysics. Hoppe W., Lohmann W., Mark H., and Zeigler H. M.(1983) Biophysics, Springer Verlag, Heidelberg.
5.	Conformation of Biological Molecules, Govil G. and Hosur R.V. (1982), Springer Verlag, Berlin, Heidelberg, New York.

Project based Learning (PBL): In whole Biophysics course applications of physics in biology have been discussed. The course also deals with the working of fundamental biophysical techniques depending on their applicability in Industry like sensors, OLED, AMOLED, DNA Logic gates, drug designing etc. Throughout the course Students will make some individual projects on selected Topics of application of Biophysics on todays biomedical and electronic industry. Students will also do some project work on drug designing. Example: For drug designing different software based techniques are used like molecular docking, MD simulation etc., piezoelectric materials are used for the making of biosensors, optical sensors, viewers which are applied in defense purpose and in medical science. Each project work will describe the detail about the specific applied field. Students will take help from available internet sources, current research papers, Text books for preparing the project. Throughout the preparation of the whole project and by presenting the project work

students will gather deep learning about the applicability of Biophysics for the requirement of current medical and electronic Industry. The overall knowledge will help them to prepare themselves as an efficient Engineer according to the requirements of current Industry.

Multi Attribute Decision Making (20B12MA411)

Basic Steps in Decision Analysis, Decision-Making Environments, Decision Making Under Uncertainty, Decision Making Under Risk, Utility Theory, Decision Tree. GDM Methods, Content-Oriented Methods, and Disadvantages of Non ranked Voting, Preferential Voting System, and Social Choice Functions. Multiattribute Decision Making, Multi Objective Decision Making, Decision Making Process, Structuring Process, Decision Matrix, Attributes, Normalization, Attribute Weight Assignment Methods. Dominance Relation method, Even-Swap method, Lexicographic method Maximax method, Maximin method, Conjunctive method, Disjunctive method, Median Ranking, Analytic Hierarchy Process, Analytic Network Process. Multi Attribute Value Theory, Simple Additive Weighting, Weighted Product, TOPSIS Outranking Methods.

Course Description

Course Code	20B12MA411	Semester- Even	Semester VIII Session 2023 -2024 Month from Jan 2024 to June 2024
Course Name	**Multi Attribute Decision Making**		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr. Pankaj Kumar Srivastava and Dr. Dinesh C. S. Bisht	
	Teacher(s) (Alphabetically)	Dr. Dinesh C. S. Bisht and Dr. Pankaj Kumar Srivastava	

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above-mentioned course, the students will be able to:		
C402-6.1	explain the concepts of decision analysis and decision-making.	Understanding (C2)
C402-6.2	develop the concept of group and multi criteria in decision making problems.	Applying (C3)
C402-6.3	categorize decision making approaches to handle multi attribute problems.	Analyzing (C4)
C402-6.4	estimate value and outranking based methods in decision making problems.	Evaluating (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Decision Analysis	Basic Steps in Decision Analysis, Decision-Making Environments, Decision Making Under Uncertainty, Decision Making Under Risk, Utility Theory, Decision Tree.	8
2.	Group Decision Making	GDM Methods, Content-Oriented Methods, and Disadvantages of Non ranked Voting, Preferential Voting System, and Social Choice Functions.	7
3.	Multicriteria Decision Making	Multiattribute Decision Making, Multi Objective Decision Making, Decision Making Process, Structuring Process, Decision Matrix, Attributes, Normalization, Attribute Weight Assignment	8

		Methods.	
4.	Elementary Methods for MADM	Dominance Relation method, Even-Swap method, Lexicographic method Maximax method, Maximin method, Conjunctive method, Disjunctive method, Median Ranking, Analytic Hierarchy Process, Analytic Network Process.	8
5	Value Based and Outranking Methods	Multi Attribute Value Theory, Simple Additive Weighting, Weighted Product, TOPSIS Outranking Methods.	11
		Total number of Lectures	**42**

Evaluation Criteria

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

Project Based Learning: Students will be divided in a group of 4-5 to collect literature and submit a report on estimation of value and outranking based methods in decision making 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.	Ishizaka, Alessio, and Philippe Nemery. *Multi-criteria decision analysis: methods and software*. John Wiley & Sons, 2013.
2.	Xu, Zeshui. *Uncertain multi-attribute decision making: Methods and applications*. Springer, 2015.
3.	Tzeng, Gwo-Hshiung, and Jih-Jeng Huang. "Multi Attribute Decision Making: Methods and Applications." *USA, CRC Press.* 2016.

Subject Code	21B12HS411	Semester: EVEN	Semester 2nd Session 2023-24 Month from Jan to June
Subject Name	URBAN SOCIOLOGY		
Credits	3	Contact Hours	3-0-0
Faculty (Names)	Coordinator(s)	Dr Yogita Naruka	
	Teacher(s) (Alphabetically)	Dr Yogita Naruka	

COURSE OUTCOMES		COGNITIVE LEVELS
C401 - 25.1	Understand the concepts and theories of urban sociology	Understanding Level (C2)
C401 – 25.2	Apply and analytical framework to understand the structural characteristics of cities students are residing in	Applying Level (C3)
C401 – 25.3	Analyze the role of agencies and actors in shaping the process of urbanization	Analyse Level (C4)
C401 – 25.4	Evaluate importance of good governance and urban planning	Evaluating Level (C5)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction to Urban Sociology	Basic Concepts and terminologies of the urban sociology, Origin of urban societies, Rural-Urban Continuum	2
2.	Theories of Urban Sociology	The classical theories – Simmel, Weber, Tonnies, Louis Wirth, Durkheim & Engels; Ecological Theories – Chicago School, Concentric Zone theory, Sector theory, Multiple Nuclei theory	5
3.	Contemporary Urban Processes	Industrialisation, Colonialism, Class-Conflict theories (Marxism), Neo-liberalism	5
4.	Urbanisation in India	Development of urban sociology in India, Evolution of urban structures, Spatial Structures and Classification of cities	4
5.	Urban Planning	Concept of urban planning – History, need and relevance,	7

		Principles of Urban planning, Urban planning in India – Agencies and Stakeholders, Strategies and techniques of urban planning – Social area analysis, mapping and zoning, role of cooperatives	
6.	Urban Governance	Urban governance – Concept and need, Urban Governance in India, Urban decentralization – agencies and role of local bodies	**4**
7.	Urban Issues in India	Urban Poverty, Informality & Exclusion, Urban Environment Lessons from Pandemic	**4**
8.	Technology and urbanisation	Smart cities, Case studies of smart cities and use of digital technologies in urban	**5**
9.	Sustainable urban Development	Sustainable urban development – concept, need, tenets and strategies Sustainable development goals (SDGs) in relation to urban	**4**
10.	Global perspectives on urban	Neo-liberalism and urban, Globalization and urban, Emergence of megacities	**5**
Total number of Hours			**45**

Evaluation Criteria

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

Project Based Learning: The students would be divided into a group of 4-5. They would be asked to map and discuss the different parts of their cities. The lectures and readings on the process of urbanization and models of urbanization will form the basis for this exercise. Students would be required to critically analyse the urban spaces using sociological perspectives and theories. The students would be needed to make a presentation and also submit a report.

Recommended Reading material:	
1.	Gottdiener, M., Budd, L., &Lehtovuori, P. *Key concepts in urban studies*. Sage. (2015)
2.	Lin Jan and Mele Christopher, ed. *The Urban Sociology Reader*. London: Routledge. (2005)
3.	Rao, M. S. A., ed. Longman. (1974) *Urban Sociology in India: Reader and Source Book*. New Delhi: Orient
4.	Savage, M., and Warde, A. Higher Education. (1993) *Urban sociology, capitalism and modernity*. Macmillan International

5.	Sivaramakrishnan, K.C., Kundu, Amitabh & Singh, B.N. *Handbook of Urbanization in India*. Oxford University Press (2007)
6.	Wirth, Louis. *Urbanism as a Way of Life*. American Journal of Sociology. (1938)
7.	Sharma, A.K. and Misra, B.D. Books Pvt. Ltd.(2018) *Urbanization in India: Issues &Challenges.*New Delhi: Ane

Subject Code	22B12CS412	Semester: Even 2024	Semester: 8th Session: 2023 -2024
			Month from: January to June 2024
Subject Name	Digital Forensics and Cyber Laws		
Credits	3-0-0	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Kapil Madan (62), Ms. Anuradha Gupta (128)
	Teacher(s) (Alphabetically)	Ms. Anuradha Gupta (128), Dr. Kapil Madan (62)

COURSE OUTCOMES		COGNITIVE LEVELS
C433-8.1	To outline the concept of cybercrimes and the different types of cybercrimes.	Remember Level (C1)
C433-8.2	Summarizing the different forms of digital forensic investigation and its life cycle.	Understand Level (C2)
C433-8.3	Examining the principles of collecting digital evidence.	Apply Level (C3)
C433-8.4	Illustrate the Cyberlaw with respect to Indian IT Act.	Apply Level (C3)
C433-8.5	Illustrating various digital forensic tools in real-time scenarios.	Analyze Level (C4)

Module No.	Subtitle of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Cybercrime	Introduction, Role of Electronic Communication Devices and Information and Communication Technologies in Cybercrime, Types of Cybercrime, Classification of Cybercriminals, Tools used in Cybercrime, Challenges to Cybercrime, Strategies to Prevent Cybercrimes	05
2.	Cyber warfare and cyber laws	Introduction to Cyber War, Ransomware ,Types of Ransomware, Mode of Infection , Events in Ransomware Attack , Role of Antivirus Deep Web and Dark Web, Accessing Dark Web, Onion Router—TOR, Introduction to Cyber Laws, Cyber Laws in India and Case Studies, Information Technology Act 2000, Amendments to the Indian Evidence Act 1872 in View of Information Technology Act 2000	06
3	Introduction to Digital Forensics	Computer Forensics Investigations , Steps in Forensic Investigation ,Forensic Examination Process , Methods Employed in Forensic Analysis, Forensics classification, Incident and Incident Handling, Disk, Network, Database, Wireless, Malware, Mobile, GPS, Email, Memory forensics, Incident and Incident handling	06
4	Digital Evidence	Digital Evidence, Evidence Collection Procedure, Acquisition and Handling of Digital Evidence, from different digital devices, Operating Systems and their Boot Processes ,Storage Medium , File System, Windows Registry, Windows Artefacts , Browser Artefacts, Linux Artefacts ,Whole Disk Encryption or Full Disk Encryption, Evidence from Mobile Devices, Digital Evidence on the Internet, Challenges with Digital Evidence	06
5	Acquisition and Handling of	Preliminaries of Electronic or Digital Evidence, Acquisition and Seizure of Evidence, Chain of Custody, Acquisition of Computer and Electronic Evidence, Acquisition Procedure using Target Disk Mode from Apple	06

	Digital Evidence	Macintosh Computer, Mobile Phone and PDA, Optical and Removable Media, Digital Cameras, Handling of Digital Evidence	
6	Analysis of Digital Evidence	Introduction ,Capturing of Forensic Copy of Memory and Hard Drive with Toolkit Forensic Imager , RAM Analysis with Volatility ,Analysing Hard Drive, Working with Autopsy, Email Tracking and Tracing	**06**
7	Forensic Tools	Forensic Tools,Types Cyber Forensic Suite, Free and Open-source Forensic Suite, Proprietary Forensic Suites, Drive Imaging and Validation Tools, Forensic Tool for Integrity Verification and Hashing , Forensic Tools for Data Recovery, Forensic Tools for RAM Analysis Registry Analysis, Encryption/Decryption, Password Recovery, Network Analysis, Forensic Utility for Metadata Processing UNIX System Analysis	**07**
	Total number of Lectures		**42**

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
T3	35
TA	25 (Attendance-05, Class Assignment/ Quiz-10, Project Based Learning - 10)
Total	100

Project Based Learning: The students are grouped into groups of size 2-3 and will be implementing various cyber forensics tools. The student will analyze the requirements and select the required applications. This will help in the employability of students in the cyber security and forensics based industry and public sectors.

	Text Books:
1.	Cyber Forensics by Murugan, S, Oxford University Press.
2	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley.
	Reference Books:
1.	Cybercrime and Digital Forensics: An Introduction by Thomas J. Holt , Adam M. Bossler, Kathryn C. Seigfried-Spellar, Routledge; 2nd edition, 2017
2.	Digital Forensics and Incident Response: A practical guide to deploying digital forensic techniques in response to cyber security incidents by Gerard Johansen, Packt Publishing Limited, 2017
3	The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics by John Sammons, Syngress; 2nd edition, 2014

Detailed Syllabus
Lecture-wise Breakup

Course Code	22B12CS413	Semester: EVEN	Semester 8ᵗʰ Session 2023-2024
			Month: Jan. 2024 to May 2024
Course Name	Data Analytics using R and Python		
Credits	3	Contact Hours	3-0-0
NBA Code	C433-9		

Faculty (Names)	Coordinator(s)	Dr. Bhawna Saxena (J62) & Dr. Vartika Puri (J128)
	Teacher(s) (Alphabetically)	Dr. Bhawna Saxena (J62) & Dr. Vartika Puri (J128)

COURSE OUTCOMES		COGNITIVE LEVELS
At the completion of the course, students will be able to		
C433-9.1	Explain the fundamental concepts of data analytics.	Understand (Level 2)
C433-9.2	Demonstrate the concepts of R & Python for data analytics.	Apply (Level 3)
C433-9.3	Apply advanced methods and their quantitative analysis for real-world problems.	Apply (Level 3)
C433-9.4	Apply statistical methods for hypothesis testing and inference problems.	Apply (Level 3)
C433-9.5	Analyze, visualize and interpret the results for useful insights.	Analyze (Level 4)

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 & Setting up, Lists & Dictionaries, Functions & Packages, Data frame, Import and Export data, Data Preprocessing.	10
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	6
3.	Correlation & Association Analysis	Pearson Correlation, Spearman Correlation, Kendall Tau Correlation, Affinity Analysis & Market Basket Analysis, APriori Algorithm, Association Rules, Frequent Pattern Analysis	7
4.	Data Analysis Techniques	Introduction to Machine Learning, Applications of ML Library in R & Python for Supervised & Unsupervised Learning, Basic Neural Network, Transfer Function Models, Multivariate Time Series Analysis.	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	5

6.	Model Evaluation Techniques	Model Evaluation Measures for Classification Task, Decision Cost/ Benefit Analysis, Rationale for measuring Cluster Goodness, Silhoutte Method	4
		Total number of Lectures	**42**

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.

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (5 Marks), Quiz / Mini-Project/Assignment (20 Marks))
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(s)

1.	Navlani, A., Fandango, A. and Idris, I. (2021). Python Data Analysis – Third Ed. Packt Publishing Ltd.
2.	Jake vander Plas, Python Data Science Handbook – Essential Tools for Working with Data, O'Really Media, 2022
3.	David J. Pine, Introduction to Python for Science and Engineering, CRC Press, 2019.
4.	Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of Hypotheses, PHI, 2014.
5.	Kabacoff, Robert I. R in action: data analysis and graphics with R. Simon and Schuster, 2015.
6.	Haider, M. (2015). Getting Started with Data Science: Making Sense of Data with Analytics. IBM Press.

Reference Books

1.	Doing Data Science, Straight Talk from The Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly (2014).
2.	Robert Johansson, Numerical Python – Scientific Computing and Data Science Applications with NumPy, SciPy and Matplotlib, Apress, 2019
3.	Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016
4.	Nelli, F., Python Data Analytics: with Pandas, NumPy and Matplotlib, Apress, 2018.
5.	Wickham, H., &Grolemund, G. (2016). R for data science: import, tidy, transform, visualize, and model data. " O'Reilly Media, Inc.".

CourseCode	22B12CS414	SemesterEven(specifyOdd/Even)	Semester:8th Session2023-2024MonthfromJanuarytoJune 2024
Course Name	AgileSoftwareDevelopmentProcess		
Credits	3	ContactHours	3-0-0

Faculty(Names)	Coordinator(s)	Dr Ashish Singh Parihar (J62), Mr. Pankaj Mishra (J128)
	Teacher(s) (Alphabetically)	Dr.Ashish Singh Parihar, Prof. Chetna Gupta, Mr. Pankaj Mishra

COURSEOUTCOMES		COGNITIVELEVELS
C433-10.1	Interpretthetrade-offsbetweentraditionalandagilesoftware developmentmethods.	Understandlevel(Level2)
C433-10.2	Applyappropriateagilesoftwareengineeringapproachfora softwaredevelopment.	ApplyLevel (Level3)
C433-10.3	Applyappropriatetoolsfortestingagileprojectsusingvarious testingstrategies	ApplyLevel (Level3)
C433-10.4	Applyrefactoringtechniquesonsourcecode forimproveddesign	Applylevel(Level3)
C433-10.5	Estimationandmonitoringof agileprojects.	Analyzelevel(level4)

Module No.	TitleoftheModule	Topicsin theModule	No. ofLectures
1.	Introduction	Traditionalsoftwaredevelopmentmethods,Introductionto AgilesoftwaredevelopmentmethodsandAgiledevelopmentFrameworks.Lean software development	3
2.	AgileFundamentals	Agilemanifesto,Agileprinciples,CharacteristicsofAgileprocesses,aniterativedevelopmentprocess,Prosandconsofincrementaldevelopment andsoftware prototyping.	3
3.	ScrumFramework	Introduction,Scrum-Prioritizing,Estimating,andPlanning,TheScrumExperience(hands-on exercise)	5
4.	ExtremeProgramming(XP)	ExtremeProgrammingValues,Principlesand Practices,Pairprogramming,Embracingchange,incremental change	5
5.	Crystal Framework	Crystalmethodologies:projectcategories,complexity,familymembers, Crystal's seven properties, Crystal clear developmentprocesscycle,Crystalyellow,crystalorangeandcrystalorange web.	4
6.	KanbanFramework	TheprinciplesofKanban,Improvingprocesswithkanban, Measureandmanage flow,Emergentbehavior	4
7.	Feature-DrivenDevelopment	Processesoffeaturedrivendevelopment,practices andprogressinFDD	2
8.	Refactoringin Agile	Badsmellsincode,propertiesofrefactoring,refactoringexamples,benefits, costand riskof refactoring	7

| 9. | Agile Testing | Agiletestingstrategy,Agiletestplan,automatedunittest,testdrivendevelopment(TDD),alpha,betaandacceptancetesting. | 5 |

10.	Estimation andMonitoringofAgile Projects	Agile estimation, Story point estimation, Sprint velocit yestimation,teamcapacity,Planningandcontrollingagileprojects.	4
		Totalnumberof Lectures	42

EvaluationCriteria	
Components	MaximumMarks
T1	20
T1	20
EndSemesterExamination	35
TA	25 *Attendance(10)+Quiz (10)+ PBL(5)*
Total	100

Projectbasedlearning: Eachstudentinagroupof3-4havetoworkonamini-project,inwhichtheywillidentifya real-life problem and develop the solution by applying their knowledge of search-based software engineeringapproach.Theprojectimplementationcanbeinanyprogramminglanguagepreferablyalongwithwelldocumen tation on different aspects of the software. It enhances the understanding of students towards differentconceptsof search-basedsoftwareengineeringapproachand alsohelps themduringtheiremployability.

RecommendedReadingmaterial: Author(s),Title,Edition,Publisher,YearofPublicationetc.(Textbooks,Reference Books,Journals,Reports,Websites etc.intheIEEE format)

1.	Shore, J., & Warden, S. (2021). *The art of agile development*. O'Reilly Media, Inc.
2.	Merkow, M. (2019). *Secure, resilient, and agile software development*. CRC Press.
3.	Martin, R. C. (2019). *Clean agile: back to basics*. Pearson Education.
4.	Stellman,A.,&Greene, J. (2014) *Learningagile:Understandingscrum,XP,lean,andkanban*.O'ReillyMedia, Inc.

Recommended Reference material:

1.	Santos, P.M., Consolaro, M. & Di Gioia, A.(2019). *Agile Technical Practices Distilled: A learning journey in technical practices and principles of software design*. Packt Publishing Limited.
2.	Goodpasture, J. C. (2015). *Project management the agile way: Making it work in the enterprise*. J. Ross Publishing.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	22B12CS422	Semester: Even	Semester VIII Session 2022 -2023
			Month from: Jan 2023 to June 2023
Subject Name		Cloud computing essentials: Azure and AWS (22B12CS422)	
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	Deepti (J62), Astha Singh(J128)
	Teacher(s) (Alphabetically)	Deepti, Astha Singh

	COURSE OUTCOMES	COGNITIVE LEVELS
C434-7.1	Recall the fundamentals of Cloud Computing, its applicability and architecture.	Remember (level 1)
C434-7.2	Understand the architecture and services of AWS (Amazon Web Services), Azure and Google Cloud platforms.	Understand (level 2)
C434-7.3	Apply the AWS, Azure and Google cloud platform to solve the real-world problems.	Apply (level 3)
C434-7.4	Analyze the AWS, Azure and Google cloud platform to solve the real-world problems	Analyze (level 4)
C434-7.5	Create the applications using appropriate cloud platforms.	Create (level 5)

Module No.	Subtitle 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 (5), Mini-Project (10), Tutorial (5) Quiz (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)	
	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/

Signature: **Signature:**
Module Coordinator: Dr. Rashmi Kushwaha   **Course Coordinator:** Astha Singh
(J-128), Deepti Singh (J-62)

Fuzzy Optimization & Decision Making (18B12MA811)

Fuzzy numbers, operations with fuzzy numbers, fuzzy set, basic operations of fuzzy sets, fuzzy relations, operations in fuzzy relations, Generalized fuzzy operations, fuzzy relations and approximate reasoning, decision making in a fuzzy environment, multistage decision making, fuzzy ranking methods, fuzzy linear programming, fuzzy transportation problem.

Course Description

Course Code	18B12MA811		**Semester** Even	**Semester** VIII **Session** 2023-2024
				Month from Jan 2024 to June 2024
Course Name	Fuzzy Optimization and Decision Making			
Credits	3		**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Lakhveer Kaur		
	Teacher(s) (Alphabetically)	Dr. Lakhveer Kaur		

COURSE OUTCOMES		COGNITIVE LEVELS
After pursuing the above mentioned course, the students will be able to:		
C402-24.1	Explain the concept of fuzzy sets, fuzzy numbers along with their types, generalized fuzzy sets and fuzzy relations.	Understanding Level (C2)
C402-24.2	Apply the concept of fuzzy relations to approximate reasoning.	Applying Level (C3)
C402-24.3	Utilize the concept of fuzzy sets and their generalizations in various decision-making processes.	Applying Level (C3)
C402-24.4	Analyze various ranking techniques for solving fuzzy transportation problems.	Analyzing Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Fuzzy sets and fuzzy numbers	Fuzzy sets and fuzzy numbers, basic operations, operations on [0, 1] – fuzzy negation, triangular norms, t-conorms, fuzzy implications, aggregation operations, fuzzy functional equations.	7
2.	Fuzzy and generalized fuzzy operations	Type - 1 and Type - 2 fuzzy sets, intuitionistic fuzzy sets. triangular fuzzy numbers, trapezoidal fuzzy numbers, bell shaped fuzzy numbers, fuzzy numbers with a flat, piecewise quadratic fuzzy numbers.	7

3.	Fuzzy relations and approximate reasoning	Fuzzy binary and n-ary relations, composition of fuzzy relations, fuzzy equivalence relations, fuzzy compatibility relations -fuzzy relational equations, applications of fuzzy relations in approximate reasoning.	8
4.	Decision making in fuzzy environment	Decision making in a fuzzy environment, individual decision making, multiperson decision making, multicriteria decision making, multistage decision making, fuzzy zero-based budgeting, fuzzy averaging for decision making.	10
5.	Ranking techniques in fuzzy transportation problems	Fuzzy ranking methods, fuzzy linear programming, fuzzy transportation, basic definitions associated with fuzzy transportation, algorithms for solution of fuzzy transportation problem.	10
Total number of Lectures			**42**

Evaluation Criteria

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

Project based learning: Students are divided in a group of 4-5 to do a survey on utilization of fuzzy sets and their generalizations for various decision-making processes in their respective branches. The students recognize decision making problems in fuzzy environment, arising in practical situations and solve these problems with the aid of different techniques, learnt in this course.

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

1.	**Bhargava, A. K.,** Fuzzy Set Theory, Fuzzy Logic and Their Applications, S. Chand & Company Pvt. Ltd., 2013.
2.	**Zimmermann, H. J.**, Fuzzy Set Theory and its Applications, 4th Edition, Allied Publishers, New Delhi, 1991.
3.	**Ross, T.J.**, Fuzzy logic with engineering applications, 2nd Edition, John Wiley and Sons, Ltd, 2004.
4.	**Baczynski, M. and Jayaram, B.**, Fuzzy Implications, Springer Verlag, Heidelberg, 2008.
5.	**Klir, G. J. & Yuan, B.**, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall NJ, 1995.

Course Code	22B12CS420	Semester Even (specify Odd/Even)	Semester:VIIIth Session 2023 -2024 Month : January to May	
Course Name	Software Construction using Kubernetes & Microservices			
Credits	4		Contact Hours	3-0-0

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

COURSE OUTCOMES		COGNITIVE LEVELS
C434-6.1	Understand the Devops practices and the complete delivery pipeline using Jenkins.	Understand Level (Level 2)
C434-6.2	Applying the version control system through platform like Git and GitHub	Apply Level (3)
C434-6.3	Compare different microservices, domain drivers and design patterns.	Analyze Level (Level4)
C434-6.4	Evaluating security and test strategies for microservices using access tokens and test principles.	Evaluate Level (Level 5)
C434-6.5	Evaluate containerization concepts through kubectl commands and pod concepts.	Evaluate Level (Level5)
C434-6.6	Create application using Kubernetes with controllers and load balancers.	Create Level (Level6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to DevOps	Why DevOps, DevOps Stages, Continuos Integration (CI), Continuos Delivery (CD) and Continuons Deployment (CDep), Continuos monitoring, DevOps Tool support.	6
2.	Jenkins and CI/CD pipeline, Git Commands	Introduction to Jenkins (With Architecture) Jenkins Management, Adding a slave nodeto Jenkins Building Delivery Pipeline,Github and Git commands.	6
3.	Why microservices	Monolithic architecture, microservices architecture, service-oriented architecture (SOA), REST architecture, Inter process Communication, microservice transaction management	6
4.	Microservices Design	Microservices design patterns, domain driver design, designing small microservices, designing independent microservices,	6
5.	Microservices security and testing	Importance of security in microservices, microservices security principles and techniques, access tokens, testing strategy for microservices, testing at different levels for	6

		microservices.	
6.	Kubernetes fundamentals	Kubernetes core concepts, kubectl commands, Pods concepts, configuring cluster nodes	6
7.	Kubernetes implementation	Kubernetes services and controllers, load balancing and deployment, configuringkubernetesscheduler, deploying an application using dashboard	6
		Total number of Lectures	42

Evaluation Criteria

T1:20

T2:20

T3:35

TA: 25 (Attendance-5, quizzes-6, assignments-5, Project-9)

Total :100

Project based learning: Each student in a group of 4-5 will select an application and will create the entire DevOps process. They will learn to work with tools and technologies such as Docker, Git, Kubernetes, Microservices and Jenkins. DevOps is currently all the rage and the demand for DevOps engineers are high. With a lot of companies focusing on reducing the operational time and costs, DevOps has become an important factor. Working on the project enhances the student's knowledge on of new world data applications and helps in enhancing their employability into related sector.

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)
1.	Davis, Jennifer.Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale. OriellyPublication. 1st edition. 2016
2.	Gene, Kim. The Phoenix Project: A Novel About IT, DevOps, and Helping Your Business Win. IT Revolution USA. 3rd edition. 2016
3.	Newman, Sam. Building Microservices: Designing Fine-Grained Systems. OOrielly Publication. 1st edition. 2016
4.	Baier Jonathan. The complete kubernetes guide. Packt publishing house, Ist edition. 2019

Syllabus

CourseCode	15B1NHS832	SemesterEven (specifyOdd/Even)		SemesterVIII Session2023-24 Monthfrom Jan- June	
CourseName	InternationalStudies				
Credits	3		ContactHours	3-0-0	

Faculty(Names)	Coordinator(s)	Dr.Ila Joshi (62), Dr Gaurika Chugh (128)
	Teacher(s) (Alphabetically)	

COCode	COURSEOUTCOMES	COGNITIVELEVELS
C402-8.1	Demonstrate an understanding of the basic concepts and theoriesin the area ofinternationalstudies	Understanding(C2)
C402-8.2	Demonstrate an understanding of the contemporary world issues.	Understanding(C2)
C402-8.3	ComparethechangesinIndia'sforeignpolicyintheColdWareraandthepost-Cold War era	Applying(C3)
C402-8.4	Analyzethemajorpoliticaldevelopmentsandeventssincethe20th century	Analyzing(C4)
C402-8.5	Analyze the working of various international and regional organizationsand their influence in international relations.	Analyzing(C4)

Module No.	Titleo ftheModule	TopicsintheModule	No. of Lectures fo rthemodule

1.	BasicConcepts	• Approaches to the Study of International Relations:Idealist, Realist, Neo-Realist Theory
		• Key Concepts in International Relations:
		  1) National interest and its instruments,
		  2) Power: Hard and Soft Power
		  3) Balance of power and Collective Security
			8

2.	An Overview ofTwentieth CenturyInternational RelationsHistory	• WorldWarI:Causesand Consequences • Fascist/Nazi Ideology • WorldWarII:CausesandConsequences • Diplomacy after World Wars: Old and New	4
3	ColdWarPolitics	• OriginandPhasesoftheColdWar • CausesoftheEndoftheColdWar • Non-Alignment Movement (NAM)	6
4	United Nations and World Politics	• League of Nations: Brief Introduction • UnitedNationsanditsOrgans:StructureandPowers. • ChapterVI:UnitedNationsandPeacefulSettlementofDisputes:Inquiry,Negotiation,Mediation,Conciliation and Arbitration • Chapter VII: United Nations and Collective SecurityMechanism (Case study of Korean War).	8

		• United Nations and Reforms	
5.	India's ForeignPolicy	• Basic Determinants (Historical, Geo-Political,Economic, Domestic and Strategic) • India- LookEastPolicy and Act East Policy • India-SAARC,ASEAN • India–QUAD,G20	8
6	Contemporary Global Concerns	• Human Rights • Role of Diaspora • Terrorism • Nuclear Proliferation	8

			TotalnumberofLectures	**42**

EvaluationCriteria

Components	MaximumMarks
T1	20
T2	20
EndSemesterExamination	35
TA	25(Assignment/ClassTest/Quiz)
Total	**100**

	Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books,ReferenceBooks, Journals,Reports, Websites etc. in theIEEE format)
1.	Appadorai,&Rajan,M.S.(eds.) (1985).*India'sForeignPolicyandRelations*.NewDelhi:SouthAsianPublishers.
2.	Baylis, J. & Smith, S. (eds.) (2011). *The Globalization of World Politics: An Introduction to InternationalRelations*.Fifth Edition. Oxford: Oxford UniversityPress,
3.	Calvocoressi,P.(2001).*WorldPolitics:1945—2000*.Essex:Pearson
4.	Carr,E.H.(2004).*InternationalRelationsbetweentheTwoWorldWars:1919-1939*.NewYork:Palgrave
5.	Chatterjee.A (2018).*InternationalRelationsToday*.Noida:Pearson
6.	Ganguly,S.(ed.)(2019).*India'sForeignPolicy:RetrospectandProspect*.NewDelhi:OxfordUniversityPress
7.	Goldstein,J.andPevehouse,J.C.(2009).*InternationalRelations*.NewDelhi:Pearson
8.	Hobsbawm,E.(1995).*AgeofExtreme:TheShortTwentiethCentury,1914—1991*.London:Abacus
9.	Mewmillians,W.C.andPiotrowski,H. (2001).*TheWorldSince1945:AHistoryofInternationalRelations*.Fifth edition. London:LynneRienner Publishers.
10.	Pant,H.V.(2009).*India'sForeignPolicyintheUnipolarWorld.*Delhi:Routledge