Detailed Syllabus

Lecture-wise Breakup

Course Code	18B12MA811	**Semester** Even	**Semester** VIII **Session** 2019 -2020 **Month from** Jan 2019 -June 2020
Course Name	Fuzzy Optimization and Decision Making		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Amit Srivastava	
	Teacher(s) (Alphabetically)	Dr. Amit Srivastava	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-24.1	Explain the concept of fuzzy sets and fuzzy numbers.	Understanding level(C2)
C402-24.2	Explain various fuzzy and generalized fuzzy operations.	Understanding level(C2)
C402-24.3	Apply the concept of fuzzy relations and approximate reasoning.	Apply level(C3)
C402-24.4	Apply the concept of fuzzy sets and their generalizations in various decision making processes.	Apply level(C3)
C402-24.5	Apply various ranking techniques in solving fuzzy transportation problems.	Apply level(C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fuzzy sets and fuzzy numbers.	Definition of Fuzzy Set, Operations with fuzzy numbers. Triangular Fuzzy Numbers, Bell Shaped Fuzzy Numbers, Fuzzy Numbers with a Flat, Trapezoidal fuzzy Numbers, Piecewise – Quadratic Fuzzy Numbers with a Flat.	7
2.	Fuzzy and generalized fuzzy operations.	Addition and Subtraction of Fuzzy Numbers, Multiplication of Fuzzy numbers, Distance between Triangular Fuzzy Numbers, Fuzzy Operations in the set of integers , Distance between Triangular Fuzzy Numbers, Fuzzy Numbers with a Maximum, Fuzzy Numbers in the set of Integers, Fuzzy Numbers of Dimension Two, Definition of Fuzzy Set, Basic Operations of Fuzzy Sets.	7
3.	Fuzzy relations and approximate reasoning.	Fuzzy Relations, Operations in Fuzzy Relations, Direct Product, Projections of Fuzzy Relation, Max-Min and Min-Max Compositions, Properties of Fuzzy Relations, Fuzzy Relations and 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, 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**

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.

Optimization Techniques (16B1NMA831)

Lecture-wise Breakup

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

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

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

	Programming	problem, Newton's Method Golden Section, Fibonacci Search, Bisection, Steepest Descent Method, Multidimensional Newton's method.	
		Total number of Lectures	**40**

Evaluation Criteria

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

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

1.	Taha H. A., Operations Research: An Introduction, 7th edition, PHI, 2002.
2.	Rao, S. S. - Engineering Optimization, Theory and Practice, Third Edition, New Age International Publishers, 2010.
3.	Wagner, H. M., Principles of Operations Research with Applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd., 1975.
4.	Hillier F. and Lieberman G. J., Introduction to Operations Research, 6th edition, McGraw-Hill, 1995.

Multi Attribute Decision Making

Lecture-wise Breakup

Course Code	**20B12MA411**	**Semester** Even	**Semester** VIII **Session** 2018 -2019 **Month from** Jan 2019 - June 2019
Course Name	**Multi Attribute Decision Making**		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Dinesh C. S. Bisht	
	Teacher(s) (Alphabetically)	Dr. Dinesh C. S. Bisht	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C402-6.1	explain basic steps in decision analysis and decision making environments.	Understanding Level (C2)
C402-6.2	apply group decision making methods to reach a collective decision.	Applying Level (C3)
C402-6.3	develop the concept of multi criteria decision making process and attributes.	Understanding Level (C2)
C402-6.4	apply elementary methods to solve multi attribute decision making problems.	Applying Level (C3)
C402-6.5	analyze value based and outranking methods to solve multi attribute decision making problems.	Analyzing Level (C4)

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 Methods.	8
4.	Elementary	Dominance Relation method, Even-Swap method,	8

	Methods for MADM	Lexicographic method Maximax method, Maximin method, Conjunctive method, Disjunctive method, Median Ranking, Analytic Hierarchy Process, Analytic Network Process.	
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**

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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH813	**Semester: EVEN**	**Semester: VIII Session** 2019 -2020 **Month from: January to June**
Course Name	Bio-Physics		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr Papia Chowdhury
	Teacher(s) (Alphabetically)	Dr Papia Chowdhury

COURSE OUTCOMES		**COGNITIVE LEVELS**
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	10

		system, productions of radionuclides, Radio tracer techniques, Radio sensitisation and protection, Target theory, Cellular effects of radiation, Radiation damage, Genetic Effect 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 (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	**100**

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

1.	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.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	18B12PH812	**Semester: Even**	**Semester 8 Session 2019 -20** **Month from January to June**
Subject Name	**Astrophysics**		
Credits	**03**	**Contact Hours**	**03**
Faculty (Names)	**Coordinator(s)**	**Prof. Anirban Pathak**	
	Teacher(s) (Alphabetically)	**Anirban Pathak**	

S. No.	**DESCRIPTION**	**COGNITIVE LEVEL**
CO1	Relate historical development of astrophysics with the modern concepts and recall the mathematical techniques used & definition of different units	Remember Level (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	Understand Level (C2)
CO3	Apply mathematical principles and laws of physics to solve problems related to astrophysical systems	Apply Level (C3)
CO4	Compare different models of universe and decide which one is logically acceptable and why	Analyze Level (C4)

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
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	**6**

		black holes.	
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**
4.	GTR and Models of Universe	Qualitative idea of general theory of relativity (without using tensor calculus) and its implications. Different models of universe. Specific attention to the ideas related to big bang, cosmological constants, dark mater and dark energy.	**6**
5.	Astrobiology	Drake equation and related questions.	**2**
6.	Conclusion	Review of the present status of Astrophysics and open questions.	**2**

Evaluation Criteria

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

Recommended Reading

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

Detailed Syllabus
Lecture-wise Breakup

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

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Recall the fundamental properties of light and the processes involved in the generation of light	Remember Level (C1)
CO2	Interpret the theory of fiber optics	Understand Level (C2)
CO3	Apply the fundamentals of various nonlinear optical effects in technology; make use of holography and its applications	Apply Level (C3)
CO4	Compare the operational principles, characteristics and trade-offs of optical detectors and modulators of light	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Lasers	Review of different types of laser systems. LEDs, Semiconductor lasers, Quantum well lasers, Modes of laser cavity, Q-switching and Mode locking in lasers.	8
2.	Fiber Optics	Numerical aperture, Step and graded index multimode fibers, attenuation and dispersion, modes in optical fibers. Single mode fiber, mode cutoff and mode field diameter. Connector and splice losses, Erbium doped fiber amplifier and Characterization techniques including OTDR.	10
3.	Photo detectors	Semiconductor photo detectors.	5
4.	Optical Electronics	Wave propagation in anisotropic media, Electro-optic effect: phase and amplitude modulation. Acousto-optic effect: modulators, deflectors and tunable filters, Magneto-optic effect: modulators.	4
5.	Optical devices	Electro-optical device, Acousto-optical device, Magneto-optical device, Voice communication, Optical communication.	2
6.	Nonlinear Optics	SHG, Sum and Difference frequency generation, parametric amplification, wavelength converters, Self focusing with lasers.	6
7.	Holography	Recording and Reproduction of Hologram, Applications of holography.	4
8.	Applications of Photons in Memory devices	CD, VCD, DVD.	1
		Total number of Lectures	**40**

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

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

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

Detailed Syllabus
Lecture-wise Breakup

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

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Recall the fundamental properties of light and the processes involved in the generation of light	Remember Level (C1)
CO2	Interpret the theory of fiber optics	Understand Level (C2)
CO3	Apply the fundamentals of various nonlinear optical effects in technology; make use of holography and its applications	Apply Level (C3)
CO4	Compare the operational principles, characteristics and trade-offs of optical detectors and modulators of light	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Lasers	Review of different types of laser systems. LEDs, Semiconductor lasers, Quantum well lasers, Modes of laser cavity, Q-switching and Mode locking in lasers.	8
2.	Fiber Optics	Numerical aperture, Step and graded index multimode fibers, attenuation and dispersion, modes in optical fibers. Single mode fiber, mode cutoff and mode field diameter. Connector and splice losses, Erbium doped fiber amplifier and Characterization techniques including OTDR.	10
3.	Photo detectors	Semiconductor photo detectors.	5
4.	Optical Electronics	Wave propagation in anisotropic media, Electro-optic effect: phase and amplitude modulation. Acousto-optic effect: modulators, deflectors and tunable filters, Magneto-optic effect: modulators.	4
5.	Optical devices	Electro-optical device, Acousto-optical device, Magneto-optical device, Voice communication, Optical communication.	2
6.	Nonlinear Optics	SHG, Sum and Difference frequency generation, parametric amplification, wavelength converters, Self focusing with lasers.	6
7.	Holography	Recording and Reproduction of Hologram, Applications of holography.	4
8.	Applications of Photons in Memory devices	CD, VCD, DVD.	1
		Total number of Lectures	**40**

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

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

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18B12PH812	**Semester: Even**	**Semester 8 Session 2019 -20** **Month from January to June**
Subject Name	**Astrophysics**		
Credits	**03**	**Contact Hours**	**03**
Faculty (Names)	**Coordinator(s)**	**Prof. Anirban Pathak**	
	Teacher(s) (Alphabetically)	**Anirban Pathak**	

S. No.	**DESCRIPTION**	**COGNITIVE LEVEL**
CO1	Relate historical development of astrophysics with the modern concepts and recall the mathematical techniques used & definition of different units	Remember Level (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	Understand Level (C2)
CO3	Apply mathematical principles and laws of physics to solve problems related to astrophysical systems	Apply Level (C3)
CO4	Compare different models of universe and decide which one is logically acceptable and why	Analyze Level (C4)

Module No.	**Subtitle of the Module**	**Topics**	**No. of Lectures**
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	**8**

		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.	
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**
4.	GTR and Models of Universe	Qualitative idea of general theory of relativity (without using tensor calculus) and its implications. Different models of universe. Specific attention to the ideas related to big bang, cosmological constants, dark mater and dark energy.	**6**
5.	Astrobiology	Drake equation and related questions.	**2**
6.	Conclusion	Review of the present status of Astrophysics and open questions.	**2**

Evaluation Criteria

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

Recommended Reading

1.	Astrophysics for Physicists, Arnab Rai Choudhuri, Cambridge University Press, Delhi, 2010.
2.	Astrophysics: Stars and Galaxies, K D Abhyankar, University Press, Hyderabad, 2009.
3.	Facts and Speculations in Cosmology, J V Narlikar and G Burbidge, Cambridge University Press, Delhi, 2009.
4.	The Cosmic Century, Malcolm Longair, Cambridge University Press, Cambridge, 2006.

5.	An Introduction to Astrophysics, Baidyanath Basu, Prentice Hall of India, Delhi 1997.
6.	Fundamentals of Equations of State, S. Eliezer, A Ghatak and Heinrich Hora, World Scientific, Singapore, 2002. Only Chapter 15.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12PH813	**Semester: EVEN**	**Semester: VIII Session** 2019 -2020 **Month from: January to June**
Course Name	Bio-Physics		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr Papia Chowdhury
	Teacher(s) (Alphabetically)	Dr Papia Chowdhury

COURSE OUTCOMES		**COGNITIVE LEVELS**
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	10

		system, productions of radionuclides, Radio tracer techniques, Radio sensitisation and protection, Target theory, Cellular effects of radiation, Radiation damage, Genetic Effect 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 (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	**100**

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

1.	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.

Detailed Syllabus
Lecture-wise Breakup

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

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

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

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

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

Evaluation Criteria

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

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

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

Detailed Syllabus

Course Code	19B12CS412	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2019 -2020 **Month from** January to June
Course Name	Advanced Java Programming		
Credits	4	**Contact Hours**	3-1-0

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

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

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

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

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Mini Project (6), Attendance (7), Internal assessment (5), Quiz (7))
Total	**100**

Textbooks	
1	Goetz, B., Peierls, T., Lea, D., Bloch, J., Bowbeer, J., & Holmes, D. Java concurrency in practice. Pearson Education. 2017.
2	Basham, Bryan, Kathy Sierra, and Bert Bates. Head First Servlets and JSP. " O'Reilly Media, Inc.", 2016 re-print.

Reference Books	
1	Schildt, Herbert. Java: The Complete Reference, Ninth Edition. US: McGraw-Hill Osborne Media, 2017.
2	Core and Advanced Java, Black Book, Ninth Edition. Dreamtech press, 2018.

Module Coordinator

Course Coordinator

Detailed Syllabus
Lecture-wise Breakup

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

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

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

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

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

Evaluation Criteria

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

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

Text Book:

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

Reference Book

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

Module Coordinators: Course Coordinators

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12CS413	**Semester Even**	**Semester VIII Session** 2019 -2020 **Month from January to May**
Course Name	Performance Analysis of Computing Systems		
Credits	**4**	**Contact Hours**	3-1-0 (L-T-P)

Faculty (Names)	**Coordinator(s)**	Dr. Amrit Pal Singh
	Teacher(s) (Alphabetically)	Dr. Amrit Pal Singh

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-5.1	Demonstrate the performance goals for methods and algorithms in computational systems and understand the various random variables with its applications.	Understand Level (C2)
C433-5.2	Inspect and examine the outcome of experiments using various approaches or techniques.	Analyze Level (C4)
C433-5.3	Select and interpret appropriate evaluation techniques, performance metrics and workloads for a system.	Evaluate Level (C5)
C433-5.4	Apply and build Markovian model to develop continuous & discrete-time queuing process by discussing various queuing models.	Apply Level (C3)
C433-5.5	Classify and examine various probability distribution model for a given applications and compare the performance of various techniques or algorithms.	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Probability Models and Simulation:**	Probability space, Random variables; Discrete and Continuous distribution: uniform, geometric, exponential, normal distribution etc, System Modeling, Measurement techniques, Experimental design, workload design, Simulations, Data analysis and Visualization.	14
2.	**Basics of Modeling:**	Performance metrics: Bandwidth utilization, throughput, delays, error rate, network reliability etc., Poisson process, Bernoulli splitting, PASTA, and Markov chain theory.	8
3.	**Queuing Theory:**	Arrival and service processes, Server disciplines, Queuing networks: Open vs. closed networks, Product-form queuing networks, M/M/1, M/M/1/K, M/M/m, M/M/m/m. M/G/1 full analysis;	12
4.	**Simulation and Analysis of Computing systems:**	Simulations: time averages versus ensemble averages, Asymptotic bounds and limit theorems, confidence intervals, generating random variables for simulation, Monte-Carlo simulation, Inspection Paradox; Empirical Workload Measurements: heavy-tailed property, Pareto distributions, self-similarity, heavy-tailed distributions;	6
5.	**Applications of**	Analysis of Scheduling: FCFS,LCFS, SJF etc., analyze the different computing system based on real life application	2

	Computing Systems:		
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
Attendance:	7
Class Test/Quizzes	7
Internal Assessment	5
Assignment In PBL Mode	6
Total	**100**

Text Books:

T1.	Sheldon M. Ross: Introduction to Probability Models 11th Edition, Academic Press, 2014.
T2.	Mor Harchol-Balter, Performance modeling and design of computer systems: queueing theory in action. Cambridge University Press, 2013.
T3.	Kishor S. Trivedi, Probability and Statistics with Reliability, Queueing, and Computer Science Applications, Wiley, 2nd edition, 2016.

Reference Books:

R1.	Sanjay K. Bose, "An Introduction to Queuing System", Springer 2002
R2.	Bertsekas D. and Gallager R., Data Networks. Englewood Cliffs, NJ: Prentice-Hall, 1992
R3.	L. Kleinrock, Queueing Systems, Vol. I: Theory, John Wiley & Sons, Inc., 1975.
R4.	Edited by P. Chretienne, E. G. Coffman, J. K. Lenstra and Z. Liu, Scheduling Theory and its Applications, John Wiley and Sons, 1995.
R5.	Larry L. Peterson and Bruce S. Davie, " Computer Networks: A Systems Approach ", 3rd Edition, Elsevier Publication, 2003.
R6.	R. Jain, The Art of Computer Systems Performance Analysis: Techniques for Experimental Design, Measurement, Simulation and Modeling, John Wiley & sons, 1991.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**18B12CS415**	**Semester** EVEN **(specify Odd/Even)**	**Semester VIII Session** 2019 -2020 **Month from January** 2020 – June 2020
Course Name	**Search-Based Software Engineering (SBSE)**		
Credits	4	**Contact Hours**	3-1-0

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

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

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	Search-based Software Engineering (SBSE), why SBSE, architecture of SBSE, commonly used search techniques, Optimization Problems, Metaheuristic Algorithms, software engineering problem as a search-based optimization problem	4
2.	Optimization	Various types of optimization problems (e.g., linear and non-linear, convex and non-convex, single and multi-objective, etc.) in the context of software engineering	3
3	Problem Formulation	Define and formulate various software engineering activities/tasks e.g., requirement analysis, software design and software restructuring as search-based optimization problem	6
4.	Meta-heuristics	Tailoring various optimization methods and algorithms used in search-based software engineering., according to their suitability with respect to various classes of software engineering problems	6

5.	Application to software engineering problem	Apply and Implement different optimization techniques on various forms of software optimization problems e.g., Requirement analysis, software design software architecture recovery, software refactoring, and software remodularization	6
6.	Statistical Analysis	Statistical hypothesis testing, parametric and nonparametric statistical tests for the analysis of the search-based software engineering solutions	6
7.	Evaluation	Evaluate the performance of different single and multi and many-objective search-based optimization techniques using different quality indicators such as Generational Distance (GD), Inverted Generational Distance (IGD), hyper-volume (HV), Error Ratio, Set Coverage Metric, Spacing and Spread	7
8.	SBSE Tools	Tools for SBSE include OpenPAT, JMetal, EvoSuite and Coverage a code coverage measurement tool for Python, etc.	4
		Total number of Lectures	42

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [Attendance = 07 , Class Test, Quizzes, etc = 07, Internal assessment = 05 , Assignments in PBL mode = 06].
Total	**100**

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

Text Book

1	Nature-Inspired Optimization Algorithms, **by Xin-She Yang** Publisher: Elsevier *Release Date: February 2014,* ISBN: 9780124167438

Reference Books

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

Module Coordinators: Course Coordinators

Detailed Syllabus
Lecture-wise Breakup

Subject Code	18B12CS419	**Semester -Even**	**Semester** VIII **Session** 2019 - 20 **Month from** January **to** June
Subject Name	Distributed Computing		
Credits	**4**	**Contact Hours**	**3-1-0**

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

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

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Review of principles, concepts foundation to Distributed Systems.	Review of Operating Systems principles, Introduction to Distributed Systems.	2
2.	Consistency and Replication Issues	Data-centric consistencies, Client-centric consistencies. Epidemic Protocols and Implementation Issues, Distributed Hash Tables and Distributed Lookup Services	8
3.	Fault Tolerance and Reliability	Fault Tolerance, Reliability in Distributed Systems, group communications, and Distributed commit. Two Phase commit and Three Phase commit.	7

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

Evaluation Criteria

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

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

Text Books

1	Sukumar Ghosh,. *Distributed systems: an algorithmic approach*. Chapman and Hall/CRC, 2014.
2.	M. van Steen and A.S. Tanenbaum, Distributed Systems, 3rd ed., distributed-systems.net, 2017.

Reference Books

1.	Ajay Kshemkalyani and Mukesh Singhal. *Distributed computing: principles, algorithms, and systems*. Cambridge University Press, 2011.
2	M. Singhal, N. G. Shivaratri, Advanced Concepts in Operating Systems, 1st Ed., Tata McGraw-Hill, 1994.
3.	"Introduction to Cloud Computing Architecture" Sun's White Paper, 1st Edition, June, 2009.
4.	IEEE, ACM Transactions, Journals and Conference papers on "Distributed and Cloud

	Computing."
5.	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'REILLY publication.
6.	"Virtualization Overview", White paper, VM Ware.
7.	"Implementing Virtualization" White paper, Intel virtualization Technology
8.	Tulloch, Mitch, Understanding Microsoft virtualization solutions: From the Desktop to Data Center, Microsoft Press.

Module Coordinators: Course Coordinators

Course Description
Detailed Syllabus

Course Code	18B12CS428	**Semester : EVEN**	**Semester : VIII Session** 2019 -2020 *Month:* **from Jan- June, 2019**
Course Name	Introduction to Deep Learning		
Credits	04	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Satish Chandra /Shikha Mehta
	Teacher(s) (Alphabetically)	1. Satish Chandra 2. Bharat Gupta

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

Lecture Plan:

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

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35

TA	25 (Attendance = 07,Class Test, Quizzes, etc = 07,Internal assessment = 05 Assignments in PBL mode = 06)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Text Books:	
1.	Nikhil Buduma, Fundamentals of Deep Learning, Shroff Publishers , 2018
2	Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Pess , 2017
Reference Book:	
1.	FRANÇOIS CHOLLET, Deep Learning with Python, Manning Publications, 2018

Module Coordinators:

Course Coordinators
Satish Chandra
Shikha Mehta

Detailed Syllabus
Lecture-wise Breakup

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

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

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

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

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

Evaluation Criteria

Components	**Maximum Marks**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (project/movie review/quiz)

Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Bhattacharjee. S. (2016). *Industrial Sociology*. Aavishkar Publications. Jaipur
2.	Edgell, S. (2006). "Unpaid Work-Domestic and Voluntary work". *The Sociology of Work: Continuity and Change in Unpaid Work.* NewDelhi:Sage
3.	Freeman. C. (2009). 'Feminity and Flexible labour: Fashioning Class through gender on the global assembly line'. Massimiliano Mollona, Geert De Neev and Jonathan parry (eds.) *Industrial Work And life:An Anthropological Reader*.Berg: Oxford
4.	Grint, K.(2005)."Classical Approaches to Work: Marx, Durkheim and Weber". *The Sociology of Work: An Introduction*. Polity Press. Cambridge.
5.	Mishra. R (2016). *Industrial Sociology*. Laxmi Publications. New Delhi
6.	Prasad. J (2013). *Industrial Sociology*.Vayu Education of India: Delhi
7.	Singh. Y. & Sharma. R (2016). *Industrial Sociology*. AITBS Publishers: Delhi
8.	Sinha, P.N.R. (2006). *Industrial relations, Trade Unions and Labour legislations*. Pearson: New Delhi
9.	Watson, T.J. (2003). *Sociology, Work and Industry.* Routledge: London and New York

Detailed Syllabus

Lecture-wise Breakup

Course Code	18B12HS814	**Semester** Even	**Semester** VIII **Session** 2019 -2020 **Month from** Jan 2020 to June 2020
Course Name	Knowledge Management		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Anshu Banwari	
	Teacher(s) (Alphabetically)	Dr. Anshu Banwari	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-30.1	Demonstrate the way knowledge is embedded in today's organization and behavioral aspects involved in managing it	Understanding Level (C2)
C402-30.2	Compare and contrast different methods to preserve, nurture, share and manage knowledge	Understanding Level (C2)
C402-30.3	Identify appropriate methods for knowledge integration to gain competitive advantage	Applying Level (C3)
C402-30.4	Identify the legal ramifications arising from knowledge sharing and an insight into the ethical concerns faced by individuals and organizations	Applying Level (C3)

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	6

		capture, Interview as a tool, Knowledge capture 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 (Assignment, Project)
Total	**100**

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

1	**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

Detailed Syllabus
Lecture-wise Breakup

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

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-32.1	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 of Quality	Perspectives and Definitions of Quality, Dimensions Of Quality for Product and Service, History of Quality, Phases of Quality Assurance, Alignment, Linkage, Reengineering, Contribution of Gurus – Shewhart, Deming, Ishikawa, Juran	6
2.	Cost of Quality and Quality Function Deployment	Cost of Quality, Voice Of Customers: Kano's Model, House Of Quality, QFD Process	6
3.	Basic Tools of Quality	Checksheets, Cause and Effect Diagrams, Histograms, Flowcharts, Pareto Analysis, Scatter Diagrams, Run Charts	9
4.	Statistical Thinking And Applications	Acceptance Sampling, Single Sampling Plan, Double Sampling Plan, Statistical Process Control, Specification And Control Limits, Control Charts For Attributes, Control Charts For Variables	9
5.	Six Sigma, Benchmarking and Lean Concepts	Six Sigma, Capability Of A Process/Product/Service, DMAIC Process, Benchmarking Meaning, Process, Methods; JIT, Andon, Kanban, Kaizen, Poka-Yoke, 5-S, 7 Mudas	9
6.	Quality Standards and Awards	ISO Standards, MBNQA, RGNQA, Deming Prize	3
Total number of Lectures			**42**

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

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	NVS Raju, Total Quality Management, 1st Edition, Cengage Learning, 2018
2.	Kanishka Bedi, Quality Management, 1st Edition, Oxford University Press, 2006
3.	D.H. Besterfield, Total Quality Management, Revised 3rd Edition, Pearson Education, 2011

Detailed Syllabus

Lecture-wise Breakup

Course Code	18B12MA811	**Semester** Even	**Semester** VIII **Session** 2019 -2020 **Month from** Jan 2019 to June 2020
Course Name	FUZZY OPTIMIZATION AND DECISION MAKING		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. AMIT SRIVASTAVA	
	Teacher(s) (Alphabetically)	Dr. AMIT SRIVASTAVA	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-24.1	Explain the concept of fuzzy sets and fuzzy numbers.	Understanding level(C2)
C402-24.2	Explain various fuzzy and generalized fuzzy operations.	Understanding level(C2)
C402-24.3	Apply the concept of fuzzy relations and approximate reasoning.	Apply level(C3)
C402-24.4	Apply the concept of fuzzy sets and their generalizations in various decision making processes.	Evaluate level(C5)
C402-24.5	Apply various ranking techniques in solving fuzzy transportation problems.	Apply level(C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Fuzzy sets and fuzzy numbers.	Definition of Fuzzy Set, Operations with fuzzy numbers. Triangular Fuzzy Numbers, Bell Shaped Fuzzy Numbers, Fuzzy Numbers with a Flat, Trapezoidal fuzzy Numbers, Piecewise – Quadratic Fuzzy Numbers with a Flat.	7
2.	Fuzzy and generalized fuzzy operations.	Addition and Subtraction of Fuzzy Numbers, Multiplication of Fuzzy numbers, Distance between Triangular Fuzzy Numbers, Fuzzy Operations in the set of integers , Distance between Triangular Fuzzy Numbers, Fuzzy Numbers with a Maximum, Fuzzy Numbers in the set of Integers, Fuzzy Numbers of Dimension Two, Definition of Fuzzy Set, Basic Operations of Fuzzy Sets.	7
3.	Fuzzy relations and approximate reasoning.	Fuzzy Relations, Operations in Fuzzy Relations, Direct Product, Projections of Fuzzy Relation, Max-Min and Min-Max Compositions, Properties of Fuzzy Relations, Fuzzy Relations and 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, 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**

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.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**18B12NHS813**	**Semester** Even **(specify Odd/Even)**	**Semester Session** 2019 -2020 **Month from** Jan2020 to June2020
Course Name	**Organizational Psychology**		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr Nilu Choudhary
	Teacher(s) (Alphabetically)	Dr Nilu Choudhary

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-29.1	Demonstrate advanced knowledge in organizational psychology, including a discussion of its historical origins and development.	Understanding Level(C2)
C402-29.2	Explain the psychological principles underlying job analysis, selection process, and performance appraisal.	Understanding Level(C2)
C402-29.3	Evaluate critically the nature of leadership and its role and development within organizations	Evaluating Level(C5)
C402-29.4	Analyze the impact of social, ethical, cultural economic and political influences on organizational behavior in local, national and global communities	Analyzing level(C4)
C402-29.5	Analyze critically the conceptual and theoretical frameworks relating to organizational psychology.	Analyzing Level(C4)
C402-29.6	Creates a learning environment that promotes respect, collaboration, productive group interaction and creates new opportunities for development and exploration.	Creating Level(C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Meaning and Scope of Organizational Psychology	2
2.	Origins of Organizational Psychology	Scientific Management, The Hawthorne Studies and the Human Relations Approach to Management and Ergonomics	7
3.	Job Analysis and Job Evaluation	Business ethics & Organizing and describing the tasks involved in a job and determining the position's monetary value,	4
4.	Personnel Selection	Matching the best person to each job using, KASo's testing, interviews , work sample exercises	4
5.	Training ,	On the job, Off the job training, Orientation, formal training, and mentoring.	3
6.	Performance Appraisal	Objective and subjective measures, Sources of Bias in Performance Ratings, 360-Degree Feedback, The Importance of Fairness, Other Performance Measures: Thinking Outside the Box and Organizational Citizenship Behaviour (OCB)	4
7.	Motivation, Approaches to Management:,	The "Japanese" Management Style, Theory X and Theory Y, Strengths-Based Management	6

	Leadership		
8	Learning Organization	Traditional and learning Organization, Employee Commitment, The Meaning of Work	4
9	Organizational Culture	Types Organizational Culture, Factors Contributing to Positive Organizational Culture, Toxic Factors in the Workplace,	4
10	Modern Organization Design	Organizational Design, Hollow, Modular, network design	2
11	Stress at Work	Job Stress at Work, Managing Job Stress	2
		Total number of Lectures	**42**

Evaluation Criteria

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

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

1.	Blum, N.L., & Naylor, J.C. "Industrial Psychology – its theoretical and social foundation", Cbs, 2004
2.	Dunnette, M. D., & Hough, L. M. "Handbook of Industrial and Organizational Psychology", Consulting Psychology Press, 1992
3.	Griffin, R. W. & Moorhead G. "Organizational Behaviour: Managing People and Organizations", South-Western Cengage Learning, 2009
4.	Luthans, F. "Organizational Behaviour", McGraw-Hill/Irwin, 2011
5	Robbins, S. P. "Organizational Behaviour", Prentice Hall, 2014
6	Schultz, D. P., & Schultz, S. P. "Psychology and Industry Today: An Introduction to Industrial and Organizational Psychology", MacMillan Co., 1992
7	Journal of Occupational and Organizational Psychology, The British Psychological Society
8	International Journal of Organization Theory & Behavior, Pracedemics Press
9	Work & Stress: An International Journal of Work, Health and Organizations, Routledge

Detailed Syllabus
Lecture-wise Breakup

Subject Code	20B12CS417	**Semester Even (specify Odd/Even)**	**Semester: VIIIth Session** 2019 -2020 Month from January to May
Subject Name	Software Defined Networks		
Credits	**4**	**Contact Hours**	**3-1-0 (L-T-P)**
Faculty (Names)	**Coordinator(s)**	1. Nitin Shukla	
	Teacher(s) (Alphabetically)	1. Nitin Shukla	

COURSE OUTCOMES		**COGNITIVE LEVEL**
C433-4.1	To summarize the conceptual design of SDN and OpenFlow.	Understand level (Level 2)
C433-4.2	To identify the different new protocols and messages exchanged among different planes.	Apply Level (Level 3)
C433-4.3	To experiment with SDN based network emulator and virtual networking.	Apply Level (Level 3)
C433-4.4	To examine Network Function Virtualization for providing standard solutions towards networking problems.	Analyze Level (Level 4)
C433-4.5	To evaluate various SDN based formal verification tools and techniques for proving correctness of different planes.	Evaluating Level (Level 5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Networks (Revisiting Networking Fundamentals)	TCP/IP Protocol Suite, Network topologies, Routing & Network Protocols (ARP, BGP, OSPF, RIP, ICMP), Network Devices (Hub, Switch, Router, Firewall etc.)	4
2.	Introduction to SDN	Overview, History and evolution of SDN, Architecture of SDN, Scalability, Reliability and Consistency, Opportunities and Challenges	6
3.	Control and Data Plane Separation	Control and data plane separation, South, North, East and West bound APIs, Introduction to OpenFlow: History and Evolution, Openflow Specifications and Messages, Virtual networking, Network Namespaces	8
4.	SDN Design and Development	Mininet, Network Virtual Machines, SDN Controller (POX, Floodlight, OpenDayLight), Applicability of OpenFlow protocols in SDN Controllers, Use-cases (Network Access Control, Virtual Customer Edge, Datacenter Optimization)	10
5.	Network Function Virtualization	Network Function Virtualization and Hypervisors, Abstraction of Physical	7

		Network (constrained forwarding model, distributed state, detailed configuration), Components of a virtual network (Virtual Switch, Bridge, Host-virtual adapter, NAT device, DHCP server, Network adapter), Network as a Service (NaaS)	
6.	SDN Programmability, Applications and Verification	Network management, Resource utilization, Network programmability, Formal Verification of SDN.	7
		Total number of Lectures	**42**

Evaluation Schème	**Test 1**	**20**
	Test 2	**20**
	Test 3	**35**
	Attendance	**07**
	Class Test, Quizzes	**07**
	Internal Assessment	**05**
	Assignments	**06**
	Total	**100**

Text Books:

1.	Nadeau, Thomas D., and Ken Gray. *SDN: Software Defined Networks: an authoritative review of network programmability technologies*. " O'Reilly Media, Inc.", 2013.
2.	Goransson, Paul, Chuck Black, and Timothy Culver. *Software defined networks: a comprehensive approach*. Morgan Kaufmann, 2016.

Reference Material:

1.	Doherty, Jim. *SDN and NFV simplified: a visual guide to understanding software defined networks and network function virtualization*. Addison-Wesley Professional, 2016.
2.	Stallings, William. *Foundations of modern networking: SDN, NFV, QoE, IoT, and Cloud*. Addison-Wesley Professional, 2015.
3.	Coker, Oswald, and Siamak Azodolmolky. *Software-defined Networking with OpenFlow: Deliver Innovative Business Solutions*. Packt Publishing Ltd, 2017.
4.	Lantz, Bob, Brandon Heller, and Nick McKeown. "A network in a laptop: rapid prototyping for software-defined networks." *Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks*. 2010.
5.	Xia, Wenfeng, et al. "A survey on software-defined networking." *IEEE Communications Surveys & Tutorials* 17.1 (2014): 27-51.
6.	De Oliveira, Rogério Leão Santos, et al. "Using mininet for emulation and prototyping software-defined networks." *2014 IEEE Colombian Conference on Communications and Computing (COLCOM)*. Ieee, 2014.
7.	Han, Bo, et al. "Network function virtualization: Challenges and opportunities for innovations." *IEEE Communications Magazine* 53.2 (2015): 90-97.
8.	Li, Yong, and Min Chen. "Software-defined network function virtualization: A survey." *IEEE Access* 3 (2015): 2542-2553.
9.	Mijumbi, Rashid, et al. "Network function virtualization: State-of-the-art and research challenges." *IEEE Communications surveys & tutorials* 18.1 (2015): 236-262.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS814	**Semester (specify Odd/Even):Even**	**Semester: 8th Session:** 2019 -2020 **Month from: January-June**
Course Name	**Digital Transformation in Financial Services**		
Credits	**3**	**Contact Hours**	3-0-0

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C402-31.1	Outline the changes that influence the financial sector in digital age	Understand (Level 2)
C402-31.2	Evaluate the key differences between traditional business management and technology management and the impact it has on business models	Evaluating (Level 5)
C402-31.3	Analyze the new developments in Financial Technology in banking sector.	Analyzing (Level 4)
C402-31.4	Analyze Consumer Behaviors & digital disruptions in Insurance	Analyzing (Level 4)
C402-31.5	Evaluate the limits, risks and broader policy and social implications of digital technology.	Evaluating (Level 5)
C402-31.6	Organising for Digital Innovation and Apply the knowledge of income tax by digital filing of income tax.	Applying (Level3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Financial services, Digitization, Digitalization, Digital Transformation, digital tools in finance, importance and risks. CASE STUDY OF BNP Paribus	**04**
2.	Digital Payment System	Electronic commerce, Advantages & Disadvantages of e commerce, Categories of e commerce, E payment systems, Electronic wallets, Smart Cards, credit cards, debit cards, Advantages and Disadvantages	**04**
3.	Digitization in Banking	Banking: its types, evolution of e banking ,payment mechanisms, RTGS,NEFT, AEPS, UPI, POS, Digital wallets, Future of e banking,challenges in digital era	**06**
4.	Business Models for Digital Financial Services	Revenue stream Distribution strategy Partnership strategy technology Implementation	**05**
5.	Consumer Behaviors in Digital Economy	Analysis of behavior of financial service user, financial service provider, Principles of behavioral finance,	**05**
6.	Digital Disruptions in Insurance	Digital Changes in Life Insurance, Health & Other Insurance	**06**
7.	Digital Financial Services Risk and	Strategic Risk, Regulatory, Operational Risk, Technology,	**08**

	its Management	Financial , Political Risk, Fraud risk, Agent Management Risk, Reputational Risk, Partnership Risk, Risk Management	
8.	Digital/E-Income Tax Filing	Income tax filing, Issues related and suggestions & Organising for digital Innovation	**04**
		Total number of Lectures	**42**

Evaluation Criteria

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

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

1.	Scardovi C., Transformation in Investment Management. In: Digital Transformation in Financial Services. Springer, Cham ,2017
2.	Financial-markets-insurance-pensions-digitalisation-and-finance.pdf
3.	Mobile Financial Services Technology Risks, AFI, 2013 (http://www.afi-global.org/ sites/default/files/pdfimages/AFI_MFSWG_guidelinenote_TechRisks.pdf)
4.	DigitalFinancialServicesandRiskManagementHandbook.pdf
5.	Sujitha K, A(2018) Cost benefit analysis of e-Banking services of SBI in Kerala, University of Calicut.

Detailed Syllabus

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

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

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

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

		• Russia	
		Total number of Lectures	**42**

Evaluation Criteria

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

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

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

Course Code	15B29CI891	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2019 -2020 **Month from** Jan to June 2020
Course Name	**Project Part – I1 (CSE)**		
Credits	12	**Contact Hours**	…

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

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

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

Evaluation Criteria

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

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

Module Coordinators: Course Coordinators

Detailed Syllabus
Lecture-wise Breakup

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Understand service products, consumers and markets	C2
CO2	Apply 4P's of marketing to service	C3
CO3	Determine and Interpret the customer Interface	C5
CO4	Create and design profitable service strategies	C6

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

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

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

Optimization Techniques (16B1NMA831)

Lecture-wise Breakup

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

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

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

	Programming	problem, Newton's Method Golden Section, Fibonacci Search, Bisection, Steepest Descent Method, Multidimensional Newton's method.	
		Total number of Lectures	**40**

Evaluation Criteria

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

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

1.	Taha H. A., Operations Research: An Introduction, 7th edition, PHI, 2002.
2.	Rao, S. S. - Engineering Optimization, Theory and Practice, Third Edition, New Age International Publishers, 2010.
3.	Wagner, H. M., Principles of Operations Research with Applications to Managerial Decisions, Prentice Hall of India Pvt. Ltd., 1975.
4.	Hillier F. and Lieberman G. J., Introduction to Operations Research, 6th edition, McGraw-Hill, 1995.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**17B1NCI735**	**Semester (Even)**	**Semester VIII Session Month from Jan to June**
Subject Name	**High Performance Web and Mobile Applications**		
Credits	**4**	**Contact Hours**	**3-1-0**

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

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

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

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

Evaluation Criteria

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

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

Text Books:

1.	Hands-On Mqtt Programming with Python By Gaston C Hillar
2.	Tomcat: The Definitive Guide, 2nd Edition by Ian F. Darwin, Jason Brittain, O'Reilly

Reference Books:

3.	Learn Docker - Fundamentals of Docker 18.x: Everything you need to know about... By Gabriel N. Schenker - Publisher: Packt Publishing

Module Coordinators: Course Coordinators

Detailed Syllabus
Lecture-wise Breakup

Course Code	17B2NCI739	**Semester** Even **(specify Odd/Even)**	**Semester** VIII **Session** 2019 -2020 **Month from January to June**
Course Name	Cognitive Radio Network		
Credits	4	**Contact Hours**	3-1-0 (L-T-P)

Faculty (Names)	**Coordinator(s)**	Himanshu Agrawal
	Teacher(s) (Alphabetically)	Himanshu Agrawal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-6.1	Define the spectrum scarcity problem and design of the wireless networks based on the cognitive radios.	**Remembering** Level (C1)
C433-6.2	Understand the technologies to allow an efficient use of TVWS for radio communications.	**Understanding** Level (C2)
C433-6.3	Apply various algorithms to achieve efficient sharing of the unutilized spectrum among cognitive and licensed users.	**Applying** Level (C3)
C433-6.4	Able to analyze the challenges for deployment of dynamic spectrum access for various applications of wireless networks such as Internet of things, wireless sensor networks and cognitive radio networks.	**Analyzing** Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction & Basic Concepts	Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, policies, interoperability/coexistence, etc.	8
2.	Spectrum	Licensed, unlicensed, shared unlicensed, opportunistic unlicensed, Current spectral usage and issues, Regulations, regulation changes	6
3.	Next generation networks	XG (soft spectrum usage, related to spectrum only), and relations with Cognitive radio, Spectral awareness, Spectrum adaptation, Dynamic frequency selection, Spectrum Sharing (secondary users in licensed spectrum), priority allocation, Adaptive bandwidth control, Policies	5
4.	Adaptation and optimization	PHY, MAC, Network, source/channel joint coding, joint routing and link adaptation, routing/power adaptation, Efficiency measures and metrics, network and system aspects, etc.	7
5.	SDR	Hardware limitations, Processing, programmability (flexibility) vs power consumption	7
6.	Sensing	Internal and external, awareness, Spectral awareness, Power efficiency, energy/battery awareness, Device capability awareness, RF Awareness, Interference/noise temperature, channel (medium, radio channel), Time of day, day of	6

		week, Location (in 3D), Geolocation, End-user environment, User profile, User needs and preferences, User contents, Radio Environment, Network Environment etc.	
7.	Miscellaneous	Current cellular cognitive features, Hand-off, Channel allocation, cellular network design, Link adaptation, incremental redundancy, Interference avoidance, detection, and cancellation, Power control	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
Attendance:	7
Class Test/Quizzes	7
Internal Assessment	5
Assignment In PBL Mode	6
Total	**100**

Text Books:

T1.	Simon Haykin, "Cognitive Dynamic Systems, Perception-Action Cycle, Radar, and Radio", Cambridge Press, 2012.
T2.	Bigleri, Goldmsith etal. “Principles of cognitive Radio", Cambridge Press, 2012.
T3.	Peyman Setoodeh, Simon Haykin, “Fundamentals of Cognitive Radio”, John Wiley & Sons, 2017.

Reference Books:

R1.	Hseyin Arslan (Ed.), "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems," Signals and Communication Technology, Springer, August 2007.
R2.	Joseph Mitola, III, "Cognitive Radio Architecture: The Engineering Foundations of Radio XML," John Wiley and Sons Ltd., February 2006.
R3.	Jeffrey H. Reed, "Software Radio: A Modern Approach to Radio Engineering," Prentice Hall PTR, 2002.
R4.	Walter H.W. Tuttlebee, "Software Defined Radio: Enabling Technologies," John Wiley and Sons Ltd., 2002.
R5.	Markus Dillinger and Kambiz Madani and Nancy Alonistioti, "Software Defined Radio: Architectures, Systems and Functions," John Wiley and Sons Ltd., 2003.
R6.	Simon Haykin, "Cognitive radio: brain-empowered wireless communications," Selected Areas in Communications, IEEE Journal on, Vol.23, Iss.2, Feb. 2005 Pages: 201- 220.
R7.	J. Walko, "Cognitive radio," IEE Review, Vol.51, Iss.5, Pg.:34-37, May 2005.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	17B2NCI744	**Semester:** Even	**Semester** VIII **Session** 2019-20 **Month from** January to May
Subject Name	Real Time Systems		
Credits	4	**Contact Hours**	3-1-0 (L-T-P)

Faculty (Names)	**Coordinator(s)**	**Bansidhar Joshi**
	Teacher(s) (Alphabetically)	**Bansidhar Joshi**

COURSE OUTCOMES		**COGNITIVE LEVEL**
C434-5.1	Outline the prime characteristics of a real-time system	Understand Level (Level 2)
C434-5.2	Identify various scheduling algorithms over periodic/aperiodic tasks set and determine their optimality in Uni/multi-processor and overloading environment	Applying Level (Level 3)
C434-5.3	Analyze the consequences of relaxing the conventional properties for real-time Databases	Analyzing Level (Level 4)
C434-5.4	Evaluate the performance of various communication protocols in a real-time traffic scenario.	Evaluate Level (Level 5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Real-time computing	Structure of a Real-Time System Characterization of Real-Time Systems and tasks - Performance measures.	4
2.	Task Assignment and Scheduling	**Uniprocessor** scheduling Algorithms – Periodic and Aperiodic Task scheduling – Resource Access Protocols	14
3.	Issues on Overload	Transient overload conditions, Metrics for performance evaluation & scheduling algorithms under overload	3
4.	Real-Time	Network topologies and Architecture Is**sues** – Protocols– Contention-based, Token-based, polled	8

	Communication	bus	
5.	Real-Time Databases	Transaction Priorities and Aborts - Concurrency control Issues Scheduling Algorithms - Two-phase approach to improve predictability	8
6.	Petri Nets	RT Modeling tool, analysis and different variations	3
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	**20**
T2	**20**
End Semester Examination	**35**
Attendance:	**7**
Class Test/Quizzes	**7**
Internal Assessment	**5**
Assignment In PBL Mode	**6**
Total	**100**

Text Books:

T1.	CM Krishna and Kang G Shin, "Real-Time Systems", International Editions, ISBN-0- 07114243-6, McGraw Hill Companies, Inc., New York, 2013
T2.	Real-time Systems, Jane W.S. Liu, Pearson Education, Inc. ISBN 81-7808-463-5, 2015
T3.	Hard Real-time Computing Systems: Predictable Scheduling Algorithms and Applications, Giorgio C. Buttazzo, , Kluwer Academic Publishers, 2013.

Reference Books:

R1.	Real-time Systems and Programming Languages, Alan Burns and Andy Wellings, Addison-Wesley Longman, ISBN 0201729881, 2003
R2.	Petri nets: Properties, Analysis and Applications, Tadao Murata, Proceedings of the IEEE, Vol. 77, No. 4, April 1989.
R3.	Petri nets and Industrial Applications: A Tutorial, R Zurawski, M Zhou, IEEE Trans. on Industrial Electronics, Vol. 41, No. 6, December 1994.

Detailed Syllabus
Lecture-wise Breakup

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

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C433-1.1	Describe classical encryption methods based on Substitution and Permutation	Understand (Level 2)
C433-1.2	Implement and apply modern block and stream cipher techniques like DES, AES and RC4	Apply (Level 3)
C433-1.3	Analyse the role of prime number theory and quadratic congruence in cryptography	Analyse (Level 4)
C433-1.4	Implement and apply asymmetric encryption algorithms of RSA , ElGamal and Elliptic Curve Cryptography	Apply (Level 3)
C433-1.5	Criticize hashing algorithms like SHA-512 and SHA – 1024	Analyse (Level 4)
C433-1.6	Compare and Choose cryptographic techniques for using Digital Signatures and certificates in existing applications	Evaluate (Level 5)

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

Total number of Lectures	**42**

Evaluation Criteria

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

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

Text Books:

1.	William Stallings, *Cryptography and Network Security*, Prentice Hall, 7th Edition, 2017.
2.	B A Forouzan and Debdeep Mukhopadhyay, *Cryptography and Network Security*, Mc Graw Hill, 3rd Edition, 2015.
3.	William Stallings, *Network security essentials: applications and standards*, Prentice Hall, , 3rd Edition ,2013.
4.	Hsiao DK, Kerr DS, Madnick SE, Computer security, Academic Press; 2014 Jun 20.

RefernceBooks:

5.	Gupta B, Agrawal DP, Yamaguchi S, editors, Handbook of research on modern cryptographic solutions for computer and cyber security, IGI global; 2016 May 16.

Module Coordinators: Course Coordinators