Detailed Syllabus

Course Code	15B11CI513	**Semester**Even	**Semester** 6th **Session** 2021 -2022 **Month from** January-22 to June-22
Course Name	**Software Engineering**		
Credits	4	**Contact Hours**	3-1-0

Faculty (Names)	**Coordinator(s)**	Dr. ShulabhTyagi (62), Dr. Mukta Goyal (128)
	Teacher(s) (Alphabetically)	Dr. Shruti Jaiswal, Mr. Ashish Kumar Tripathi, Ms Shruti, Mr. Ashish

COURSE OUTCOMES		**COGNITIVE LEVELS**
C314.1	Explain software engineering principles and software process models for project development.	Remembering(Level 1)
C314.2	Identify functional and non-functional requirements of a software project and design document software requirements specification.	Understand (Level 2)
C314.3	Design, represent and document software requirements specification. Plan and execute activities for a software project.	Create (Level 6)
C314.4	Apply UML modeling for software design from software requirements specification.	Apply(Level 3)
C314.5	Analyze code checklist. Perform code Reviews, Code Refactoring, and Code optimization, design pattern	Analyze(Level 4)
C314.6	Apply testing principles, develop and implement various manual and automated testing procedures, formal methods	Apply(Level 3)
C314.7	Evaluate software in terms of general software quality attributes and possible trade-offs presented within the given problem.	Evaluate(Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	*Unit-1*	***Introduction to Software Engineering:*** Introduction to software engineering Principles, Software process models(build and fix model,waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models, Agile Models (tools study). Project planning, Project Scheduling: network diagram, Gant Chart, CPM and PERT.	**7**
2.	***Unit-2***	***Requirement Engineering:*** Types of requirement, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	**4**
3.	***Unit-3***	***Software Design:*** Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Component Diagram and Package diagram. Design Modularity: Coupling Cohesion.	**7**
4.	***Unit-4***	***Software Construction:*** Coding standards and guidelines, Code checklist, Code Reviews, Code Refactoring, Code optimization.Design	**8**

		pattern, Modern programming environments (Code search, Programming using library components and their APIs), Program comprehension; Program correctness, Defensive programming.	
5.	***Unit-5***	***Software Metrics:*** Size-Oriented Metric, Function-oriented Metric, Halstead's Software Metric, Information Flow Metric, Object-oriented Metric, Class-Oriented Metric, COCOMO Model.	**7**
6.	***Unit-6***	***Software Testing:*** White-Box Testing, Basis Path Testing, Control Structure Testing: Condition Testing, Data Flow Testing, Loop Testing, Black-Box Testing: Equivalence class partitioning, Boundary Value Analysis, Decision table testing, Cause effect graphing, Mutation Testing and regression Testing, formal methods**.**	**9**
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments/Tutorial/ Mini Project : 15, Attendance : 10)
Total	**100**

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

The course emphasized on the skill development for employability in software industry by engaging students on Software Development methodologies. Various activities are carried out to enhance the student's software development skills. Some of them are study of various software process models and their applicability, progress tracking, size estimation techniques, software testing strategies, etc.

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

Text Book(s):

1.	Roger S. Pressman, "Software Engineering: A practitioner approach", Fifth Edition-TMH International .
2.	Sommerville , "Software Engineering" , Seventh Edition - Addison Wesley.

Reference Book(s):

3.	Grady Booch, James Rumbaugh, Ivar Jacobson, The Unified Modeling Language User Guide, Addison Wesley, Reading, Massachusetts, May 2005
4.	Richard Thayer , "Software Engineering Project Management", Second Edition -Wiley-IEEE Computer Society Press.
5.	B. Bezier, "Software Testing Techniques", Second Edition- International Thomson Computer Press.
6.	Pankaj Jalote, "An Integrated Approach to Software Engineering" Third addition , Springer Press

Detailed Syllabus

Subject Code	15B11CI514	**Semester: EVEN (specify Odd/Even)**	**Semester** EVEN **Session** 2021-2022 **Month from** February 22 **to** June 22
Subject Name	ARTIFICIAL INTELLIGENCE		
Credits	4	**Contact Hours**	3+1

Faculty (Names)	**Coordinator(s)**	Dr. Swati Gupta/ Dr. Satish Chandra
	Teacher(s) (Alphabetically)	Dr. Swati Gupta/ Dr. Satish Chandra

COURSE OUTCOMES		**COGNITIVE LEVELS**
C312.1	Design, implement and analyze the problem solving agents using various informed, uninformed search strategies.	Analyzing [Level 4]
C312.2	Analyze and apply algorithms to solve problems requiring evolutionary search strategies, constraint satisfaction and game theory.	Analyzing [Level 4]
C312.3	Represent knowledge and Apply inference mechanisms using propositional logic (PL) and first order predicate logic (FOPL).	Apply [Level 3]
C312.4	Apply model of probabilistic reasoning in incomplete and uncertain environment.	Apply [Level 3]
C312.5	Develop the agents with natural language processing and learning capabilities.	Apply [Level 3]

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction	History and foundations of AI	01
2.	Problem solving and intelligent agents	PEAS, Structure of agents, nature of environments, concept of rationality	03
3.	Problem solving-I	Problem solving agents, Uninformed search strategies (BFS, UCS, DFS, DLS, IDS)	04
4.	Problem solving-II	Informed Search and Exploration (GBFS, Heuristic function, A*, RBFS, Hill climbing, Genetic Algorithms)	06
5.	Problem solving-III	Constraint satisfaction problems (backtracking search), Adversarial Search (optimal decision in games, alpha beta pruning)	05
6.	Propositional Logic	Knowledge based agents, Propositional	05

		Logic, First order Logic, Syntax and Semantics), Inference in FOPL (Unification, forward and backward chaining, resolution)	
7.	Knowledge representation	Ontology, actions, situations and events, time and event calculus, mental events,	03
8.	Uncertainty	Inference using full joint distribution, Probabilistic reasoning, Bayesian rule, Bayesian network, Maximum likelihood estimation	04
9.	Learning	decision tree, ensemble learning, K-Nearest Neighbor, K-Means algo, Reinforcement Learning	07
10.	Natural Language Processing	Preprocessing, POS tagging using MLE, Parsing using CYK	04
		Total number of Lectures	**42**

Evaluation Criteria

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

Project Based Learning component- Students made project in a group of 3-4 members. Projects are made by applying the concepts learned in class to real life applications like stock prediction, customer recommendation, gamming etc. This helps their employability in IT sector.

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

1.	Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008.
2.	Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017
3.	Artificial Intelligence Review: An International Science and Engineering Journal, Springer
4.	Minds and Machines: Journal for Artificial Intelligence, Philosophy and Cognitive Science, Springer
5.	IEEE Intelligent Systems

Software Engineering Lab (15B17CI573)
Detailed Syllabus

Course Code	**15B17CI573**	**Semester: Even**	**Semester:** VI **Session:** 2021 -2022 **Month from Feb to May**
Course Name	**Software Engineering Lab**		
Credits	0-0-1	**Contact Hours**	**2**

Faculty (Names)	**Coordinator(s)**	Dr. Bhawna Saxena (J62), Dr. Vartika Puri (J128)
	Teacher(s) (Alphabetically)	J62: Anuja Arora, Bhawna Saxena, Indu Chawla, Purtee Kohli, Sonal, Sulabh Tyagi J128: Ashish Kumar, Himanshu Agrawal, Mukta Goyal, Shruti Jaiswal, Vartika Puri

COURSE OUTCOMES		**COGNITIVE LEVELS**
C374.1	Explain software engineering principles and software process models for project development, software requirements specification for a software project	Understand Level (Level 2)
C374.2	Apply software design and modeling.	Apply Level (Level 3)
C374.3	Apply software optimizing and refactoring	Apply Level (Level 3)
C374.4	Apply testing principles and implement various testing procedures	Apply Level (Level 3)
C374.5	Creation of software using software engineering principles	Create (Level 6)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1.	Introduction to Software Engineering Principles	Introduction to software engineering Principles (evolution, failures, changing nature of software, software myths, product, process, software crisis and need of testing), Software process models (build and fix model, waterfall model, Incremental process model, Evolutionary- Prototype and Spiral models, Agile models – extreme programming and scrum, selection of a life cycle model), PSP, TSP. Types of requirement, Feasibility studies, Requirement Elicitation, Analysis, Specification, SRS, Requirement Verification and Validation.	C374.1
2.	Software Design and Modeling.	Use case diagram, State diagram, Activity Diagram, Class Diagram, Sequence diagram, Collaboration diagram, Deployment Diagram, Event trace diagram. Size oriented metrics, LOC, token count, Function Count, cost estimation, data structure metrics, Halstead's Software Metric, Information Flow Metric, Overview of Quality Standards like ISO 9001, SEI-CMM, COCOMO, COCOMO-II, Software risk management	C374.2

3.	Software Optimizing and Refactoring	Coding standards and guidelines, Code checklist, Code Refactoring and Code optimization	C374.3
4.	Software Testing	Black box testing techniques: Equivalence class testing, Boundary value analysis, Decision table testing, Cause effect graphing, White box testing: Path testing, Data flow and mutation testing, Levels of testing- unit testing, integration and system testing, Debugging-techniques, approaches, tools & standards.	C374.4

Evaluation Criteria

Components	**Maximum Marks**
Lab Test 1	20
Lab Test 2	20
Day-to-Day	60 (Attendance (10), Evaluation/ Viva (20), Project (30))
Total	**100**

Project based learning: Each student in a group of 3-4 have to work on a mini-project, in which they will create Software Requirements Specification (SRS) document and design the software diagrams. Further, the software implementation should be followed with testing reports. This enhances the understanding of students towards different software engineering concepts and also help them during their employability.

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

1.	Pressman, Roger S. Software engineering: a practitioner's approach. Palgrave Macmillan, 2005.
2.	Jalote, Pankaj. An integrated approach to software engineering. Springer Science & Business Media, 2012.
3.	KK Aggarwal, Software Engineering, 2001.
4.	David Solomon and Mark Russinovich ," Inside Microsoft Windows 2000", Third Edition, Micorosoft Press
5.	https://www.tutorialspoint.com/software_engineering/
6.	ACM/IEEE transactions on Software Engineering
7.	ACM Transactions on Software Engineering Methodology
8.	Springer Journal of Empirical Software Engineering
9.	Springer Journal of Software and Systems Modeling

Detailed Syllabus

Course Code	15B17CI574	**Semester** EVEN **(specify Odd/Even)**	**Semester** 6th **Session** 2021-2022 **Month** Jan to June
Course Name	Artificial Intelligence Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Pratistha Verma, Raju Pal
	Teacher(s) (Alphabetically)	Pratistha Verma, Dhanlaxmi G, Raju Pal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C372.1	Construct problem solving agent using various Informed and uninformed search strategies	Apply Level (C3)
C372.2	Utilize evolutionary search algorithms to solve the real world complex problems	Apply Level (C3)
C372.3	Analyze and apply algorithms to solve problems requiring constraint satisfaction and game theory	Analyze Level (C4)
C372.4	Demonstrate and understand the inference mechanisms using propositional and first order logic	Understand(C2)

Module No.	**Title of the Module**	**List of Experiments**	**No. of Lab hours for the module**	**CO**
1	Introduction to Programming in Python	Familiarize the following concepts of Python programming language like Arrays, Lists, functions, Tuples, Dictionary, Sets, Objects and classes	2	C372.2
2	Problem solving	Problem solving agents, Uninformed search strategies (BFS, UCS, DFS, DLS, IDS) Informed Search and Exploration (BFS, A*, IDA*, SMA*,IDA*)	4	C372.3
3	Evolutionary Algorithms	Genetic Algorithms	2	C372.3
4	Constraint satisfaction problems	Formulating Problems as constraint satisfaction problems	2	C372.4
5	Adversarial Search problems	Adversarial Search (optimal decision in games, alpha beta pruning)	4	C372.3
6	Knowledge representation	Inference using Prolog	2	C372.2

Evaluation Criteria	
Components	**Maximum Marks**
Evaluation 1	15
Lab Test 1	20
Lab Test 2	20
Mini-project	15
Evaluation 2	15
Attendance	15
Total	**100**

Project Based learning:

In this subject, students work in a team of 3-4 people, to implement a small application/mini-project based on AI. Projects are made by applying the concepts learned in class to real life applications like automated hardware based application, stock prediction, recommendation system, gaming etc. This helps their employability in the IT sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008.
2.	Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017
3.	Artificial Intelligence Review: An International Science and Engineering Journal, Springer
4.	Minds and Machines: Journal for Artificial Intelligence, Philosophy and Cognitive Science, Springer
5.	IEEE Intelligent Systems

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B19PH692	Semester Even	Semester: 2021-2022 Session Month from: January to June
COURSE NAME	LIGHT EMITTING DIODES: BASICS AND APPLICATIONS		
Credits	2	Contact Hours	2-0-0

Faculty (Names)	Coordinator(s)	Dr. B.C. Joshi
	Teacher(s) (Alphabetically)	Dr. B.C. Joshi

COURSE OUTCOMES		COGNITIVE LEVELS
C305-6.1	Recall the basic concepts of semiconducting materials, working of p-n junction diode and light emitting diodes.	Remembering (C1)
C305-6.2	Explain the various physical parameters involved in designing and fabrication of LEDs.	Understanding (C2)
C305-6.3	Solve various problems related to efficiency, emission intensity and spectrum of LEDs.	Applying (C3)
C305-6.4	Analyze the problems in designing & fabricating blue, white and green high brightness LEDs.	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	History of LEDs	History of SiC, GaAs, GaAsP, GaInP, GaN, and InGaN LEDs.	4
2.	Theory of Recombination's	Radiative and non-radiative recombination's, Low-level and high-level excitations, Bio-molecular rate equation for quantum well structure, Van Roosbroeck-Shockley Model, Einstein Model.	6
3.	LED Basics	Electrical properties: I-V characteristics, parasitic resistances, carrier distribution in homo and hetero junctions, carrier losses, carrier overflow in heterojunctions, Optical properties: Internal, external, extraction and power efficiencies, Emission spectra, escape cone and temperature dependency	6
4.	Growth & Fabrications	LED materials, Organic LEDs, Growth, Fabrication and Characterization Techniques	4
5.	Applications	Solid state lighting, White LEDs, HB LEDs, Color Mixing and Rendering, LED Drivers, Display Devices, AMOLED, Communication, High Voltage LEDs	10
		Total number of Lectures	**30**

Evaluation Criteria

Components	Maximum Marks
Mid Term Examination	30
End Semester Examination	40
TA	30 [Attendance + Class Tests, Quizzes, *etc* (09 M), Internal assessment and Assignments in PBL mode.
Total	**100**

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

1.	**Text 1:** Light-Emitting Diodes, Schubert E. Fred, Cambridge University Press, 3rd Edition 2018.
2.	**Reference:** Introduction to Light Emitting Diode Technology and Applications, Held Gilbert, Auerbach Publications, 2008.
3.	**Reference:** Light-Emitting Diodes; Materials, Processes, Devices and Applications, Editors: Jinmin Li, G. Q ZHANG, Springer, 2019

Project based learning: In a group of 3 to 5 a task will be assigned to the students, related to design and modelling of light emitting diodes, LED circuits and applications. This will help students in understanding the basic knowledge of LEDs, their working, and applications. Students will learn how to work in groups and this will improve their analytical skills and problem-solving capability.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS 531**	**Semester : Even (specify Odd/Even)**	**Semester : VI Session: 2021 - 2022 Month from: Feb- June 2021**
Course Name	**Sociology of Youth**		
Credits	**3**	**Contact Hours**	**(3-0-0)**

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-13.1	Demonstrate an understanding of Youth and youth culture in sociological perspectives	Understanding (C 2)
C304-13.2	Explain the ethical, cultural& social issues concerning Youth	Evaluating(C 5)
C304-13.3	Examine the relative importance of structure and agency in shaping young people's experiences and life opportunities	Analyzing(C 4)
C304-13.4	Evaluate youth experience in a context of social change	Evaluating(C 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Youth	Meaning and characteristics of youth, demographic profile of youth in India, Challenges faced by Youth, Youth's roles and responsibilities in society	4
2.	Youth Culture	Concept of Youth Culture, role of Popular culture in shaping youth culture,	4
3.	Perspectives on Youth Culture	Functionalist, Conflict, Interactionist and Feminist Perspective on Youth Culture, Youth and Gender	5
4.	Youth and Identity	Social divisions: sexuality, urban and rural youth, social identities: subcultural, digital, Experiences of youth to negotiate identities in contemporary societies	8
5.	Socialization of Youth	Concept and processs of socialization, Internalization of norms, types of socialization, conditions of learning, internalized objects, theories of socialization, stages of socialization, adult socialization, agents of socialization, role of culture in socialization, socialization and cultural differences, importance of socialization, Failure of the socialization process	9
6.	Problems of Youth	Role and Value conflicts, Generation Gap, Career decisions and Unemployment, Emotional adjustment, Coping with pressures of living, Unequal Gender norms, Crime (Social Strain theories),	8

7.	Changing perceptive of Youth and Youth Culture in 21st century	involvement of youth in major decision making institutions, Post-modernity and Youth, Youth Unrest	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20 (Project based)
T2	20
End Semester Examination	35
TA	25 (Presentation, Assignment, attendance, Quiz and Participation in Tutorial)
Total	**100**

PBL- Each student will identify the variables shaping their identity and aspirations. In what ways do they do this? (Another way to think about this question: How do these social forces or institution provide you with the chance to pursue your goals? How do they limit your life chances?)

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.	Tyyskä, V. *Youth and Society: The long and winding road*, 2nd Ed., Canadian Scholars' Press, Inc. (2008).
2.	White, Rob, Johanna Wyn and Patrizia Albanese. *Youth & Society: Exploring the Social Dynamics of Youth Experience.* Don Mills, ON: Oxford University Press, 2011.
3.	Bansal, P. *Youth in contemporary India: Images of identity and social change*. Springer Science & Business Media, 2012.
4.	Furlong, Andy. *Youth studies: An introduction*. Routledge, 2012.
5.	Blossfeld, Hans-Peter, et al., eds. *Globalization, uncertainty and youth in society: The losers in a globalizing world*. Routledge, 2006.
6.	Ruhela, Satya Pal, ed. Sociology of the teaching profession in India. National Council of Educational Research and Training, 1970.
7.	Frith, S. "The sociology of youth. Themes and perspectives in sociology." Ormskirk, Lancashire: Causeway Books , 1984.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NHS631	**Semester Even**	**Semester 6th Session** 2021 -2022 **Month from January 2022to June 2022**
Course Name	PROJECT MANAGEMENT		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Deepak Verma, Dr. Swati Sharma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma, Dr. Swati Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-5.1	Apply the basic concepts of project management such as features, objectives, life cycle, model and management, in a given context	Apply Level (C3)
C304-5.2	Analyze projects and their associated risks by understanding the various theoretical frameworks, non-numerical and numerical models in order to make correct selection decisions	Analyze Level (C4)
C304-5.3	Evaluate the stages of project management and identify and determine correct techniques for planning and scheduling	Evaluate Level (C5)
C304-5.4	Evaluate management processes for budgeting, controlling and terminating projects in order to achieve overall project success	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Project Management: Introduction	Characteristics of project; Life Cycle of Project; Project Model; Project Management as discipline; Contemporary aspects of Project Management	4
2.	Project Selection	Theoretical Models; Non-numeric models; Numeric Models; Financial Models; Project Portfolio process, Significance and applicability of Monte Carlo simulation	6
3.	Project Organization, Manager and Planning	Pure Project organization; Functional Organizations; Mixed organizations; Matrix organizations; Role, Attitudes and Skills of Project Manager, Project Coordination, Systems Integration, Work Breakdown Structure, Linear Responsibility Charts.	4
4.	Risk Management	Theoretical Aspects of risk, Risk Management process, Numeric Techniques, Hillier model, Sensitivity Analysis, Certainty Equivalent approach and Risk adjusted discount rates, Game theory.	4
5.	Project Scheduling and Resource Allocation	Theoretical aspects-Importance, Focus Area-PERT/CPM, AOA and AON charts, Probability Analysis, Gantt Charts, Crashing of Projects- Time and Cost tradeoff, Basics-Resource Leveling and Loading.	6
6.	Budgeting, Control	Estimating Project Budgets, Improving the process of cost	4

	and Project Termination	estimation, Basics, Importance, Purpose of control, Types of Control, Desirable features of Control, Control Systems, Critical Ratio Method, Control of creative activities, Control of change and scope creep, Why Termination, Types of termination, typical termination activities.	
Total number of Lectures			**28**

Project Based Learning: Students are supposed to form a group (Maximum 5 students in each group) and identify a real-life project. They are supposed to do the in-depth study of this project and assess it in terms of project objectives. They are supposed to do the detailed study of project planning and project organization. They must highlight the various tools and techniques of Project planning, which are used in their chosen project. The fundamentals of Project management are very important in today's corporate world and certainly this subject enhances student's employability in every sector.

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Project, 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.	Meredith, Mantel, Project Management-A Managerial Approach, 10th Edition, Wiley Publications,2017
2.	Timmothy Kloppenborg, Contemporary Project Management, 5th[t] Edition, Cengage Learning, 2017
3.	Harold Kerzner,Project Management: A Systems Approach to Planning, Scheduling, and Controlling,12th Edition,Wiley Publications,2017
4.	Wysocki,R.K., Effective Project Management: Traditional, Agile, Extreme, Hybrid, 8th Edition, Wiley Publications,2018
5.	Vohra, N. D., Quantitative Techniques in Management, 5thEdition, Tata McGraw Hill Publishing Company, 2017

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS634**	**Semester** Even **(specify Odd/Even)**	**Semester Session** 2021-2022 **Month from** February to July
Course Name	**Theatre and Performance (Value added)**		
Credits	**2**	**Contact Hours**	**1-0-2**

Faculty (Names)	**Coordinator(s)**	Dr Nilu Choudhary and Dr. Ankita Das
	Teacher(s) (Alphabetically)	Dr. Ankita Das and Dr. Nilu Choudhary

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C304-14.1	Demonstrate problem solving ability and effective life skills through theatre performances.	Understanding level(C2)
C304-14.2	Develop awareness of the role of these arts in human life	Understanding level(C2)
C304-14.3	Apply skills of listening, articulation, awareness and collaboration through the creation of performance.	Applying level(C3)
C304-14.4	Design and present an original performance alone or in collaboration with other artists.	Creating level(C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction of Theatre	History of theatre: role of theatre in human culture with special reference to India	2
2.	Characterization	Tips for developing character, thinking about thoughts, Flash –back, Performance	2
3.	Script Writing	Turning a story into a play , How to write a one Act , setting the scene ,character , stage direction , Dialogues	3
4.	School of Drama	Natya-Shastra, Stanislavsky and Brecht	3
5.	Text and its interpretation	Mother Courage ,Galileo , Aadhe Adhure (any one)	3
6.	Back-stage work	Management, planning, execution	1
		Total number of Lectures	**14**

Module No.	Title of the Module	List of Experiments/Activities	CO
1.	Moving in Space.	Students will be moving around the room, filling up the space, changing pace, changing direction, being aware of other people but not touching them. Find new ways of moving, with a different emphasis each time – smooth, jagged, slow, fast, heavy, light, high up, low down and so on. Every now and again Teacher will shout "Freeze! And Students need to freeze every muscle in your body.	**C304-14.1**

		Absolutely NO LAUGH, LOOKING AROUND, OR MOVING. You will be out.	
2.	Mirror Activity	A great way to get students aware of body movement and working together.	**C304-14.1**
3.	Characterization	Developing and analyzing characters to reveal the special qualities and personalities of the characters in a story, making character believable.	**C304-14.2**
4.	Script Writing	The more passionate you feel about your idea, the more attractive your play will be. Divide the idea into abeginning, middle and end.	**C304-14.3**
5.	Role Assignment	No acting or movement at this point – just sit together to speak and hear the script carefully. Discuss and clarify any confusing aspects of the script and any apparent challenges in bringing the script to the stage. Division of script into small "units" and rehearsed separately	**C304-14.3**
6.	Turning story into a play	Read thru each episode or unit separately "on its feet".Actors moving around the stage space. Set blocking for each episode. Use ideas generated from Mini-Episodes, and Staging with Images. Make sure the gestures, movements, and stage pictures tell the story clearly.	**C304-14.3**
7.	Stage blocking	Practice the blocking and the lines so that everyone knows what happens when and what their performance responsibilities are. Memorize lines. Work on making characters, relationships, and dialogue clear. This is a good place in which to use the Creating the Character lessons. Pay attention to vocal projection and articulation. Generate ideas about any technical elements you want to incorporate using the Transformation of Objects.	**C304-14.3**
8.	Script to performance	Finalize and run the entire play from beginning to end without stopping to check any additional rehearsal required to get everything running smoothly or not. Finally Perform!!	**C304-14.4**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30
End Term	40
TA	30 (Script writing, End term stage performance)
Total	**100**

Project Based Learning: Students will be given a project in a group of 5-6 which would require them to use their imagination to form original stories with relatable characters and convert it into a script to be performed as a play. While putting together an entire performance would help them in learning organizational lessons such as team work, their efforts towards developing relatable characters would help them in analyzing the varied experiences and emotions of human life.

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.	Eric Bentley, ed., The Theory of the Modern Stage: An Introduction to Modern Theatre and Drama, Penguin Books, 1968
2.	Mark Fontier, Theory/ Theatre: An Introduction, New York: Routledge, 2002

3.	Michael Holt, Stage Design and Property, Oxford: Phaidon, 1986
4.	Michael Holt, Costume and Make-up, Oxford: Phaidon, 1988
5.	Natyashastra, tr. by Adya Rangacharya, New Delhi: Munshiram Manoharlal, 1996,
6.	G.J Watson, Drama: An Introduction. Macmillan International Higher Education, 2017.
7.	Micheal Mangan, The Drama, Theatre and Performance Companion. Basingstoke: Palgrave Macmillan, 2013.
8.	Kenneth Pickering Key Concepts in Drama and Performance. New York: Palgrave Macmillan, 2010.

Statistics (16B1NMA633)

Course Description

Course Code	16B1NMA633	**Semester:** Even	**Semester** VI **Session** 2021-22 **Month from** Jan 2022 - June 2022
Course Name	Statistics		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Anuj Bhardwaj	
	Teacher(s) (Alphabetically)	Dr. Himanshu Agarwal, Dr. Anuj Bhardwaj	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-1.1	make use of measures of central tendency, dispersion, skewness and, kurtosis for description and visualization of population data.	Applying Level (C3)
C302-1.2	apply correlation and regression in statistical analysis of data.	Applying Level (C3)
C302-1.3	explain sampling theory and its distributions.	Understanding Level (C2)
C302-1.4	explain the concepts and properties of estimation theory.	Understanding Level (C2)
C302-1.5	apply sampling and estimation theory to find the confidence interval.	Applying Level (C3)
C302-1.6	analyze small and large sample data by using the test of hypothesis.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Descriptive Statistics	Graphical representation such as histogram, frequency polygon, AM, GM, HM, median, mode, measures of dispersion, skewness and kurtosis such as central and non-central moments, population variance, β, γ coefficient, Box and Whisker plot.	8
2.	Correlation and Regression Analysis	Scatter diagram. Karl Pearson's and Spearman's rank correlation coefficient, regression lines, regression coefficient and their properties.	5
3.	Sampling and Sampling Distributions	Populations and Sample, random sample, statistics, sample moments, law of large numbers, central limit theorem, distribution of sample mean and sample variance, MGF, Chi-square distribution, F-distribution, Student's *t* distribution.	7
4.	Parametric Point Estimation	General concept of point estimation, methods of moments and maximum likelihood for finding estimators, unbiasedness, consistency, efficiency, UMVUE, Cramer-Rao inequality, sufficiency, factorization theorem, completeness, Rao-Blackwell theorem.	10

5.	Parametric Interval Estimation	definition of confidence interval, pivotal quantity, confidence interval for mean, variance, difference of means and difference of variances for small and large samples.	5
6.	Hypothesis Testing	The basic idea of significance test. null and alternative hypothesis, type-I and type II errors, testing of small and large samples for mean, variance, difference in means, and difference in variances.	7
Total number of Lectures			**42**

Evaluation Criteria

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

Project based learning: Students in a group of 4 will collect sample data set and make simple regression models. They will validate the model by hypothesis testing. By this students will be able to make simple linear regression models and validate it.

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.	**Biswas and Srivastava**, A Textbook, Mathematical Statistics Ist Edition, Narosa Publishing House, New Delhi.
2.	**W. Feller**, Introduction to Probability Theory and its Applications Vol. I and II. Wiley Eastern-Ltd, 1971
3.	**V. K.Rohatgi**, An Introduction to Probability Theory and Mathematical Statistics Wiley Eastern, 1984
4.	**R. V. Hogg, A. T. Craig,** Introduction to Mathematical Statistics, McMillan, 1971
5	**AM. Mood**, **F. A. Graybill, and D. C. Boes**, Introduction to the Theory of Statistics McGraw Hill, 1974
6.	**Des Raj & Chandak**, Sampling Theory, Narosa Publishing House, 1998.
7.	**Sheldon Ross**, A First Course in Probability, 10th edition, Pearson Education Asia, 2018.
8.	**Meyer, P.L**, Introductory Probability and Statistical Applications Addison-Wesley Publishing Company, 1965.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH632	**Semester** EVEN	**Semester 6th Session** 2021 -2022 **Month from January to May**
Course Name	SOLID STATE ELECTRONIC DEVICES		
Credits	3	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Dr. Dinesh Tripathi	
	Teacher(s) (Alphabetically)	NA	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Define terminology and concepts of semiconductors with solid state electronic devices.	Remembering (C1)
CO2	Explain various electronic, optical and thermal properties of semiconductors; various techniques used in device fabrication.	Understanding (C2)
CO3	Solve numerical problems based on solid state electronic devices.	Applying(C3)
CO4	Examine the impact of various parameters on semiconductor devices and their performances.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Energy band and charges carriers in conductors	Bonding forces and energy bands in solids, charge carriers in semiconductors, carries concentrations, drift of carriers in electric and magnetic fields, Invariance of the Fermi level at equilibrium, optical absorption, Luminescence, Carrier lifetime and photoconductivity, diffusion of carriers	12
2.	Junctions	Fabrication of p-n junctions, equilibrium conditions, steady state conditions, reverse bias breakdown, recombination and generation in the transition region, metal semiconductor junctions, heterojunctions,	10
3.	Transistors	Field effect transistor (FET), Metal-insulator FET, Metal-insulator-semiconductor FET, MOS FET, Bipolar junction transistors	08
4.	Devices	Photodiodes, solar cell, light emitting diodes, semiconductor lasers, Negative conductance Microwave devices: Tunnel diode, IMPATT diode, Gunn diode	10
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (5), Attend. (5), PBL (10) and Class performance (5)]
Total	**100**

Project based learning: To make a better understanding about the subject, groups of 4-5 students will be formed and a project on semiconductor devices viz. Gauss meter, Photodiode, Light Emitting Diode, Solar cell, Tunnel Diode, FET, MOSFET etc. will be allotted to each of the groups. The students will collect all the information's and understand about the basic principle, fabrication process and current research activities going on in the particular field. The students will also be encouraged to explore the field and create interactive simulations based on these devices.	
Recommended Reading material:	
1.	Donald A Neamen&Dhrubes Biswas, Semiconductor Physics and Devices, McGraw Hill Education
2.	S. M. Sze, Physics of Semiconductor devices, Wiley-Interscience
3.	Streetman and Banerjee, Solid State Electronic devices, PHI
4.	Umesh Mishra and Jasprit Singh, Semiconductor Device Physics and Design,

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH633	**Semester: Even**	**Semester:** VI **Session: 2021-22** **Month: January to June**
Course Name	Photovoltaic Techniques		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Bhubesh Chander Joshi
	Teacher(s)	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Classify various types of renewable energy sources and explain working of photovoltaic devices.	Understand Level (Level 2)
CO2	Demonstrate the use of basic principles to model photovoltaic devices	Understand Level (Level 2)
CO3	Identify challenges and apply strategies to optimize performance of various type of solar cells	Apply Level (Level 3)
CO4	Analyze Solar PV module, mismatch parameter and rating of PV module	Analyze Level (Level 4)
CO5	Evaluate the performance of various stand-alone PV systems with battery and AC and DC load	Evaluate Level (Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review	Energy issues, conventional energy sources, Renewable energy sources, Solar Energy	02
2.	Solar cell fundamentals	Fundamental of semiconductor, charge carriers and their motion in semiconductors, carriers generation and recombination, p-n junction diode, introduction to solar cell, p-n junction under illumination, Current-Voltage (I-V), open circuit voltage (V_{OC}), short circuit current (I_{SC}) Maximum power, current and voltage and Efficiency, Quantum Efficiency	10
3.	Design of solar cells	Upper limits of cell parameters, loses in solar cell, solar cell design, design for high I_{sc}, V_{oc}, FF, solar simulators	08
4.	Solar cell technologies	Production of Si, Si wafer based solar cell technology, thin film solar cell technologies (CIGS, microcrystalline and polycrystalline Si solar cells, amorphous Si thin film solar cells), multijunction solar cells, Emerging solar cell technologies: organics solar cells, Dye-sensitized solar cell (DSC), GaAs solar cell	12
5.	Photovoltaic system	PV system: Introduction, Stand-alone system, Grid connected system, Hybrid system, Designing of PV system, Balance of system- BOS (Inverters, Controllers, Wiring, Batteries) Photovoltaic Cells, Estimating PV system size and cost, Photovoltaic safety.	08
		Total number of Lectures	**40**
Evaluation Criteria			

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 [Attendance, Class Test, Quizzes, Internal assessments (15 M), and Assignments in PBL mode (10 M)].
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Tom Markvart and Luis Castaner, "Solar Cells: Materials, Manufacture and Operations," Elsevier, 2006
2.	Stuart R. Wenhem, Martin A. Green, M.E. Watt, "Applied Photovoltaics," Earthscan, 2007
3.	Jenny Nelson, "The Physics of Solar Cells" Imperial college press," Aatec publications, 1995.
4.	C S Solanki, Solar Photovoltaics, PHI

Project based learning: Students will be given a task to design a PV system for the water pump and/or home appliances. This design will help students in understanding the basic knowledge of PV systems, wiring, load calculation, battery sizing, PV panels, etc. It will improve their analytical skills and problem-solving capability and help them in getting jobs in the renewable energy sector.

Detailed Syllabus
Lecture-wise Breakup

Course Code	16B1NPH636	**Semester: Even**	**Semester: VI Session** 2021 -2012 **Month from:** January 2022 to June 2022
Course Name	Medical & industrial applications of nuclear radiations		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Manoj Tripathi	
	Teacher(s) (Alphabetically)	Dr. Manoj Tripathi	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
CO2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
CO3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
CO4	Analyze different radiocarbon dating mechanisms and processes.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Nucleus, Radioactivity & Dating	Structure of matter**;** Nucleus:Nuclear Size, Structure and forces; Binding energy and Nuclear stability, mass defect;Nuclear reaction: Fission, Fusion, chain reaction. Nuclear fusion in stars, Formation of basic elements: proton-proton chain, CNO cycle, Hydrostatic equilibrium; Applications: atom bomb, hydrogen bomb, nuclear power plants, Nuclear reactor problems, precautions. **ii)** Radioactive decay, kinetics of radioactive decay, Types of radioactive decay and their measurement, Half life, decay constant, Population of states, Production of radionuclides. Radioactive dating, Radiocarbon dating: Formation, mechanism of dating, carbon cycle, radiocarbon clock and applications, advantages, disadvantages, precautions; Other dating techniques, protein dating, accuracy in dating;	17
2.	Radiation and matter interactions	Dosimetry and applications: Interaction of Radiation of matter: Biological effects of radiations; dosimetry, working principles, Tools and radiotherapy, Doses, Radioisotopes, Radiotracers;	09
3.	NMR and MRI	Nuclear Magnetic Resonance: General Introduction to Magnetic Resonance, Reference Frame; RF Pulses, Larmor precision, Basic principles of NMR & ESR Spectroscopy, Nuclear shielding, Chemical shifts; Couplings, Nuclear Imaging; 1D,2D, 3D Images, Application of NMR in medical industry as MRI, working MRI, Types of differen MRI, Applications of NMR in quantum computation;	09

4.	Nuclear Medicine and Nuclear Imaging	Nuclear Medicine and Nuclear imaging techniques, preclinical imaging, detector designing, photon counting, Medical imaging using $\beta+\gamma$ coincidences, SPECT AND PET: Radiation tomography, applications;	05
		Total number of Lectures	**40**

Evaluation Criteria

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

Project Bad Learning: Different groups of students with 5-6 students in each group may be formed and these groups may be given to complete a task like identifying common applications to nuclear science, recent developments in medical applications, etc. These problem domains (elemental and content analysis, materials modification, radiation gauging, solid/liquid Interface, and heart imaging) may be also chosen based on their potential interest to students. Students may be given a task of presenting the working of devices like MRI, PET scan, X-rays and other imaging techniques. Within each of these problem domains, the students will learn to work in a team. It will improve their analytical skills and the students will learn to achieve their common goal through mutual discussion and sharing of knowledge, information & understanding.

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.	Basic Sciences of Nuclear Medicine; Magdy M K halil, Springer
2.	Physics and Radibiology of Nuclear Medicine; Gopal B Saha, Springer
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	Radionuclide Techniques in Medicine, JM McAlister (Cambridge University Press, 1979).
5.	Nuclear Physics; S.N.Ghosal

Employability: In this course, students learn about the principles and mechanism of working of various medical imaging instruments like MRI, SPECT, PET, PETCT. This course enhances the skill among the students to develop new theories, mechanisms for today's medical industry. By obtaining knowledge in this domain, students may get job opportunity in medical and biomedical industries like nuclear pharmacy, nuclear medicine radiology etc.

Subject Code	18B11CS311	Semester: Even	Semester 6th Session Month from Feb-June 2022
Subject Name	Computer Networks and Internet of Things		
Credits	3	Contact Hours	3-0-0

Faculty (Names)	Coordinator(s)	1. Kirti Aggarwal (JIIT 62), 2. Dr. Gaurav Kr. Nigam (JIIT 128)
	Teacher(s) (Alphabetically)	**JIIT 62:**1.Amarjeet Kaur 2. Dr Apeksha Aggarwal 3. Dr. Vikash 4. Somya Jain 5. Kirti Aggarwal

COURSE OUTCOMES		COGNITIVE LEVELS
C313.1	Defining the basics of networking, components and underlying technologies	Remembering (Level 1)
C313.2	Illustrate the various key protocols in OSI model and TCP/IP protocol suite and explain various application protocols.	Understanding (Level 2)
C313.3	Examine various transport protocols and its performance enhancing mechanisms.	Analysing (Level 4)
C313.4	Determine the shortest path for the network using various routing protocols and evaluate it.	Evaluating (Level 5)
C313.5	Choose IP & MAC addressing mechanisms and data link layer protocols to solve communication, error detection and correction problems.	Applying (Level 3)
C313.6	Identification and description of various components, architectures and protocols of Internet of Things (IoT) and their real life problems.	Understand (Level 2)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Introduction	Network terminologies,Network Models, Protocol layers and their services, Connection Oriented and Connectionlessservices,Physical Media.	04
2.	The Application Layer	Principles of Application-Layer Protocols, HTTP, File Transfer: FTP, DNS, Electronic Mail in the Internet	4
3.	The Transport Layer	Transport-Layer Services and Principles, Multiplexing and Demultiplexing Applications, UDP and TCP, Connection Establishment, Transport Layer Protocols (go back N, stop and wait, selective repeat), Flow Control, TCP Congestion Control	8
4.	The Network Layer	Introduction and Network Service Model, IP: the Internet IP addressing, Routing Principles, Protocol, Routing in the Internet,	08

5.	The Link Layer and Local Area Networks	The Data Link Layer: Introduction, Services, Error Detection and Correction, Multiple Access Protocols and LANs, LAN Addresses and ARP, IEEE standards and Ethernet	06
6.	Introduction to Internet of Things	Introduction to IoT, IoT reference Model - IoT Reference Architecture,M2M architecture, IOT devices	05
7	IoT protocols	Introduction to IOT protocols:IEEE 802.11, LoRaWAN, 6LoWPAN, RPL and MQTT and CoAP	05
Total number of Lectures			**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance = (10), Assignments/Mini-Project/Tutorial/Quiz = (15))
Total	**100**

Project Based Learning: Each student in a group of 2-4 will choose some real-world problems such as congestion control, building smart devices, network traffic analyser etc. for development and analysis. By applying the different network protocol layer concepts and with the help of simulators it helps the students in enhancing their understanding and skills towards networking, communication and IoT related issues leading towards employability in IT and hardware sector.

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

1	James Kurose, Keith Ross," Computer Networking: A Top-Down Approach Featuring the Internet ", Addison Wesley
2	Andrew S. Tanenbaum ,"Computer Networks ", Prentice-Hall Publishers
3	Larry Peterson , Bruce Davie ,"Computer Networks a Systems Approach ", Morgan Kaufmann
4	William Stallings ,"Data and Computer Communications", Prentice Hall
5	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017
6	RajkumarBuyya, and Amir VahidDastjerdi, eds. Internet of Things: Principles and paradigms. Elsevier, 2016.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS611	**Semester EVEN (specify Odd/Even)**	**Semester** VI **Session** 2021-2022 **Month from : Feb - June**
Course Name	Marketing Management		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	Dr Swati Sharma
	Teacher(s) (Alphabetically)	Dr. Deepak Verma, Dr Swati Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-7.1	To illustrate the fundamentals of marketing, marketing environment and market research	Understanding Level (C2)
C304-7.2	To model the dynamics of marketing mix	Applying Level (C3)
C304-7.3	To demonstrate the implications of current trends in social media marketing and emerging marketing trends.	Understanding Level (C2)
C304-7.4	To appraise the importance of marketing ethics and social responsibility	Evaluating(C5)
C-304-7.5	To conduct environmental analysis, design business portfolios and develop marketing strategies for businesses to gain competitive advantage.	Creating (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Understanding New Age Marketing**	Defining Marketing For 21st Century The importance of marketing and marketing's role in business and society. Introduction to Digital Marketing. Online Communication Tools. The Social Media-Conversations, Community and Content. Affiliate Marketing and Mobile Engagement. The Digital Campaigns	5
2	**Marketing Environment and Market Research and insights**	Internal and external forces impacting marketers. Marketing and Customer Value. Gathering Information and Scanning the environment. Company's Micro and Macro Environment Responding to the Marketing Environment	3
3	**Strategic Planning and the marketing Process**	Explore the impact of social forces on marketing actions. Describe how technological change affects marketing. Designing the business Portfolio Discuss the Strategic Planning Process and Strategic Marketing Process.	5

4	**Consumer and Business Buyer Behaviour**	Consumer Markets and consumer buyer behaviour. The buying decision process. Business Markets and business buyer behaviour. Discuss the modern ethical standards.	5
5	**Branding**	Brand Image, Identity and Association. Product brands and Branding decisions. Product line and mix decisions. Consumer Brand Knowledge. New Product Development and Product life cycle strategies.	4
6	**Pricing products: Pricing considerations and strategies**	Factors to consider when setting prices. New product pricing strategies. Product mix pricing strategies. Price adjustments and changes.	4
7	**The New Age Social Marketing**	Ethics and social responsibility in marketing. Ethical behavior in business. Ethical decision making. Social forces affecting marketing. Impact of culture on marketing. Discuss modern ethical standards. Importance of marketing in CSR and business sustainability.	2
		Total number of Lectures	**28**

Project Based Learning: Students will be assessed on a Project report. The students will present a business plan for a prospective business idea focusing on its marketing strategies applying all the concepts taught in the course

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project & Viva)
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.	Kotler, Philip and Gary Armstrong, Principles of Marketing, 16th Global Edition, New Delhi, Pearson Education, 20015.
2.	Darymple, Douglas J ., and Leonard J. Parsons, Marketing Management: Text and Cases, 7th Edition, John Wiley & Sons(Asia) Pte. Ltd., 2002.
3.	Kotler, Philip., and Kevin Lane Keller, Marketing Management, 12th Edition, New Delhi, Pearson Education, 2006.
4.	Winer, Russell S ., Marketing Management, 2nd Edition, Prentice Hall,2003.
5	Dalrymple, Douglas J ., and Leonard J. Parsons, 2nd Edition, Wiley Publication, 2000.

Operations Research (18B12MA611)

LPP, graphical solutions, simplex method, Big-M method, two phase method, primal-dual relationship, dual simplex method, sensitivity analysis, north west corner rule, least cost method, Vogel's approximation method, resolution on degeneracy, Hungarian method, travelling salesmen problems, pure and mixed integer linear programming problems, cutting plane method, branch and bound method, convex functions, unconstraint problem, extreme points, quadratic programming, Wolfe's method, constrained problems, Lagrange method for equality constraints, Kuhn-Tucker conditions.

Course Description

Course Code	18B12MA611	**Semester** Even	**Semester** VI **Session** 2020-21 **Month from** Jan - Jun 2021		
Course Name	Operations Research				
Credits	3		**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**				
	Teacher(s) (Alphabetically)				

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-3.1	construct mathematical models for optimization problems and solve linear programming problems (LPP) using graphical and simplex method.	Applying Level (C3)
C302-3.2	apply two-phase, Big-M and dual simplex method for linear programming problems.	Applying Level (C3)
C302-3.3	make use of sensitivity analysis to linear programming problems.	Applying Level (C3)
C302-3.4	solve transportation, assignment and travelling salesman problems.	Applying Level (C3)
C302-3.5	apply cutting plane and branch & bound techniques to integer programming problems.	Applying Level (C3)
C302-3.6	examine optimality conditions and solve multivariable nonlinear problems.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Preliminaries	Introduction, Operations Research Models, Phases and Scope of O.R. Studies.	3
2.	Linear Programming Problems (LPP)	Convex Sets, Formulation of LPP, Graphical Solutions, Simplex Method, Big-M Method, Two Phase Method, Special Cases in Simplex Method.	8
3.	Duality and Sensitivity Analysis	Primal-Dual Relationship, Duality, Dual Simplex Method, Sensitivity Analysis.	8

4.	Transportation Problems	Introduction, Matrix Form, Applications, Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method. Degeneracy, Resolution on Degeneracy, Optimal Solution, Maximization TP Model.	5
5.	Assignment Problems	Definition, Hungarian Method, Traveling Salesmen Problems.	4
6.	Integer Linear Programming Problems	Pure and Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and Bound Method.	6
7.	Non Linear Programming	Introduction to NLP, convex functions and graphical solution, Unconstrained Problem, Constrained Problems - Lagrange Method for equality constraints, Kuhn-Tucker Conditions for inequality constraints, Quadratic Programming - Wolfe's Method	8
Total number of Lectures			**42**

Evaluation Criteria

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

Project based learning: Each student in a group of 4-5 will collect literature on transportation, assignment and integer programming problem to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with afore mentioned topics.

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, Pearson Education, 2011.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.

CO-PO and CO-PSO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO1 2**	**PS O1**	**PS O2**
C302-3.1	**3**	**3**	**2**	**1**	**1**							**2**		
C302-3.2	**3**	**3**	**2**	**1**	**1**							**2**		
C302-3.3	**3**	**3**	**3**	**2**	**1**							**2**		
C302-3.4	**3**	**3**	**3**	**1**	**1**							**2**		
C302-3.5	**3**	**2**	**2**	**1**	**1**							**1**		
C302-3.6	**3**	**2**	**2**	**2**								**1**		

Applied Mathematical Methods (18B12MA612) (New)

Functional, variation and its properties, Euler's equation, the fundamental lemma of the calculus of variations, functionals in the form of integrals, functionals depending on the higher derivatives of the dependent variables, conversion of Volterra Equation to ODE, successive approximation, successive substitution methods for Fredholm and Volterra integral equations, Finite difference method, explicit method, implicit method, Crank-Nicolson method and applications, Laplace and Poisson equation, Hyberbolic equation, Von Neumann stability.

Course Description

Subject Code	18B12MA612	**Semester** Even	**Semester** VI **Session** 2021-2022 **Month from** Feb 2022 to June 2022	
Subject Name	Applied Mathematical Methods			
Credits	3	**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	Dr Vipin Chandra Dubey		
	Teacher(s) (Alphabetically)	Dr Nisha Shukla, Dr Vipin Chandra Dubey		

COURSE OUTCOMES		
After pursuing the above mentioned course, the students will be able to:		**COGNITIVE LEVELS**
C302-4.1	explain the functional and its variations required to optimize the physical problem.	Understanding Level (C2)
C302-4.2	apply different forms of Euler–Lagrange equation on the various variational problems with fixed boundaries.	Applying Level (C3)
C302-4.3	explain different types of integral equations including their conversions from IVP and BVP.	Understanding Level (C2)
C302-4.4	solve Volterra and Fredholm integral equations using various analytical methods.	Applying Level (C3)
C302-4.5	explain various numerical methods along with their stability analysis.	Understanding Level (C2)
C302-4.6	apply different numerical methods for solving differential equations.	Applying Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Functional and its Variation	Introduction, problem of brachistochrone, problem of geodesics, isoperimetric problem, variation and its properties, comparison between the notion of extrema of a function and a functional.	8
2.	Variational Problems with Fixed Boundaries	Euler's equation, the fundamental lemma of the calculus of variations, examples, functionals in the form of integrals, special cases contaning only some of the variables, examples, functionals involving more than one dependent variables and their first derivatives, the system of Euler's equations,	5
3.	Variational Problems (continued)	Functionals depending on the higher derivatives of the dependent variables, Euler- Poisson equation, functionals containing several independent variables, Ostrogradsky equation, Variational problems in parametric form, applications to differential equations.	5

4.	Fredholm and Volterra Integral Equations	Introduction and basic examples, Classification, Conversion of Volterra Equation to ODE, Conversion of IVP and BVP to integral equation, decomposition, direct computation, successive approximation, successive substitution methods for Fredholm and Volterra integral equations.	8
5.	Numerical Methods I	Classification of PDEs, Finite difference approximations to partial derivatives. Solution of one dimensional heat conduction equation by Explicit and Implicit schemes (Schmidt and Crank Nicolson methods), stability and convergence criteria.	8
6.	Numerical Methods II	Laplace equation using standard five point formula and diagonal five point formula, Poisson equation, Iterative methods for solving the linear systems. Hyperbolic equation, explicit / implicit schemes, method of characteristics. Solution of wave equation. Solution of I order Hyperbolic equation. Von Neumann stability.	8
Total number of Lectures			**42**

Evaluation Criteria

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

Project based learning: Students will be divided in the group of 4-5 students to collect the literature and explore the different numerical methods to solve partial differential equations.

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.	**Hilderbrand, F.B.,** Methods of Applied Mathematics, 2ndEdition, Prentice Hall, 1969.
2.	**Gupta, A.S.,** Calculus of Variations with Applications, Prentice Hall of India, 2003.
3.	**Gelfand, I.M.,** Fomin, S.V. Calculus of Variations, Prentice Hall, 1963.
4.	**Elsgolts, L.,** Differential Equations and the Calculus of Variations, Mir Publishers, Moscow, 1973.
5.	**Petrovsky, I.G.,** Lectures on the Theory of Integral Equations, Mir Publishers, Moscow, 1971.
6.	**Smith, G. D.**., Numerical solution of partial differential equations: finite difference methods. Oxford University Press, 1985

CO-PO and CO-PSO Mapping:

CO Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
C302-4.1	2	2	2									1		
C302-4.2	2	3	2									2		

C302-4.3	**3**	**2**	**2**									**2**		
C302-4.4	**3**	**3**	**3**									**2**		
C302-4.5	**2**	**2**	**2**									**1**		
C302-4.6	**3**	**2**	**2**									**2**		

Detailed Syllabus

Lab-wise Breakup

Subject Code	**18B15CS311**	**Semester EVEN 2022**	**Semester VI Session 2022 Month Feb 2022 to June 2022**
Subject Name	**Computer Networks and Internet of Things Lab**		
Credits	**1**	**Contact Hours**	**0-0-2**

Faculty (Names)	**Coordinator(s)**	Dr. Somya Jain(J62) and Rupesh Koshariya(J128)
	Teacher(s)	Ms. Amarjeet Kaur, Dr.Apeeksha Aggarwal, Dr.Kavita Pandey, Ms. Kirti Aggarwal, Dr.Naveen Kr. Gupta, Dr.Parmeet Kaur, Dr. Somya Jain, Mr. Vikash, Rupesh Koshariya, Dr Neeraj Jain, Dr Anubhuti, Ms. Anuradha Gupta, Dr Gaurav Nigam, Dr Payal, Ms. Ambalika Sarkar, Mr Bansidhar Joshi

S. No.	DESCRIPTION	COGNITIVE LEVEL(BLOOMS TEXONOMY)
CO1	Classify all the wired/wireless technologies and the basic network building blocks	Understand Level (Level 2)
CO2	Visualize and analyze the data packets of different TCP/IP layers. Store the data packets as *.pcap files.	Apply Level (Level 3)
CO3	Create client and server applications using the "Sockets" and the implementation of various protocols at Data link and TCP layer	Analyze Level (Level 4)
CO4	Implement the working of various sensors and actuators using Arduino and Raspberry Pi.	Apply Level (Level 3)
CO5	Design and develop applications for various challenges and problems related to Sustainable Development	Create (level 6)

Module No.	Subtitle of the Module	Topics in the module	CO
1.	**Introduction**	Introduction to Computer Network devices / UNIX Commands for TCP/IP Protocol	CO1

2.	Wireshark Simulator	Practice on WIRESHARK with tcp dump : Application Layer, Transport Layer	CO2
3.	Socket Programming	Client server programming using TCP and UDP, Implementing a calculator	CO3
4.	Network Simulator (NS2)	Introduction, Implementation of TCP Tahoe and Reno using ns-2, Performance Analysis of TCP Congestion Control Algorithm, Implementation of AQM Algorithm and its performance analysis, and its performance analysis	CO4
5.	IOT development boards and interfacing with sensors	Arduino Boards, Raspberry Pi. Temperature Sensor, Humidity Sensor, Pressure Sensor, Proximity Sensor, Accelerometer, IR Sensor, Optical Sensor, Gas Sensor, Smoke Sensor.	CO4
6	Application with LORA KIT development	Developing smart applications for various challenges and problems related to Sustainable Development, e.g., energy and waste management, water conservation, smart cities, smart agriculture.	CO5

Evaluation Criteria

Components	**Maximum Marks**
Lab Test -1	**20**
Lab Test -2	**20**
Lab Evaluations	**30**
Project	**20**
Attendance	**10**
Total	**100**

Project based learning: Each student in a group of 4-5 will select an application and analyze the different layers of the network model and how data flows through each in order to make subject application based. Understanding the various challenges and problems related to sustainable development, like energy and waste management, water conservation, smart cities, smart agriculture helps in determining the major requirements of the communication sector. This enhances the student's knowledge on of new world data applications and helps in enhancing their employability into related sector.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	James F. Kurose, Keith W. Ross, " Computer Networking : A Top-Down Approach Featuring the Internet " 3rd Edition Pearson Education.
2.	Andrew S. Tanenbaum,"Computer Networks" 4th Edition
3.	UNIX Network Programming, Volume 1, Second Edition: Networking APIs: Sockets and XTI, Prentice Hall, 1998, ISBN 0-13-490012-X.
4.	Teerawat Issariyakul, Ekram Hossain, "Introduction to Network Simulator NS2", Springer.
5.	Anish nath, "Packet Analysis with Wireshark Paperback," Packt Publishing
6.	Yoram Orzach, "Network Analysis Using Wireshark Cookbook," Packt Publishing
7	https://www.arduino.cc/en/Tutorial/HomePage
8	https://www.raspberrypi.org/documentation/
9	https://www.dragino.com/downloads/

SYLLABUS AND EVALUATION SCHEME

Lecture-wise Breakup

Course Code	19B12HS611	**Semester : EVEN (specify Odd/Even)**	**Semester:** VI **Session** 2021-22 **Month from:** Feb-June
Course Name	Econometric Analysis		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Manas Ranjan Behera
	Teacher(s) (Alphabetically)	Manas Ranjan Behera

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-2.1	*Demonstrate* the key concepts from basic statistics to understand the properties of a set of data.	Understanding Level - C2
C304-2.2	*Apply* Ordinary Least Square method to undertake econometric studies.	Apply Level - C3
C304-2.3	*Examine* whether the residuals from an OLS regression are well-behaved.	Analyze Level - C4
C304-2.4	*Evaluate* different model selection criteria for forecasting.	Evaluation Level - C5
C304-2.5	*Create* models for prediction from a given set of data.	Creation Level - C6

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Statistical Inference	Point and interval estimation; ;The Z distribution ;The Null and Alternate hypotheses ;The chi-square distribution; The F distribution; The t distribution	3

2.	Regression Analysis	Two variable regression model; The concept of the PRF; Classical assumptions of regression; Derivation of the OLS estimators and their variance; Properties of OLS estimators under classical assumptions; Gauss-Markov Theorem; Tests of Hypothesis, confidence intervals for OLS estimators; Measures of goodness of fit: R square and its limitations; Adjusted R square and its limitations	7
3.	Econometric Model Specification	Identification: Structural and reduced form; Omitted Variables and Bias; Misspecification and Ramsay RESET; Specification test; Endogeneity and Bias	5
4.	Failure of Classical Assumptions	Multi-collinearity and its implications; Auto-correlation: Consequences and Durbin-Watson test ;Heteroskedasticity: Consequences and the Goldfeld - Quandt test	2
5.	Forecasting	Forecasting with a)moving averages b) linear trend c) exponential trend CAGR; Forecasting with linear regression; Classical time series decomposition; Measures of forecast performance: Mean square error and root mean square error; Limitations of econometric forecasts	5
6.	Time Series Analysis	Univariate Time Series Models: Lag Operator, ARMA , ARIMA models, Autoregressive Distributed Lag Relationship	3
7.	Linear Programming	Linear programming; Dual of a linear programming problem; Simplex method Transportation	3
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20

End Semester Examination	35
TA	25 (Quiz+Project+Viva -Voce)
Total	**100**

Project based Learning: Students have to form a group (maximum 5 students in each group) and have to do an econometric analysis on the topic assigned. Students will use the different statistical methods using quantitative data to develop theories or test existing hypothesis. Students will also be encouraged to forecast future economic trends.

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.	Gujarati, D.N. (2002), Basic Econometric (4^{th} ed.), New York: McGraw Hill.
2.	Greene, W.H. (2003), Econometric Analysis, New Jersey: Prentice Hall.
3.	Madala, G.S. (1992), Introduction to Econometrics (2^{nd} ed.), New York: Macmillan.
4.	Wooldridge,J (2010),Econometric Analysis of Cross Section and Panel Data(2nd ed.), Cambridge, The MIT Press.
5.	Stock, J. H., and M. W. Watson. (2015). Introduction to Econometrics, (Third Update), Global Edition. Pearson Education Limited.

Detailed Syllabus
Lecture-wise Breakup

Course Code	19B12HS612	Semester: Even	**Semester VI** **Session** 2021 -2022 **Month from** Feb 2022 to June 2022
Course Name	Social Media and Society		
Credits	3	**Contact Hours**	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Shirin Alavi
	Teacher(s) (Alphabetically)	Dr. Shirin Alavi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-1.1	Infer the implications of digital change, and the concept of social media and e-marketing in the context of the changing marketing landscape	Apply Level(C3)
C304-1.2	Elaborate the implications of cyber branding and digitization on online marketing mix decisions	Create Level (C6)
C304-1.3	Develop specific models related to social media and social media analytics	Create Level (C6)
C304-1.4	Evaluate concepts related to Search Engine Marketing, Customer Centric Web Business models and Web Chain Analysis	Evaluate Level(C5)
C304-1.5	Illustrate the new age marketing practices	Understand Level (C2)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction, Individuals Online and Rules for engagement for social media	What is social media marketing, the importance of social media for influencing target audience, Patterns of internet usage, Internet user demographics, The Behavioural Internet, E-Marketing, The Virtual world, the changing Marketing Landscape, E -Marketing-Strengths and Applications, Online Marketing Domains, Digital Marketing Optimization, The Need for Digital Engagement	4
2.	The Online Marketing Mix	The Online Marketing Mix, Consumer Segmentation, Consumer Traits, Consumers and Online Shopping Issues, E-Product, E-Place, E-Price, E-Promotion, Website Characteristics affecting online purchase decision.	3
3.	The Online Consumer and Social Media	The Digital Ecosystem, Online Consumer Behavior, Cultural Implications of key web characteristics, Models of website visits, Web 2.0 and Marketing, The collaborative web, Network evolution, Network science, Marketing with networks, Metcalfe's law, Netnography, Social Media Model by McKinsey, social media Tools-Blogs, Wikis, Online Communities, Facebook, Twitter, You Tube, Flickr, Microblogging.	4

4.	Online Branding and Traffic Building	Cyber branding, Online brand presence and enhancement, The Digital Brand Ecosystem, Brand Experience, Brand Customer Centricity, Brands and Emotions, The Diamond Water paradox, Internet Traffic Plan, Search Marketing Methods, Internet Cookies and Traffic Building, Traffic Volume and quality, Traffic Building Goals, Search Engine Marketing, Keyword Advertising, Keyword value, Internet Marketing Metrics, Websites and Internet Marketing.	4
5.	Web Business Models ,Social Media Strategy ,Social Media Marketing Plan	The value of a Customer Contact, Customer Centric Business Management, Web Chain of Events, Customer Value Analysis and the Internet, Business Models, Revenue Benefits, Value Uncertainty, Purchase Importance, Define a social media plan, explain the social Media marketing planning cycle, list the 8C's of strategy development.	4
6.	Market Influence analytics in a Digital Ecosystem	Engagement Marketing through Content Management, Online Campaign Management, Consumer Segmentation, Targeting, and Positioning using Online Tools, Market Influence Analytics in a Digital Ecosystem, The Digital Ecosystem, Knowledge as a value proposition, CGM and Consumer behavior, The value of the power of influence, Amplifying Social Media Campaigns.	4
7.	The Contemporary Digital Revolution and its impact on society	Online Communities and Co-creation, The fundamentals of online community management strategies, The World of Facebook, The Future of Social media Marketing—Gamification and Apps, Game based marketing The world of Apps, Apps and the Indian Diaspora	3
8.	Integrating Mobile into Social Media Marketing	Types of Mobile Marketing, Progression of the mobile as a Marketing channel, some Indian mobile marketing campaigns, Impact of social media on government, the economy, development, and education	2
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project-Report and Viva)
Total	**100**

Project Based Learning: The project is to be done in a group size of 4 -5 members. Students were asked to identify one brand/company on social media. Read the information available on social media and browse through campaigns. Study the consumer engagement and comments. Write their opinion about it. Analyze the same with a social media tool and compare the results. Also identify and elucidate the strategies used by the brand in the context of online branding. This helped the students to understand concepts of cyber branding and social media analytics and enhanced their employability skills in an organization.

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.	Digital Marketing, Seema Gupta,First Edition ,Mc Graw Hill Education (India) Private Limited ,2018
2.	Social Media Marketing A Strategic Approach, Melissa Barker,Donald Barker,Second Edition Cengage Learning ,2017.
3.	Digital Marketing, Vandana Ahuja, First Edition, Oxford University Press, 2015
4.	Social Media Marketing, Liana "Li" Evans,First Edition , Pearson, 2011.

Applicational Aspects of Differential Equations (20B12MA311)

Existence and uniqueness of solutions, applications to ordinary differential equations in LCR and mass spring problem, Sturm-Liouville problems, orthogonality of characteristic functions, the expansion of a function in a series of orthogonal functions, trigonometric Fourier series, matrix method for homogeneous linear systems with constant coefficients, basic theory of partial differential equations, solution of partial differential equations by Laplace and Fourier transform methods, applications of differential equations in mechanics.

Course Description

Course Code	20B12MA311	**Semester** Even	**Semester** VI **Session** 2021-22 **Month from** Jan - Jun 2022
Course Name	Applicational Aspects of Differential Equations		
Credits	**3**	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Shikha Pandey, Dr. Lakhveer Kaur	
	Teacher(s) (Alphabetically)	Dr. Shikha Pandey, Dr. Lakhveer Kaur, Dr. Richa Sharma, Dr. Amit Srivastava	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above mentioned course, the students will be able to:		
C302-2.1	solve ordinary differential equations in LCR and mass spring problems.	Applying Level (C3)
C302-2.2	explain orthogonality of functions and apply it to solve Sturm-Liouville boundary value problems.	Applying Level (C3)
C302-2.3	apply matrix algebra to find the solution of system of linear differential equations.	Applying Level (C3)
C302-2.4	formulate and solve first and second order partial differential equations.	Applying Level (C3)
C302-2.5	evaluate solution of differential equations arising in engineering applications.	Evaluating Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic Theory of Ordinary Differential Equations	Existence and uniqueness of solutions, applications to ordinary differential equations in LCR and mass spring problem.	10
2.	Sturm-Liouville Boundary Value Problem	Sturm-Liouville problems, orthogonality of characteristic functions, the expansion of a function in a series	10

		of orthogonal functions, trigonometric Fourier series.	
3.	Matrix Methods to solve ODE's	Matrix method for homogeneous linear systems with constant coefficients.	4
4.	Basic Theory of Partial Differential Equations	Solution of first order equations: Lagrange's equation, Charpit's method, higher order linear equations with constant coefficients.	4
5.	Applications of Differential Equations	Fourier integrals, Fourier transforms, solution of partial differential equations by Laplace and Fourier transform methods, applications of differential equations in mechanics.	14
Total number of Lectures			**42**

Evaluation Criteria

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

Project based learning: Each student in a group of 3-4 will apply the concepts of differential equations arising in engineering applications.

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.	**Ross, S.L.,** Differential Equations, 3rd Ed., John Wiley & Sons, 2004.
2.	**Jain, R.K. and Iyengar, S.R.K.,** Advanced Engineering Mathematics, 3rd Ed., Narosa Publishing House, 2012
3.	**Chandramouli, P.N.,** Continuum Mechanics, Yes Dee Publishing India, 2014.
4.	**Kreysizg, E.,** Advanced Engineering Mathematics, 10th Edition, John Wieley & Sons, Inc. 2013.

CO-PO-PSO Mapping:

Cos	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**

C302-2.1	**3**	**3**	**2**									**2**		
C302-2.2	**3**	**2**	**2**									**2**		
C302-2.3	**3**	**2**	**2**									**2**		
C302-2.4	**3**	**2**	**2**									**2**		
C302-2.5	**3**	**3**	**3**	**2**								**3**		

Course Code	**20B16CS322**	**Semester** Even	**Semester** VI **Session** 2021 -2022 Month from Jan to Jun
Course Name	**Java Programming**		
Credits	Audit	**Contact Hours**	[1- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Dr. Shruti Jaiswal, Ms. Shradha Porwal
	Teacher(s) (Alphabetically)	Dr. Amarjeet Prajapati, Kashav Ajmera, Mr. Prantik Biswas, Dr. Raghu, Ms. Shradha Porwal, Dr. Shruti Jaiswal,

COURSE OUTCOMES At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-8.1	Write basic Java programs using Java constructs – loops, switch-case and arrays.	Understand Level (C2)
C305-8.2	Define all basic concepts related to OOP concepts	Remember Level (C1)
C305-8.3	Develop java programs using Java collection framework	Apply Level (C3)
C305-8.4	Create or design an application based on Java programming constructs	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Overview of OOA (Object Oriented Analysis) and Java basics	Classes, Objects, OOPs concept using JAVA, Packages and Interfaces.	**3**
2.	JVM Internals	Memory management, Garbage Collection	**1**
3.	String Handling	Using String and StringBuilder class. String Immutability(toString())	**2**
4.	Exception Handling in JAVA	Fundamentals, Exception types, Java built-in exceptions, Custom Exceptions, Chained Exceptions.	**2**
5.	Collections Framework	Collection Overview, List, Map (hashCode& Equals), Set, Queue & other collections	**4**
6.	Multithreading in Java	Multithreading overview and requirement, Thread state diagram, Java multithreading implementation	**2**

		(Thread/Runnable), Challenges in multithreading/Mutual Exclusion, Java handling of mutual exclusion (synchronization), Communication between threads (wait/notify)	
			Total number of Lectures **14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance = 07, Quizzes = 08, Internal assessment = 07, Assignments in PBL mode = 08.)
Total	**100**

Project based learning:Assignments on different topics are given to each student. They utilize the java concepts and try to solve different problems given as assignments.

The course emphasized on the Skill development of studentsin Java Programming. Topics like inheritance, classes, exception handling,multithreading, collection frameworks, etc. are taught to enhance the programming skills of the students for making them ready for employability in software development companies.

Recommended Reading material:	
Text Books	
1.	Schildt, H. (2014). *Java: the complete reference*. McGraw-Hill Education Group.
2.	Bloch, J. (2016). *Effective java*. Pearson Education India.
Referenc Books	
1.	Sierra, K., & Bates, B. (2005). Head First Java: A Brain-Friendly Guide. " O'Reilly Media, Inc.".
2.	Mughal, K. A., & Rasmussen, R. W. (2003). A programmer's guide to Java certification: a comprehensive primer. Addison-Wesley Professional.

Detailed Syllabus

Course Code	**20B16CS323**	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2021 -2022 Month from January to June
Course Name	Problem Solving using C and C++		
Credits	0	**Contact Hours**	[1- 0 - 2]

Faculty (Names)	**Coordinator(s)**	Ms. Anuradha Gupta, Dr. Vimal Kumar
	Teacher(s) (Alphabetically)	Akanksha Mendiratta, Anuradha Gupta, Bharat Kumar, Shilpa Budhkar, Sakshi Gupta, Vimal Kumar

COURSE OUTCOMES [NBA Code: C305-9] At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-9.1	Apply and use library functions, pointer arithmetic, arrays, and regular expressions and secure coding practices in programs.	Apply Level (C3)
C305-9.2	Use critical thinking skills and creativity to choose the appropriate containers, iterators and algorithms for a given problem.	Apply Level (C3)
C305-9.3	Demonstrate the use of concurrency principles, input and output streams and defensive techniques in programs.	Apply Level (C3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review and practice problems on Functions in C/C++	Functions, Alt function syntax, Function return type deduction, static, const and inline functions, default parameters, overloaded functions- operator and members, friends, overriding functions.	**CO1**
2.	Practice problems on Arrays and Pointers and Indirections	Smart pointers, pointers and dynamic memory allocation, type inference, array and pointers and their arithmetic and indirections	**CO1**
3.	Secure Coding practices in C/C++	Common String, Integer and dynamic memory allocation Errors, Integer and dynamic memory allocation and String vulnerabilities their mitigation strategies.	**CO1**
4.	String Localization and Regular Expression	Localization and working with regular expression, Programming with Regex library	**CO2**
5.	Practice problems	Errors and Exceptions, Exception Mechanisms,	**CO2**

	on Exception Handing and Assertions	Exceptions and Polymorphism, Stack unwinding and Cleanup, Common error handling issues	
6.	Applications with Disk Files and other I/O	Using streams, Input and Output with Streams, String Streams, File Streams and Bidirectional I/O	**CO2**
7.	Generic Programming with Templates	Class templates, Function templates, variable templates, Template parameters, Specialization of templates, template recursion, variadic templates, Meta-programming	**CO3**
8.	Working with Standard Template Library	Understanding and working with containers, container adapters and iterators, Lambda expressions, Function objects, STL algorithms, Customize and extend STL	**CO3**
9.	Programming using Dynamic Memory Allocation Model	Working with dynamic memory, array-pointer duality, low level memory operations, smart pointers and common memory pitfalls	**CO3**
10.	Problems on Concurrency in Programming	Introduction, Threads, Atomic operations library, Mutual Exclusion, Conditional variables	**CO3**
			14

Evaluation Criteria

Components	**Maximum Marks**
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance = 07, Quizzes = 08, Internal assessment = 07, Assignments in PBL mode = 08.)
Total	**100**

Project based learning: Project based learning: Each student in a group of 2-4 will choose an industrial application for development. To fulfil the objective of this lab i.e., learning and applying the programming skills in C and C++. Students need to consider a trending industrial requirement for application development using the programming language skills learned. Understanding programming application development helps the students in enhancing knowledge on industry need of software design and development using programming languages.

Recommended Reading material:

Text Books

1.	Schildt, H. (2003). C++: The complete reference. McGraw-Hill/Osborne.
2.	Lafore, R. (2002). Object-oriented programming in C++. Pearson Education.

3.	Deitel, P., & Deitel, H. (2016). C++ how to Program. Pearson.
Reference Books	
1.	Savitch, W. J., Mock, K., Msanjila, S., & Muiche, L. (2015). Problem Solving with C++. Pearson.
2.	Seacord, R. C. (2005). Secure Coding in C and C++. Pearson Education.
3.	Drozdek, A. (2012). Data Structures and algorithms in C++. Cengage Learning.

Detailed Syllabus

Course Code	**20B16CS324**	**Semester** Even	**Semester VI** **Session** 2021 -2022 Month from Jan 2022 to Jun 2022
Course Name	**Non-linear Data Structures & problem solving**		
Credits	1	**Contact Hours**	1- 0 - 2

Faculty (Names)	**Coordinator(s)**	Dr. Manju (62), Varsha Garg (128)
	Teacher(s) (Alphabetically)	Dr. Ankit Vidyarthi, Dr. Manish Ku. Thakur, Dr. Manju, Nishtha, Mrs Varsha Garg

COURSE OUTCOMES At the completion of the course, Students will be able to		**COGNITIVE LEVELS**
C305-10.1	Demonstrate operations on different data structures.	Understand Level (C2)
C305-10.2	Use critical thinking skills and creativity to choose the appropriate data structure and solve the given problem.	Apply Level (C3)
C305-10.3	Identify the correctness and efficiency of the solution by constructing different test cases.	Apply Level (C3)
C305-10.4	Develop solutions to real world problems by incorporating the knowledge of data structures	Create Level (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Problem Solving and Data Structures	Concepts of Problem Solving, Performance metrics for Algorithm Analysis, Why study Data structures and Abstract Data Types. Practice problems on Sparse Matrix	**1**
2.	Practice problems on advanced list structures	Multi-list, skip list, XOR linked list, self organizing list, unrolled linked list	**2**
3.	Practice problems on point and range queries using tree structures	Suffix array and suffix tree, Trie and persistent trie, Segment tree and persistent segment tree, Interval tree, K dimensional tree, Binary indexed tree, Splay tree, Treap (randomized BST), Order statistics tree	**4**
4.	Practice problems on optimization	Tournament tree, Decision tree, Cartesian tree	**2**

	problems using tree structures.		
5.	Practice problems on heaps and sets	Sparse set, Disjoint set, Leftist heap, K-ary heap	**2**
6.	Problem solving using graphs	Social graphs, Transportation system graphs, Resource allocation graphs	**3**
		Total number of Lectures	**14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Tern Evaluation	30
End Semester Examination	40
TA	30 (Attendance – 10, Quizes/Mini Project – 20)
Total	**100**

Project based Learning: Each student in a group of 3-4 will develop a simulator with the help of various advanced data structures. Students will be able to understand and apply algorithms and advanced data structures properly; know how to evaluate, choose appropriate algorithms or data structures; know how to design and implement algorithms or data structures to serve the purpose of designing solution. Selecting t**he appropriate** data **structure** is an integral part of the programming and problem-solving process. The project typically incorporates various advanced data structure concepts to enable the synthesis of knowledge from real-life experiences.

Recommended Reading material:	
Text Books	
1.	Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education. Ltd., Fourth Edition.
2.	Handbook of Data Structures and Applications, 2nd Edition by Sartaj Sahni, Dinesh P. Mehta, CRC Press
References	
3.	Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and .Mount, Wiley student edition, John Wiley and Sons.
4.	Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
5.	Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
6.	Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.
7.	Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson education

Detailed Syllabus
Lecture-wise Breakup

Course Code	**20B16CS326**	**Semester EVEN**	**Semester VI Session** 2021 -2022 **Month from JAN-JUN**
Course Name	Front End Programming		
Credits		**Contact Hours**	1-0-2

Faculty (Names)	**Coordinator(s)**	Mr. Janardan Verma (J62), Dr. Shailesh Kumar(J128)
	Teacher(s) (Alphabetically)	Janardan Verma, Kapil Madan, Kritika Rani, Mahendra Gurve, Shailesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-11.1	Demonstrate new technologies by applying foundation paradigms	Understanding [Level 2]
C305-11.2	Build strong foundations for basic front end tools & technologies thereby making them understand the application development lifecycle.	Apply [Level 3]
C305-11.3	Develop elegant and responsive Front-end by leveraging latest technologies	Apply [Level 3]
C305-11.4	Explain activity creation and Android UI designing	Understanding [Level 2]
C305-11.5	Develop an integrated mobile application to solve any complex real time problem	Create [Level 6]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Object Oriented Programming Concepts	Objects, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism	1
2.	Introduction to basic front end techniques	HTML 5, CSS 3, Javascript, jquery, bootstrap	3
3.	Java Fundamentals	Decision Making, Loop Control, Operators, Array, String, Overloading, Inheritance, Encapsulation, Polymorphism, Abstraction	2
4.	Advanced Front End Programming Concepts	Storing and retrieving data, Python Programming Concepts, Python for developing Android Application.	2
5.	Designing Android Application	Android development lifecycle, Learning UI and layout, controller, component, Directives, Services & views.	3
6.	Android with Database	Data base Application Development	2
7.	Privacy & Security Issues	Security Issues with Android Platform	1
		Total number of Lectures	**14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Semester Examination	30
End Semester Examination	40
TA	30 (**Attendance-10, Assignments/ Class Test/ Quiz/ LAB Record -05, Project -15**)
Total	**100**

Project based learning: In this subject students will learn the latest front end technology. After completing the subject, each student in a group of 3-4 will be able to create a mobile application.

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

Reference Books:	
1.	Schildt, H. (2014). Java: The Complete Reference. McGraw-Hill Education Group.
2.	Mughal, K. A., & Rasmussen, R. W. (2016). A Programmer's Guide to Java SE 8 Oracle Certified Associate (OCA). Addison-Wesley Professional.
3.	Gaddis, T., Bhattacharjee, A. K., & Mukherjee, S. (2015). Starting out with Java: early objects. Pearson.
Text Books:	
4.	Duckett, J. (2014). Web Design with HTML, CSS, JavaScript and jQuery Set. Wiley Publishing.
5.	Shenoy, A., & Sossou, U. (2014). Learning Bootstrap. Packt Publishing Ltd.
6.	Lee, W. M. (2012). Beginning android for application Development. John Wiley & Sons.
7.	Hardy, B., & Phillips, B. (2013). Android Programming: The Big Nerd Ranch Guide. Addison-Wesley Professional.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS312	**Semester: EVEN SEM**	**Semester 6th Session** 2021-2022 **Month from** Feb to June 2022
Subject Name	**Sensor Technology and Android Programming**		
Credits	**03**	**Contact Hours**	**3 -0 -0**

Faculty (Names)	**Coordinator(s)**	Hema N, SHARIQ MURTUZA
	Teacher(s) (Alphabetically)	Hema N, SHARIQ MURTUZA

COURSE OUTCOMES **After the completion of the course, the students will be able to**		**COGNITIVE LEVELS**
C331-1.1	Understand the sensor, smart sensors and various platform of sensing devices	Level-1 (Remembering)
C331-1.2	Understand Anatomy of an android development environment (IDE) for sensing application	Level-2 (Understanding)
C331-1.3	Accessing various physical sensors of the Android device and its programming	Level-3 (Applying)
C331-1.4	Develop various user services/app using Android and sensors	Level-6 (Create)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	**Fundamentals of Sensors**	**Sensing and Sensor Fundamentals:** Sensing Modalities, Mechanical Sensors, MEMS Sensors, Optical Sensors, Semiconductor Sensors, Electrochemical Sensors, Biosensors **Key Sensor Technology Components-Hardware and Software Overview:** Smart Sensors, Sensor Systems, Sensor Platforms, Microcontrollers for Smart Sensors, Microcontroller Software and Debugging	9

2.	**Introduction to Android Programming**	**Overview of the Android Platform:** Introducing Android, Setting Up Your Android Development Environment. **Android Application Basics:** Anatomy of an Android Application, Android Manifest File, Managing Application Resources. **Android User Interface Design Essentials:** Exploring User Interface Building Blocks, Designing with Layouts, Partitioning the User Interface with Fragments, Displaying Dialogs.	9
3.	**Inferring Information from Physical Sensors**	**Overview of Physical Sensors,** Android Sensor API, Sensing the Environment, Sensing Device Orientation and Movement. **Detecting Movement:** Acceleration Data. **Sensing the Environment:** Barometer vs. GPS for Altitude Data **Android Open Accessory (AOA):** AOA Sensors versus Native Device Sensors, AOA Beyond Sensors, AOA Limitations, AOA and Sensing Temperature	8
4.	**Sensing the Augmented, Pattern-Rich External World**	RFID, Near field communication (NFC), Inventory Tracking System using NFC, Camera Activity, Barcode Reader, Image-Processing using AOA, Android Clapper and Media Recorder.	8
5.	**Development of user Services using Android and Sensors**	Development of android services such as motion detection, Air Monitoring, Screen Brightness Monitoring, Acceleration, Position, Air Pressure Monitoring, and Monitor of Temperature	8
		Total number of Lectures	**42**

Evaluation Criteria Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 {(Quiz + Project Assignment +Class Test)→15+ Attendance→10}
Total	**100**

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

1.	Greg Milette, Adam Stroud, "Professional Android Sensor Programming", ISBN: 978-1-118-18348-9, Wiley June 2012

2.	McGrath, Michael J., Cliodhna Ni Scanaill, and Dawn Nafus. "*Sensor technologies: healthcare, wellness, and environmental applications"*. Springer Nature, 2013.
3.	Annuzzi, Joseph, Lauren Darcey, and Shane Conder. *Introduction to Android application development: Android essentials*. Pearson Education, 2014.
4.	Fraden, Jacob. Handbook of Modern Sensors: Physics, Designs, and Applications. Germany, Springer International Publishing, 2015.
5.	Advances in Modern Sensors: Physics, design, simulation and applications (IOP Series in Sensors and Sensor Systems) Hardcover – Import, 16 November 2020 by G R Sinha
6.	Horton, John. Android Programming for Beginners. United Kingdom, Packt Publishing, 2015.
7.	Kurniawan, Budi. *Introduction to Android Application Development*. Brainy Software Inc, 2014.

Project based learning: Learning smart sensors of android devices, student can write, read, and analyze graphical data of any connected android device from anywhere in the world. Students will get employment in sensor-based and android app firms. Group project will be given to the students to design custom based android application/services which access the various sensors of the android devices remotely. Depending on the services and its popularity, one can even have a start-up company for the same.

Detailed Syllabus
Lecture-wise Breakup

Course Code	21B12CS314	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2021 - 2022 **Month from** Jan 2022 to June 2022
Course Name	Introduction to Large Scale Database Systems		
Credits	**3**	**Contact Hours**	**3-0-0**

Faculty (Names)	**Coordinator(s)**	Dr.Indu Chawla
	Teacher(s) (Alphabetically)	Dr.DevpriyaSoni, Dr.Indu Chawla

COURSE OUTCOMES		**COGNITIVE LEVELS**
C331-3.1	Infer the background processes involved in queries and transactions, and explain how these impact on database operation and design	Understand level (Level 2)
C331-3.2	Choose appropriate ways of storing data and optimize queries.	Analyze level (Level4)
C331-3.3	Explain the concept and challenge of big data and demonstrate the comparison of relational database systems with NoSQL databases	Understand level (Level 2)
C331-3.4	Compare and discover the suitability of appropriate large databases to manage, store, query, and analyze various form of big data	Analyze level (Level4)
C331-3.5	Apply techniques for data fragmentation, replication, and allocation to design a distributed or parallel database system	Apply Level (Level3)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to large scale Databases	Review of database systems, Data sources and join processing, modelling and query languages	2
2.	Transaction management	Transaction processingconcepts, Concurrency control techniques and protocols	4
3.	Data Storage and Indexing	Data storage and indexing of massive databases in databases and data warehouses. Introduction to technologies for handling big data	7
4.	Query processing and Optimization	Measures of query cost, Evaluation of expressions, Query planning, evaluation and optimization	5
5.	Big data Tools and Technologies	Review of Big data, CAP Theorem (consistency, availability, partition tolerance), Using big data in businesses, Data visualization for data analysis, NoSQL databases	7

6.	Hadoop and its Ecosystem	Hadoop core components, Hadoop Ecosystem components, Data storage and processing in Hadoop framework	5
7.	Application-driven databases	Parallel and Distributed databases, Distributed Database Design, Architecture of Distributed DBMS	8
8.	Advanced databases	Graph databases, spatial and temporal databases	4
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based Learning: Each student in a group of two or three student will explore a large database from the domain of their choice. For real time applicability of subject, they will explore and choose one visualization tool available. The chosen visualization tool will be used for analyzing the database. Understanding the data visualization process, will help in their employability in big data analysis organizations.

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.	AviSilberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition, McGraw-Hill, March 2019.
2.	RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems (7th Edition) 7th Edition, Pearson Education (June 18, 2015), ISBN-10: 0133970779, ISBN-13: 978-0133970777.
3.	Sadalage, P.J. &Foowlwer, M. 2013. NoSQL distilled: a brief guide to the emerging world of polygot persistence. Addison-Wesley
4.	White, Tom. Hadoop: The definitive guide. " O'Reilly Media, Inc.", 2012.
5.	Zikopoulos, Paul, and Chris Eaton. Understanding big data: Analytics for enterprise class hadoop and streaming data. McGraw-Hill Osborne Media, 2011.
6.	Shashank Tiwari, Professional NoSQL, Wiley, 2011

Reference Books

1.	Rick, Smolan, and Jennifer Erwitt. "The human face of big data." Against All Odds Production (2012).
2.	Prajapati, Vignesh. Big data analytics with R and Hadoop. Packt Publishing Ltd, 2013.
3.	Provost, Foster, and Tom Fawcett. Data Science for Business: What you need to know about data mining and data-analytic thinking. " O'Reilly Media, Inc.", 2013.
4.	DeRoos, Dirk. Hadoop for dummies. John Wiley & Sons, 2014.
5.	Mayer-Schönberger, Viktor, and Kenneth Cukier. Big data: A revolution that will transform how we live, work, and think. Houghton Mifflin Harcourt, 2013.

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS315	**Semester Odd (specify Odd/Even)**	**Semester** VI **Session** 2021 -2022 **Month from:** Jan to Jun 2022
Subject Name	Web Technology and Cyber Security		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	P. Raghu Vamsi (J62), Vartika Puri (J128)
	Teacher(s) (Alphabetically)	Bhawna Saxena, P. Raghu Vamsi, Vartika Puri, Sangeeta Mittal

COURSE OUTCOMES		**COGNITIVE LEVELS**
C331-4.1	Apply the fundamental elements of Web development in design of web pages	Apply (level 3)
C331-4.2	Understand the web development concepts built on Advanced Java Scripting	Understand (level 2)
C331-4.3	Use the popular web development frameworks to build web applications	Apply (level 3)
C331-4.4	Apply hacking techniques to attack websites and describe their countermeasures	Apply (level 3)
C331-4.5	Understand defense mechanisms for cyber security	Understand (level 2)

Module No.	**Subtitle of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Review of Essential topics in Web Development	HTML, CSS, JavaScript Basics, Primitives, Functions, Objects , Event - Driven Programming, Callbacks	4
2.	Programming in React JS	Understanding SPA, React Overview, React vs Angular, React Deep-Dive, Composition over Inheritance, Declarative code with JSX, Unidirectional Data Flow, Components, Life Cycle, React Router	8
3.	Programming in Node JS	Introduction to Node JS, Event Loop, REPL, Modules, REST, Scaling	4
4.	Web Development Frameworks	Developing web applications using Django, Bootstrap, JQuery	5
5.	Hacking Web Applications and Countermeasures	Cross Site Scripting, Cross Site Request Forgery, XML External Entity (XXE) attacks and their countermeasures	5
6.	Injection Attacks and Their Defenses	SQL injection, code injection and Command injection Attacks and their Defenses	4
7.	Denial of Service Attacks	Denial of Service and Distributed Denial of Service Attacks on Web Applications and Defenses	2
8.	Securing Web Applications	Principles of Cyber Security and Secure Application Architecture	2
9.	Secure Network Protocols	DNS Attacks and DNSSec, SSL/TLS. VPNs , HTTPs and IPSec	8

Total number of Lectures	**42**

Evaluation Criteria

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

Project based learning: Each student will make a web application using any of the web technologies (either single or in combination) covered as part of this course. Student will be required to develop a secure web application having countermeasures implemented against web hacks like XSS, CSRF, injection attacks, DOS attacks etc. Building a web application using advanced JS scripting and/ or web frameworks, while handling the various facets of cyber security will give students a hands on experience of working in the area of web technology and cyber security. The knowledge gained will enhance their employability in the IT sector.

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

	Text Books
1.	Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th, Pearson, 2015.
2.	Matt Bishop, Computer Security: Art and Science, Addison-Wesley Educational Publishers Inc, 2003.
3.	Brad Dayley , Brendan Dayley et al., Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications (Developer's Library), 2nd, Addison-Wesley Educational Publishers Inc, 2018.
4	Chris Northwood, The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer, Apress, 2018.
	Reference Books
1	Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, 2nd, Apress, 2019.
2.	William Stallings, Lawrie Brown, Computer Security, Principles And Practice, 4th, Pearson Education, 2018.
3	Dr. David Basin, Applied Information Security, Springer, 2011.
4	Douglas R. Stinson, Cryptography Theory and Practice, 3rd, CRC Press, 2005.

Detailed Syllabus
Lecture-wise Breakup

Course Code	21B12CS317	**Semester Even (specify Odd/Even)**	**Semester:** VI **Session** 2021 -2022 **Month: January 2022**
Course Name	Introduction to Blockchain Technologies		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr Naveen Kumar Gupta (J62), Mr. Himanshu Agrawal (J128)
	Teacher(s) (Alphabetically)	Dr Naveen Kumar Gupta, Dr. Vikas Hassija (J62), Mr. Himanshu Agrawal (J128)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C332-1.1	Define the basic blockchain terminologies and its related application areas.	Remember Level (Level 1)
C332-1.2	Understand the security components in decentralized networks such as cryptography and digital signatures.	Understand Level (Level 2)
C332-1.3	Verify the feasibility of applying different consensus algorithms in blockchain to support low latency and more number of nodes.	Apply Level (Level 3)
C332-1.4	Analyze various consensus algorithms like PoW, PoS, PoB, Raft consensus, Paxos consensus, BFT.	Analyze Level (Level 4)
C332-1.5	Evaluate the performance improvements in block time and throughout by using different consensus algorithms namely PBFT, PoW.	Evaluate Level (Level 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction	Overview, Digital Age, Internet of Information, Concept of Trust, Trust protocol, What is blockchain, how blockchain works, steps in Blockchain transaction, Main components of Blockchain.	4
2.	Components of Blockchain	Importance of distributed consensus, Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles.	3
3.	Blockchain design principles	Network integrity, Distributed Power, Value as Incentives, Security, Privacy, Rights Preservation, Inclusion, and Guidelines for choosing Blockchain project. Example case studies, Application areas.	4
4.	Blockchain Implementation Challenges	1) The Technology challenges, 2) The Energy Consumption, 3) Governments role, 4) Impact of Old Paradigms 5) Challenges with the Incentives, 6) Blockchain as Job Killer, 7) Governing the Protocols, 8) Distributed Autonomous Agents, 9) Privacy, 10) Malicious usage	3
5.	Blockchain Transactions and consensus	The real need for mining – consensus – Byzantine Generals Problem, and Consensus as a distributed coordination problem, Consensus algorithms, RAFT, Paxos, Byzantine fault Tolerance, PBFT, PoW, PoS.	8

6.	Introduction to Bitcoin Blockchain	Introduction to digital currency, Crypto currency, Explanation of Bitcoin with concepts covered in Module 1, 2, and 3. Cryptographic methods in Bitcoin, Hashing in Bitcoin, Overview of Hash puzzle in Bitcoin, Consensus in Bitcoin, Bitcoin block structure, block creation and storage, and Bitcoin wallets.	4
7.	Metrics for Crypto currencies	Metrics to be considered for designing crypto currency blockchain.	2
8.	Introduction to Smart Contracts	Role of Bitcoin scripts, advantage of smart contracts, Introduction to REMIX IDE, Introduction to Solidity smart contracts, Solidity structure and language syntax, Deploying and interacting with smart contracts via Remix IDE.	8
9.	Developing Blockchain	Getting started with Node js, Role of Node js in crypto currency development, Front end development in Node JS, Back end development in Node JS, Best practices, case study.	6
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (10), Assignment (5), PBL mode (7) and Quiz (3))
Total	**100**

Project based learning: Each student in a group of 4-5 will opt a company that builds tools to help financial institutions and governments monitor the exchange of crypto currencies. The company's due diligence software monitors and detects fraudulent trading, laundering and compliance violations, and builds trust in blockchain.

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.	Nakamoto, Satoshi. Bitcoin: A peer-to-peer electronic cash system. Manubot, 2019.
2.	Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016. (Chapters 2, 3, and 5)

References :

1	Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World
2.	Blockchain: Blueprint for a New Economy
3.	The Truth Machine: The Blockchain and the Future of Everything
4.	IEEE Transactions on vehicular technology
5	ACM Transactions on Blockchain

Course Description

Course Code	21B12CS319	**Semester EVEN**	**Semester** VI **Session** 2021 -2022 **Month from JAN-JUN**
Course Name	Fundamentals of Soft Computing		
Credits	3	**Contact Hours**	3 –0 - 0

Faculty (Names)	**J62**	Dr. Parul Agarwal
	J128	Ashish Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C332-3.1	Understand vagueness, ambiguity and uncertainty in different type ofreal worldproblems	Understanding (Level 2)
C332-3.2	Analyze the fuzzy inference system and their applications in different set of problems	Analyze(Level 4)
C332-3.3	Assess different optimization techniques through error /loss functions	Evaluate (Level 5)
C332-3.4	Integrate and develop standalone and hybrid Intelligent techniques for real time engineering application.	Create (Level 6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction, Knowledge representation and Evolutionary Algorithm	Concept of computing systems, Soft computing vs. Hard computing, Characterstics and applications of soft computing, methods of Knowledge representation, Introduction to Genetic Algorithm.	1+4
2.	Fuzzy Inference System with applications	Fuzzy sets, operations of fuzzy sets, membership functions, Fuzzyrealtions, rules and fuzzy inferences, Defuzzification techniques, Fuzzy expert systems. Application of fuzzy logic.	08
3.	Introduction to Artificial Neural Network	Fundamentals, Evolution of neural network, Basic models of Neural networks, Terminologies of ANNs, McCulloh – Pitts Neuron, Single Layer Perceptron, MultiLayer PerceptronActivation Functions (Linear, Sigmoid, Tanh, Relu, Leaky Relu), Loss Functions, optimization techniques (Gradient Descent, Stochastic Gradient Descent, Mini Batch Gradient Descent, ADAM, RMSProp, AdaGrad, Nadam)	12
4.	Supervised Learning Models	Feed forward, Back Propagation Network, batch normalization, one hot, dropout, embedding, LSTM, GRU, CNN + RNN, Bi-Directional RNN	3+4
5.	Unsupervised Learning Models	Boltzmann machines, autoencoders, encoder-decoder, variational autoencoder, stack, convolutional autoencoder	08
Total number of Lectures			**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20

T2	20
End Semester Examination	35
TA	25 (Attendance = 10, Class Test/ Quizzes/Internal assessment/Mini Project=15)
Total 100	

Project Based Learning: Each student in a group of 3-4 will develop one intelligent application using some real time dataset and explaining the real time usage of the developed application. Also the application to be assessedbased on the performance metrics and optimization techniques.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. **TEXT BOOKS**	
1	S. N. Sivanandam and S. N. Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd, 2007
2	Simon Haykin, Neural Network: A comprehensive foundation, Pearson Education Asia(Adisson Wesley), 2003
3	David E. Goldberg, Genetic Algorithm in Search Optimization and Machine learning, Pearson Education Asia(Adisson Wesley),2000
4	Mohamad H. Hassoun, Foundamentals of Artificial Neural Networks, The MIT Press, 1995
5	George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, PHI
6	B. Yegnanarayana, Artificial Neural Networks, PHI
REFERENCE BOOKS Journals, Reports, Websites etc. in the IEEE format	
7	IEEE Transactions on Evolutionary Computation
8	IEEE Transactions on Fuzzy Systems
9	IEEE Transactions on Neural Networks
10	IEEE Transactions on Pattern Analysis and Machine Intelligence
11	ACM Transactions on Intelligent Systems and Technology

Detailed Syllabus
Lecture-wise Breakup

Subject Code	21B12CS320	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2021 -2022 **Month from:** Jan **to** June 2022
Subject Name	Open source software development		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr. Arpita Jadhav Bhatt (62), Ms. Kritika Rani (128)
	Teacher(s) (Alphabetically)	Arpita Jadhav Bhatt, Kashav Ajmera (62) Kritika Rani (128)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C332-4.1	Understand the benefits of using Open Source Software and key concepts.	Understand Level (Level 2)
C332-4.2	Understand the application of open source repository for collaborative development and version control.	Understand Level (Level 2)
C332-4.3	Understand the Linux Architecture, and its utilities used in Open Source Software Development.	Understand Level (Level 2)
C332-4.4	Understand the concept of Virtualization and cloud computing using open source tools.	understand Level (Level 3)
C332-4.5	Develop applications using the open source language and tools.	Apply Level (Level 3)

Module No.	**Subtitle of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Open Source Software	What is Open Source Software, What Is Proprietary Software, Pragmatism vs Idealism, History of Open Source Software, Open Source Governance Models ,Advantages of OSS, Contributing to OSS Projects, Tips for Successful Contributions, Continuous Integration, OSS Licenses and Legal Issues, Patents and Licenses, Leadership vs. Control, Diversity in OSS	2
2.	Linux tools for a developer	Introduction to Linux, its Kernel and Other System Components, Linux File System, Editing Tools – gedit, vi, emacs, Manual Pages, Linux Commands – cat, ps, top; File and Directory Management commands, grep, wc, sort, ls, head, tail, env, netstat, ip, pwd, chmod etc.,AWK,SED, SHELL Scripting, GCC, JVM, ECLIPSE, NETBEANS	10
3.	Git for distributed development	Introduction to GIT, its installation and usage, Working with GIT, Common GIT Commands, Creating Repositories, Creating a Commit, GIT Fork, Merge, Pull, Push, Clone; Merge Conflicts, Version Control	2
4.	Python and its libraries	Introduction to python, Python programming, Python as a Language, Installing Python and Writing A Program, Expression,Python programming continued: Conditional statements, functions, strings, File processing , python lists, Dictionaries, Counting with Dictionaries, Tuples and dictionaries	10

		Python libraries: NumPy, Pandas, matplotlib,	
5.	Open Source Tools for App Development	Introduction to App Development and process using Android Studio, Android Architecture, Setting up the environment, SDK, Description of Architectural components, Creating simple Android applications, Activities, Intents and manifest files, Life cycles of an activity, Handling buttons and action listener, working with intents, Passing intent object to link activities and types of intent, Passing data using intents, bundle, working with multiple activities	5
6.	Virtualization and Cloud Computing	Introduction to Virtualization – OS Network and Memory, Dockers and Containers, Introduction to Hypervisors, working of hypervisors, Types of Virtual Machine, Creating a Virtual Machine. Cloud Computing overview and history, OpenStack Overview & History, High Level Overview of OpenStack Architecture, Architecting & Implementing OpenStack Deployment, Horizon dashboard.	10
7.	Case Studies: Popular Open Source Software	Study Popular Open Source Software, their Architecture, Development Time-Line, Challenges, Communities	3
		Total number of Lectures	**42**

Evaluation Criteria

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

Project based learning: The students will work in a group of 3 members. In the mini-project, students will be able to develop applications in either domain - General Purpose Applications, Web-applications, and Cloud using OpenStack. Further they will be able to explore various open source tools and techniques. used in different domains like data-science, cloud computing, machine learning and AI etc.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Text Book(s):	
1.	Cannon, Jason. Linux for Beginners. United Kingdom: Createspace Independent Pub, 2014.
2.	Bresnahan, Christine., Blum, Richard. Linux Command Line and Shell Scripting Bible. United Kingdom: Wiley, 2021.
3.	Petersen, Richard. Linux: The Complete Reference, Sixth Edition. United Kingdom: McGraw-Hill Education, 2008.
4.	Brown, Amy, and Greg Wilson. *The Architecture of Open Source Applications: Elegance, Evolution, and a Few Fearless Hacks*. Vol. 1. Lulu. com, 2011.
5.	Fogel, Karl. Producing Open Source Software: How to Run a Successful Free Software Project. United States: O'Reilly Media, 2009.
6.	Hagos T. Android Studio IDE Quick Reference: A Pocket Guide to Android Studio Development. Apress; 2019 Jul 31.
7.	Griffiths D. Head First Android Development: a brain-friendly guide. " O' Reilly Media, Inc."; 2017 Aug 9.
Reference Book(s) and Other Reading Material:	
8.	Chacon, Scott, and Ben Straub. *Pro git*. Springer Nature, 2014.
9.	Peterson, Kevin. *The github open source development process*. url: http://kevinp. me/github-process-research/github-processresearch. pdf
10.	Shotts, William. *The Linux command line: a complete introduction*. No Starch Press, 2019.
11.	William “Bo” Rothwell .*Linux for Developers: Jumpstart Your Linux Programming Skills*, Publisher(s): Addison-Wesley Professional
12.	Portnoy, Matthew. *Virtualization essentials*. Vol. 19. John Wiley & Sons, 2012.
13.	Chisnall, David. *The definitive guide to the xen hypervisor*. Pearson Education, 2008.
14.	Pepple, Ken. *Deploying openstack*. " O'Reilly Media, Inc.", 2011.
15.	Jackson, Kevin. *OpenStack cloud computing cookbook*. Packt Publishing Ltd, 2012.
16.	Lutz, Mark. *Programming python*. " O'Reilly Media, Inc.", 2001.
17.	McKinney, Wes. "pandas: a foundational Python library for data analysis and statistics."*Python for High Performance and Scientific Computing* 14, no. 9 (2011).
18.	Oliphant, Travis E. *A guide to NumPy*. Vol. 1. USA: Trelgol Publishing, 2006.
19.	Tosi, Sandro. *Matplotlib for Python developers*. Packt Publishing Ltd, 2009.
20.	Naramore, Elizabeth, et al. *Beginning PHP5, Apache, and MySQL web development*. John Wiley & Sons, 2005.
21.	Lee, James, and Brent Ware. *Open Source Web Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP*. Addison-Wesley Professional, 2003.
22.	Swain, Nathan R., et al. "A review of open source software solutions for developing water resources web applications."*Environmental Modelling & Software*67 (2015): 108-117.

Detailed Syllabus
Lecture-wise Breakup

Course Code	21B12CS321	**Semester Even (specify Odd/Even)**	**Semester** VI **Session** 2021-22 **Month from** January **to** June 2022
Course Name	Concepts of Graph Theory		
Credits	3	**Contact Hours**	3-0-0

Faculty (Names)	**Coordinator(s)**	Dr Manish Kumar Thakur
	Teacher(s) (Alphabetically)	Dr Pratishtha Verma

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Understand the fundamental concepts in graph theory	Understand Level (Level 2)
CO2	Understand the procedure to store graphs and way to access them	Understand Level (Level 2)
CO3	Apply graph theory logics to solve real world problems using planarity and coloring	Apply Level (Level 3)
CO4	Analyze problems related to spectral and analytical domain that can be solved using special graphs	Analyzing Level (Level 4)
CO5	Evaluate the concept of Flow mechanism to solve domain specific problems	Evaluate Level (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Fundamental Concepts, Graph representations, Graph Isomorphisms, Subgraphs, Complement of a Graph	3
2.	Graph Traversing	DFS, BFS, Shortest paths, Optimal tours, Cycle detection, Euler's Cycle, Hamiltonian Cycle, TSP, etc.	5
3.	Applications of Trees	Minimum Spanning Tree, Depth First Search, Spanning Tree, Breadth First Search Spanning Tree	4
4.	Connectivity and Traversability	Connectivity Properties and Structure, de Bruijn Graphs and Sequences, Chinese Postman Problems, Traveling Salesman Problems, Further Topics in Connectivity	5
5.	Dual and Graph Planarity	Combinatorial vs. Geometric Graphs, Planar Graphs, Kuratowski's Graph, Planarity detection, Geometric duality, Thickness and crossing	5
6.	Coloring	Chromatic number, portioning, polynomial, Edge Coloring, Vertex coloring, Four color problem	4
7.	Applications of Coloring	Algorithms for Graph Coloring, Applications in Storage management, Timetable schedules	3
8.	Matching and Covering	Graph Matching, Matching algorithms, Applications; Covering properties, procedure, applications	4
9.	Extended Graph Theory	Algebraic Graph Theory, Spectral Graph Theory, Topological Graph Theory, Analytic Graph Theory	5
10.	Network Flow Graph	Flows in transportation networks, max-flow min-cut theorem, Maximum flow algorithm, Revisiting theorems	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance (10), Tutorial/Quiz/Class Test/Mini Project (15))
Total	**100**

Project Based Learning: Students in a group of 3-4 will take some real-world problem and apply Graph logics to solve the problem in a meaning way. Students can able to understand the core logic about data sharing and retrieval using Graph centric approach.

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.	Koh Khee Meng, Dong Fengming, Tay Eng Guan, Introduction to Graph Theory, World Scientific Press, 2014
2.	Jonathan L Gross, Jay Yellen, Ping Zhang, Handbook of Graph Theory, Second Edition, CRC Press 2013
3.	Krishnaiyan "KT" Thulasiraman, Handbook of Graph Theory, Combinatorial Optimization, and Algorithms, CRC Press 2016
4.	Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice-Hall, Reprint 2016
5.	Jean-Claude Fournier, Graph Theory With Applications, Wiley 2013

DETAILED SYLLABUS AND EVALUATION SCHEME

Course Code	21B12HS311	**Semester: EVEN (specify Odd/Even)**	**Semester: VI Session: 2021-22** Month from: Feb-June
Course Name	Development Issues and Rural Engineering		
Credits	03	Contact Hours	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Amandeep Kaur
	Teacher(s) (Alphabetically)	Dr. Amandeep Kaur amandeep.kaur@mail.jiit.ac.in

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-10.1	Understand the concept, philosophy and determinants of rural development	Understanding Level- (C2)
C304-10.2	Assess public policies related to rural development	Analyze Level –(C4)
C304-10.3	Explain the role of local self-governance in planning and development of rural areas.	Understanding Level- (C2)
C304-10.4	Analyze the impact of recent policy changes and schemes on rural development.	Analyze Level –(C4)
C304-10.5	Evaluate the issue and challenges of through possible determinants of rural development.	Evaluation Level- (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Rural Development: An Introduction	Rural Development Philosophy, Concepts, Principles, Traditional and Modern Concept of Development, Trends and Pattern of micro as well as macro indicators of Rural Development.	4
2.	Public Policies and Rural Development	Policies related to Employment Generation, Poverty Reduction, Skill Development and, Infrastructure such as MGNGEGA, DDUGKY, Atam Nirbhar Bharat rojgar yojna and schemes related to MSMEs etc.	6
3.	Rural Development Administration and Panchayat Raj Institutions	Rural Development administration: Panchayat Raj System (73rd Amendment Act), functions of Panchayat Raj System, Financial Distribution of Resources in Rural India through Panchayat Raj System, merits and demerits of Panchayat system, Ways to strengthen the existing system by overcoming the flaws.	6

4.	Rural Development Issues and Challenges	Issues and challenges of Rural development: Employment in line with sectoral distribution (GDP and Employment), Poverty and Migration Issue, Rural and Urban Consumption and Production Linkages.	7
5.	Recent Advancements and changes	Recent packages and schemes implemented in Rural India, Budget Allocation for Rural Development -2019-20 and 2020-21: For Employment Generation, poverty reduction, infrastructure and MSMEs.	5
Total number of Lectures			**28**

Evaluation Criteria

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

Project-based Learning: Students are required to collect the data related to different indicators of rural development (related to agriculture, health and education infrastructure, literacy levels, population density, poverty, employment etc.). They also need to check the compatibility of data (data mining and data refining process) and then analyse the contribution of these indicators in rural development of particular state/country as whole. Moreover, they are required to analyse the extent of progress and failure of programmes/schemes implemented in rural areas for poverty reduction, employment generation and MSMEs. Collecting information and analysing the data related to development indicators and policies will upgrade students' knowledge regarding the development issues and strengthen their skills to tackle multiple data handling and measuring issues.

Recommended Reading material:

1.	**Singh, Katar.** Rural Development: Principles, Policies and Management *(3e).*2009
2.	**Coke, P., Marsden, T. and Mooney, P.** Handbook of Rural Studies. Sage Publications, 2006
3.	**Todaro, M.P**., **Stephen C. Smith,** Economic Development, Pearson Education, 2017
3.	**Ahuja, H. L.**, Development Economics, S Chand publishing, 2016
4.	**Musgrave, R. A., Musgrave, P. B.,** Public Finance in Theory and Practice, McGraw Hill Education,2017