Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	: Diploma In Computer Technology / Computer Engineering / Computer Science & Engineering / Computer Science

Programme Code	: CM / CO / CW / SE	**With Effect From Academic Year**	: 2023-24
Duration Of Programme	: 6 Semester	**Duration**	: 16 WEEKS
Semester	: Fourth NCrF Entry Level : 3.5	**Scheme**	: K

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week	Credits	Paper Duration (hrs.)	Theory			Based on LL & TL				Based on Self Learning		Total Marks
																Practical						
						CL	TL	LL					FA-TH	SA-TH	Total	FA-PR		SA-PR		SLA		
													Max	Max	Max Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																						
1	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	314301	2	3	-	-	1	4	2	1.5	30	70*#	100 40	-	-	-	-	25	10	125
2	JAVA PROGRAMMING	JPR	AEC	314317	-	4	-	4	2	10	5	3	30	70	100 40	25	10	50#	20	25	10	200
3	DATA COMMUNICATION AND COMPUTER NETWORK	DCN	DSC	314318	-	3	-	4	1	8	4	3	30	70	100 40	25	10	25@	10	25	10	175
4	MICROPROCESSOR PROGRAMMING	MIC	DSC	314321	-	3	-	2	1	6	3	3	30	70	100 40	25	10	25@	10	25	10	175
5	PYTHON PROGRAMMING	PWP	AEC	314004	-	2	-	4	-	6	3	-	-	-	-	50	20	50#	20	-	-	100
6	UI/UX DESIGN	UID	SEC	314005	-	1	-	4	1	6	3	-	-	-	-	25	10	25@	10	25	10	75
	Total				2	16		18	6		20		120	280	400	150		175		125		850

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , AbilityEnhancement Course (AEC) , Skill Enhancement Course (SEC) , GenericElective (GE)

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	Course Code : 314301

Programme Name/s	: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Computer Science/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures/
Programme Code	: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ SE/ TC/ TE/ TR/ TX
Semester	: Fourth
Course Title	: ENVIRONMENTAL EDUCATION AND SUSTAINABILITY
Course Code	: 314301

I. RATIONALE

The survival of human beings is solely depending upon the nature. Thus, threats to the environment directly impact on existence and health of humans as well as other species. Depletion of natural resources and degradation of ecosystems is accelerated due to the growth in industrial development, population growth, and overall growth in production demand. To address these environmental issues, awareness and participation of individuals as well as society is necessary. Environmental education and sustainability provide an integrated, and interdisciplinary approach to study the environmental systems and sustainability approach to the diploma engineers.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Resolve the relevant environmental issue through sustainable solutions

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify the relevant Environmental issues in specified locality.
- CO2 - Provide the green solution to the relevant environmental problems.
- CO3 - Conduct SWOT analysis of biodiversity hotspot
- CO4 - Apply the relevant measures to mitigate the environmental pollution.
- CO5 - Implement the environmental policies under the relevant legal framework.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH			Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314301	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	3	-	-	1	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125

Total IKS Hrs for Sem. : 2 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the need of studying environment and its components. TLO 1.2 Investigate the impact of population growth and industrialization on the relevant environmental issues and suggest remedial solutions TLO 1.3 Explain the Concept of 5 R w.r.t. the given situation TLO 1.4 Elaborate the relevance of Sustainable Development Goals in managing the climate change TLO 1.5 Explain the concept of zero carbon-footprint with carbon credit	**Unit - I Environment and climate change** 1.1 Environment and its components, Types of Environments, Need of environmental studies 1.2 Environmental Issues- Climate change, Global warming, Acid rain, Ozone layer depletion, nuclear accidents. Effect of population growth and industrialization 1.3 Concept of 5R, Individuals' participation in i) 5R policy, ii) segregation of waste, and iii) creating manure from domestic waste 1.4 Impact of Climate change, Factors contributing to climate change, Concept of Sustainable development, Sustainable development Goals (SDGs), Action Plan on Climate Change in Indian perspectives 1.5 Zero Carbon footprint for sustainable development, (IKS-Enviornment conservation in vedic and pre-vedic India)	Lecture Using Chalk-Board Presentations

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY   **Course Code : 314301**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Justify the importance of natural resources in sustainable development TLO 2.2 Explain the need of optimum use of natural resources to maintain the sustainability TLO 2.3 Differentiate between renewable and non-renewable sources of energy TLO 2.4 Suggest the relevant type of energy source as a green solution to environmental issues	**Unit - II Sustainability and Renewable Resources** 2.1 Natural Resources: Types, importance, Causes and effects of depletion. (Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources), (IKS-Concepts of Panchmahabhuta) 2.2 Impact of overexploitation of natural resources on the environment, optimum use of natural resources 2.3 Energy forms (Renewable and non-renewable) such as Thermal energy, nuclear energy, Solar energy, Wind energy, Geothermal energy, Biomass energy, Hydropower energy, biofuel 2.4 Green Solutions in the form of New Energy Sources such as Hydrogen energy, Ocean energy & Tidal energy	Lecture Using Chalk-Board Presentations
3	TLO 3.1 Explain the characteristics and functions of ecosystem TLO 3.2 Relate the importance of biodiversity and its loss in the environmental sustainability TLO 3.3 Describe biodiversity assessment initiatives in India TLO 3.4 Conduct the SWOT analysis of the biodiversity hot spot in India TLO 3.5 Explain the need of conservation of biodiversity in the given situation	**Unit - III Ecosystem and Biodiversity** 3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem 3.2 Biodiversity - Definitions, Levels, Value, and loss of biodiversity 3.3 Biodiversity Assessment Initiatives in India 3.4 SWOT analysis of biodiversity hot spot in India 3.5 Conservations of biodiversity - objects, and laws for conservation of biodiversity	Lecture Using Chalk-Board Presentations Video Demonstrations
4	TLO 4.1 Classify the pollution based on the given criteria TLO 4.2 Justify the need of preserving soil as a resource along with the preservation techniques TLO 4.3 Maintain the quality of water in the given location using relevant preventive measures TLO 4.4 State the significance of controlling the air pollution to maintain its ambient quality norms TLO 4.5 Compare the noise level from different zones of city with justification TLO 4.6 Describe the roles and responsibilities of central and state pollution control board	**Unit - IV Environmental Pollution** 4.1 Definition of pollution, types- Natural & Artificial (Man- made) 4.2 Soil / Land Pollution – Need of preservation of soil resource, Causes and effects on environment and lives, preventive measures, Soil conservation 4.3 Water Pollution - sources of water pollution, effects on environment and lives, preventive measures, BIS water quality standards for domestic potable water, water conservation 4.4 Air pollution - Causes, effects, prevention, CPCB norms of ambient air quality in residential area 4.5 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city 4.6 Pollution Control Boards at Central and State Government level: Norms, Roles and Responsibilities	Lecture Using Chalk-Board Presentations

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY   **Course Code : 314301**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Explain Constitutional provisions related to environmental protection TLO 5.2 Explain importance of public participation (PPP) in enacting the relevant laws TLO 5.3 Use the relevant green technologies to provide sustainable solutions of an environmental problem TLO 5.4 Explain the role of information technology in environment protection	**Unit - V Enviornmental legislation and sustainable practices** 5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts 5.2 Public awareness about environment. Need of public awareness and individuals' participation. Role of NGOs 5.3 Green technologies like solar desalination, green architecture, vertical farming and hydroponics, electric vehicles, plant-based packaging 5.4 Role of information technology in environment protection and human health	Lecture Using Chalk-Board Presentations Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

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Suggest the steps to implement (or improve the implementation) of the 5R policy in your home/institute stating your contribution
Draft an article on India's Strategies to progress across the Sustainable Development Goals
Make a chart of Renewable and non-renewable energy sources mentioning the advantages and disadvantages of each source
Conduct the SWOT analysis of biodiversity hotspot in India
Prepare a mind-mapping for the zero carbon footprint process of your field
Prepare a chart showing sources of pollution (air/water/ soil), its effect on human beings, and remedial actions
Any other assignment on relevant topic related to the course suggested by the facilitator

UNICEF Certification(s)

•   Students may complete the self-paced course launched by Youth Leadership for climate Exchange under UNICEF program on portal www.mahayouthnet.in . The course encompasses five Modules in the form of Units as given below:
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Unit 1: Living with climate change
Unit 2 : Water Management and Climate Action
Unit 3: Energy Management and Climate Action
Unit 4 : Waste Management and Climate Action
Unit 5 : Bio-cultural Diversity and Climate Action
If students complete all the five Units they are not required to undertake any other assignment /Microproject/activities specified in the course. These units will suffice to their evaluations under SLA component

Micro project

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Technical analysis of nearby commercial RO plant.
Comparative study of different filters used in Household water filtration unit
Evaluate any nearby biogas plant / vermicomposting plant or any such composting unit on the basis of sustainabilityand cost-benefit
IKS-Study and prepare a note on Vedic and Pre-Vedic techniques of environmental conversion

Visit a local polluted water source and make a report mentioning causes of pollution
Any other activity / relevant topic related to the course suggested by the facilitator

Activities

•

Prepare a report on the working and functions of the PUC Center machines and its relavance in pollution control.
Prepare and analyse a case study on any polluted city of India
Prepare a note based on the field visit to the solid waste management department of the municipal corporation / local authority
Record the biodiversity of your institute/garden in your city mentioning types of vegetation and their numbers
Visit any functional hall/cultural hall /community hall to study the disposal techniques of kitchen waste and prepare a report suggesting sustainable waste management tool
Watch a video related to air pollution in India and present the summary
Any other assignment on relevant topic related to the course suggested by the facilitator

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Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Nil	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Environment and climate change	CO1	8	4	4	4	12
2	II	Sustainability and Renewable Resources	CO2	10	4	4	8	16
3	III	Ecosystem and Biodiversity	CO3	8	4	4	4	12
4	IV	Environmental Pollution	CO4	12	4	8	6	18
5	V	Enviornmental legislation and sustainable practices	CO5	7	4	4	4	12
		Grand Total		45	20	24	26	70

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

• Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered. Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as UNICEF Certification(s)/Microproject/assignment/activities. (60 % weightage to process and 40 % to product)

Summative Assessment (Assessment of Learning)

- Online MCQ type Exam

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	1	-	-	3	2	3			
CO2	-	2	2	-	3	2	3			
CO3	-	-	-	-	3	1	2			
CO4	1	-	-	-	3	2	2			
CO5	1	-	2	-	3	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Y. K. Singh	Environmental Science	New Age International Publishers, 2006, ISBN: 81-224-2330-2
2	Erach Bharucha	Environmental Studies	University Grants Commission, New Delhi
3	Rajagopalan R.	Environmental Studies: From Crisis to Cure.	Oxford University Press, USA, ISBN: 9780199459759, 0199459754
4	Shashi Chawla	A text book of Environmental Science	Tata Mc Graw-Hill New Delhi
5	Arvind Kumar	A Text Book of Enviornmental science	APH Publishing New Delhi (ISBN 978-8176485906)

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://sdgs.un.org/goals	United Nation's website mentioning Sustainability goals
2	http://www.greenbeltmovement.org/news-and-events/blog	Green Belt Movement Blogs on various climatic changes and other issues
3	http://www.greenbeltmovement.org/what-we-do/tree-planting-fo r-watersheds	Green Belt Movement's work on tree plantation, soil conservation and watershed management techniques
4	https://www.youtube.com/@ierekcompany/videos	International Experts For Research Enrichment and Knowledge Exchange – IEREK's platform to exchange the knowledge in fields such as architecture, urban planning, sustainability
5	www.mahayouthnet.in	UNICEF Intiative for youth leadership for climate action

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY   **Course Code : 314301**

Sr.No	Link / Portal	Description
6	https://eepmoefcc.nic.in/index1.aspx?lsid=297&lev=2&lid=1180 &langid=1	GOI Website for public awareness on enviornmetal issues
7	https://egyankosh.ac.in/handle/123456789/61136	IGNOU's Intiative for online study material on Enviornmental studies
8	https://egyankosh.ac.in/handle/123456789/50898	IGNOU's Intiative for online study material on sustainability
9	https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf	Final list of proposed Sustainable Development Goal indicators
10	https://sustainabledevelopment.un.org/memberstates/india	India's Strategies to progress across the SDGs.
11	https://www.un.org/en/development/desa/financial-crisis/sustainable-development.html	Challenges to Sustainable Development
12	https://nptel.ac.in/courses/109105190	NPTEL course on sustainable development
13	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview	Swayam Course on Enviornmetal studies (Natural Resources, Biodiversity and other topics)
14	https://onlinecourses.nptel.ac.in/noc23_hs155/preview	NPTEL course on enviornmental studies which encomopasses SDGs, Pollution, Cliamate issues, Energy, Policies and legal framework
15	https://www.cbd.int/development/meetings/egmbped/SWOT-analysis-en.pdf	SWOT analysis of Biodiversity
16	https://www.sanskrit.nic.in/SVimarsha/V2/c17.pdf	Central sanskrkit university publication on Vedic and pre vedic enviornmetal conservation

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 21/11/2024   **Semester - 4, K Scheme**

Programme Name/s	: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/ Electronics & Computer Engg./
Programme Code	: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ SE/ TE
Semester	: Fourth
Course Title	: JAVA PROGRAMMING
Course Code	: 314317

I. RATIONALE

Java is platform independent, open-source object-oriented programming language and used for web applications. Java has the broad industry support and is prerequisite with many allied technologies like Java Server Pages, Android Application Development. This course will enable students to develop applications using java.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop standalone and network-based applications using Java.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Develop java program using classes and objects.
- CO2 - Develop java program for implementing code reusability concept.
- CO3 - Develop program to implement multithreading and exception handling.
- CO4 - Develop java program for implementing event handling using window-based application components.
- CO5 - Implements network programming in java.
- CO6 - Develop java program for managing database.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314317	JAVA PROGRAMMING	JPR	AEC	4	-	4	2	10	5	3	30	70	100	40	25	10	50#	20	25	10	200

JAVA PROGRAMMING | **Course Code : 314317**

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

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6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Write programs to create classes and objects for the given problem. TLO 1.2 Describe characteristics of the given java token. TLO 1.3 Write program to evaluate given expressions. TLO 1.4 Write programs using relevant control structure to solve the given problem. TLO 1.5 Develop programs using vectors and wrapper classes for the given problem. TLO 1.6 Use constructors for the given programming problem.	**Unit - I Basic Syntactical Constructs in Java** 1.1 Java features and the Java programming environment 1.2 Defining a class, creating object, accessing class members 1.3 Java tokens and data types, symbolic constant, scope of variable, typecasting, and different types of operators and expressions, decision making and looping statements 1.4 Arrays, strings, string buffer classes, vectors, wrapper classes 1.5 Constructors and methods, types of constructors, method and constructor overloading, nesting of methods, command line arguments, garbage collection, visibility control: public, private, protected, default, private protected	Chalk-Board Demonstration Flipped Classroom Presentations
2	TLO 2.1 Apply identified type of inheritance for the given programming problem. TLO 2.2 Differentiate between overloading and overriding with the help of examples. TLO 2.3 Develop program using interface. TLO 2.4 Create user defined package for the given problem.	**Unit - II Inheritance, Interface and Packages** 2.1 Inheritance: concept of inheritance , types of Inheritance: single inheritance, multilevel inheritance, hierarchical inheritance, method overriding, final variables, final methods, use of super, abstract methods and classes 2.2 Interfaces: Define interface, implementing interface, accessing interface variables and methods, extending interfaces 2.3 Package: Define package, types of package, naming and creating package, accessing package, import statement, static import, adding class and interfaces to a package	Lecture Using Chalk-Board Presentations Hands-on Flipped Classroom

JAVA PROGRAMMING | **Course Code : 314317**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Distinguish the errors and exceptions with example. TLO 3.2 Develop program for handling the given exception. TLO 3.3 Create threads to run multiple processes in a program. TLO 3.4 Develop program using different thread life cycle methods.	**Unit - III Exception Handling and Multithreading** 3.1 Errors and Exception: Types of errors and exceptions, try and catch statement, throws and finally statement, built-in exceptions, throwing our own exception 3.2 Multithreaded programming : creating a thread: By extending to thread class and by implementing runnable Interface, Life cycle of thread: Thread methods, thread exceptions, thread priority and methods, synchronization	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on
4	TLO 4.1 Write steps to develop Graphical User Interface (GUI) using AWT components with frame for the given problem. TLO 4.2 Develop program using menu and dialog boxes for the given problem. TLO 4.3 Write steps to develop Graphical user interface (GUI) using advanced swing components for the given problem. TLO 4.4 Use delegation event model to develop event driven program for the given problem. TLO 4.5 Use relevant AWT/ Swing component(s) to handle the given event.	**Unit - IV Event handling using Abstract Window Toolkit (AWT) & Swings Components** 4.1 Component, container, window, frame, panel, use of AWT controls: labels, buttons, checkbox, checkbox group, textfield, textarea 4.2 Use of layout managers: flowLayout, borderLayout, gridLayout, gridBagLayout, menubars, menus, file dialog 4.3 Introduction to swing: Swing features, difference between AWT and Swing. 4.4 Swing components: Icons and Labels, TextField, ComboBox, Button, Checkbox, RadioButton 4.5 Advanced Swing Components: Tabbed Panes, Scroll Panes, Trees, Tables, Progress bar, tool tips 4.6 Introduction to Event Handling: The delegation Event Model: Event sources, Event listeners 4.7 Event classes: The action event class, the Item event class, the Key event class, the mouse event class, text event 4.8 Event listener interfaces: ActionListener , ItemListener , KeyListener , MouseListener , MouseMotion , TextListener	Lecture Using Chalk-Board Presentations Demonstration Hands-on
5	TLO 5.1 Describe the concepts of sockets in java. TLO 5.2 Use networking classes to retrieve host details. TLO 5.3 Develop program for Client/Server communication through TCP/IP Server sockets for the given problem.	**Unit - V Basics of Network Programming** 5.1 Socket Overview: Client/Server , reserved Sockets , proxy servers , Internet Addressing 5.2 Java and the Net: The networking classes and interfaces, InetAddress : Factory Methods , Instance Methods 5.3 TCP/IP Client and Server Sockets, datagram sockets, datagram packets 5.4 The URL Class, URLConnection class	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on
6	TLO 6.1 Choose relevant database connectivity methods. TLO 6.2 Describe two tier and three tier architecture of JDBC. TLO 6.3 Choose relevant type of JDBC driver for the specified environment. TLO 6.4 Elaborate steps with example to establish connectivity with the specified database.	**Unit - VI Interacting with Database** 6.1 Introduction to JDBC, ODBC 6.2 JDBC architecture: Two tier and three tier models 6.3 Types of JDBC drivers, Class Class , DriverManager class, Connection interface, Statement interface, PreparedStatement interface, ResultSet Interface	Lecture Using Chalk-Board Presentations Flipped Classroom Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

JAVA PROGRAMMING

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install any IDE software application.	1	* Setup Java Programming development environment using: • Command prompt.(Classpath and path setup) • Any IDE (Eclipse, Netbeans, VScode, Jcreator etc.).	2	CO1
LLO 2.1 Implement programs to evaluate different types of Expressions.	2	Write programs to evaluate different types of expressions.	2	CO1
LLO 3.1 Develop program to implement different control structures.	3	Write programs to demonstrate use of: • if statements (all forms of if statement • Switch – Case statement • Different types of Loops(for,while and do..while).	2	CO1
LLO 4.1 Develop program to implement different control structures.	4	*Write programs for implementation of different methods of: • String class. • StringBuffer class.	2	CO1
LLO 5.1 Implement array and vectors in Java.	5	* Write programs to demonstrate: • Use of Array. • Use of Vectors .	2	CO1
LLO 6.1 Convert primitive data types into object and vice-versa.	6	Write programs using Wrapper Class : • to convert primitive into object. • to convert object into primitive.	2	CO1
LLO 7.1 Initialize objects using constructors.	7	Develop a program for implementation of different types of constructors.	2	CO1
LLO 8.1 Implement concepts of inheritance for code reusability.	8	Develop program to implement: • Single inheritance. • Multilevel inheritance.	2	CO2
LLO 9.1 Implement multiple inheritance.	9	* Develop program for implementation of interface.	2	CO2
LLO 10.1 Implement packages in Java.	10	*Write programs to demonstrate use of : • Built in packages • User defined packages.	2	CO2
LLO 11.1 Identify the different types of errors using exception handling.	11	Write programs for implementation of try, catch and finally block.	2	CO3
LLO 12.1 Manage different types of user defined exceptions.	12	*Write programs for implementation of throw, throws clause.	2	CO3
LLO 13.1 Execute different processes simultaneously using multithreading.	13	*Write programs using multithreading.	2	CO3

JAVA PROGRAMMING

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Design GUI using different AWT components.	14	* Write program to design any type of form using AWT components.	2	CO4
LLO 15.1 Design GUI using different menu class.	15	Write program to create a menu bar with various menu items and sub menu items.	2	CO4
LLO 16.1 Design GUI using border layout manager.	16	Write program to demonstrate the use of border layout. The layout shows four buttons at four sides with captions "left", "right", "top" and "bottom" using Swing Components.	2	CO4
LLO 17.1 Design GUI using grid layout manager.	17	*Write program to design a calculator to demonstrate the use of grid layout using swing components.	2	CO4
LLO 18.1 Implement swing components in a frame.	18	Write program using swing to display a JComboBox in a JFrame .	2	CO4
LLO 19.1 Design tree and table using advanced swing components in a frame.	19	Write program to create JTree and JTable.	2	CO4
LLO 20.1 Implement various keys and mouse events.	20	* Write program to handle key events and mouse events.	2	CO4
LLO 21.1 Implement action event in java.	21	*Write program to implement action event in frame using swing components.	2	CO4
LLO 22.1 Implement text event in java.	22	Write program to handle text event on swing components.	2	CO4
LLO 23.1 Extract the hostname and IP address using InetAddress class.	23	Write program to retrieve hostname and IP address using InetAddress class.	2	CO5
LLO 24.1 Retrieve various components of URL using different methods of URL and URLConnection class.	24	*Write program to demonstrate various methods of: • URL class. • URLConnection.	2	CO5
LLO 25.1 Implement client-server TCP based communication.	25	*Write program that demonstrates connection oriented communication using socket.	2	CO5
LLO 26.1 Implement client-server UDP based communication.	26	Write program to demonstrate sending and receiving data through datagram.	2	CO5
LLO 27.1 Make database connectivity using appropriate JDBC driver.	27	*Write program to: • Create sample database. • Make connectivity with database.	2	CO6
LLO 28.1 Manage database using JDBC.	28	*Write program to implement following operations on database: • Insert record. • Update record. • Delete record.	2	CO6
LLO 29.1 Manage database using JDBC.	29	Write program to demonstrate the use of PreparedStatement.	2	CO6
LLO 30.1 Implement dynamic query.	30	*Write program to retrieve data from table using ResultSet interface.(Use various methods of navigation methods).	2	CO6

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -
- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Other

- Complete any course of Java Programming on Infosys Springboard/Spoken Tutorial/NPTEL
- Develop java code for given problem suggested by course teacher.

Micro project

- Develop mini-ATM machine system. It should accept account_no, account_holder_name, account_balance and perform operations such as withdrawal, Deposit and balance check.
- Develop Quiz Management System. Quiz should accept student credentials and contain 10 MCQ type questions. Determine the final result. Save the result in table along with student credentials.
- Energy Billing System: Expected to develop bill amount module based on usage of energy consumption.
- Develop Employee Management System. Insert employee details such as employee_name, emp_id,emp_salary etc.. into database and retrieve data from table.
- Any other micro project as suggested by course teacher.

Assignment

- Solve assignment covering all COs given by course teacher.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Databases like MySQL, Oracle, MS-Access or any other.	27,28,29,30
2	Computer System (Any computer system with basic configuration).	All
3	Computer with JDK1.8 or above, any IDE for Java Programming such as Eclipse, Jcreator, NetBeans,VScode .	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

JAVA PROGRAMMING   **Course Code : 314317**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basic Syntactical Constructs in Java	CO1	8	4	4	4	12
2	II	Inheritance, Interface and Packages	CO2	10	2	4	6	12
3	III	Exception Handling and Multithreading	CO3	12	2	4	6	12
4	IV	Event handling using Abstract Window Toolkit (AWT) & Swings Components	CO4	14	4	4	8	16
5	V	Basics of Network Programming	CO5	8	2	4	4	10
6	VI	Interacting with Database	CO6	8	2	2	4	8
		Grand Total		**60**	**16**	**22**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process 40% weightage to product
- A continuous assessment based on term work

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	2	--	1	1			
CO2	2	2	2	2	--	1	1			
CO3	2	2	2	2	--	1	1			
CO4	2	2	2	2	1	2	2			
CO5	2	2	3	2	1	2	2			
CO6	2	2	3	3	1	2	2			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	E Balaguruswamy	Programming with JAVA	Mcgraw Hill Education (India) Private Limited, New Delhi . ISBN-13: 978-93-5134-320-2
2	Schildt Herbert	Java Complete Reference	Mcgraw Hill Education, New Delhi . ISBN:9789339212094
3	Holzner, Steven et al	Java 8 Programming Black Book	Dreamtech Press, New Delhi. ISBN: 978-93-5119-758-4

JAVA PROGRAMMING

Course Code : 314317

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.javatpoint.com/java-tutorial	All content
2	https://www.w3schools.com/java/	All content
3	https://www.tutorialspoint.com/java/index.htm	All content
4	https://www.programiz.com/java-programming/online-compiler/	Online compiler for java
5	https://onecompiler.com/java	Online compiler for java
6	https://www.odbms.org/wp-content/uploads/2013/11/009.01-Arlow-JDBC-Tutorial-July-2005.pdf	Database Connectivity
7	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview	All content
8	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138420095549112329730_shared/overview	All content
9	https://onlinecourses.nptel.ac.in/noc22_cs47/preview	All content

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

DATA COMMUNICATION AND COMPUTER NETWORK	Course Code : 314318

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science**
Programme Code	**: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ SE**
Semester	**: Fourth**
Course Title	**: DATA COMMUNICATION AND COMPUTER NETWORK**
Course Code	**: 314318**

I. RATIONALE

Data communication and computer networks are essential components of modern computing infrastructure, enabling seamless exchange of information and facilitating collaboration across various devices and locations. By considering various applications, students should be able to choose, classify, install, troubleshoot, and maintain various data communication networks. This course provides the important concepts and techniques related to networking and offer students to have valuable insights into technology behind network communication.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified Outcome through various teaching learning experiences:
• Manage Data Communication and Computer Network

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Analyze the functioning of Data Communication and Computer Network.
- CO2 - Select relevant Transmission Media and Switching Techniques as per need.
- CO3 - Analyze the Transmission Errors with respect to IEEE standards.
- CO4 - Configure different TCP/IP services.
- CO5 - Implement relevant Network Topology using Networking Devices.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH	Credits	Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314318	DATA COMMUNICATION AND COMPUTER NETWORK	DCN	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

DATA COMMUNICATION AND COMPUTER NETWORK | **Course Code : 314318**

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the role of the given component in the process of data communication. TLO 1.2 Compare the characteristics of analog and digital signals on the given parameter. TLO 1.3 Explain the process of data communication using the given mode. TLO 1.4 Classify computer networks on the specified parameter.	**Unit - I Fundamentals of Data Communication and Computer Network** 1.1 Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol 1.2 Protocols, Standards, Standard organizations, Bandwidth, Data Transmission Rate, Baud Rate and Bits per second 1.3 Modes of Communication (Simplex, Half duplex, Full Duplex) 1.4 Analog Signal and Digital Signal, Analog and Digital Transmission: Analog To Digital, Digital To Analog Conversion 1.5 Fundamental Of Computer Network: Definition And Need Of Computer Network, Applications, Network Benefits 1.6 Classification Of Network: LAN, WAN,MAN	Lecture Using Chalk-Board, Presentations, Video Demonstrations

DATA COMMUNICATION AND COMPUTER NETWORK Course Code : 314318

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Explain with sketches the construction of a given type of cable. TLO 2.2 Explain with sketches the characteristics of the given type of unguided transmission media. TLO 2.3 Explain with sketches the working of the given Multiplexing technique. TLO 2.4 Describe with sketches the working principle of the given Switching technique. TLO 2.5 Compare different Switching techniques on the given parameter.	**Unit - II Transmission Media And Switching** 2.1 Communication Media: Guided Transmission Media Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable 2.2 Unguided Transmission Media: Radio Waves, Microwaves, Infrared, Satellite 2.3 Line-of-Sight Transmission, Point-to-Point, Broadcast 2.4 Multiplexing: Frequency-Division Multiplexing ,Time - Division Multiplexing 2.5 Switching: Circuit-switched network, Packet switched network	Lecture Using Chalk-Board, Presentations, Video Demonstrations
3	TLO 3.1 Explain working of the given error detection and correction method. TLO 3.2 Explain features of the given IEEE communication standard. TLO 3.3 Explain characteristics of the given layer in IEEE 802.11 architecture. TLO 3.4 Explain with sketches the process of creating a Bluetooth environment using the given architecture. TLO 3.5 Compare the specified generations of mobile telephone systems on the given parameter.	**Unit - III Error Detection and Correction** 3.1 Types of Errors, Forward Error Correction Versus Retransmission 3.2 Framing: Fixed Sized and Variable Sized Framing 3.3 Error Detection: Repetition codes, Parity bits, Checksums, CRC 3.4 Error Correction: Automatic Repeat Request (ARQ), Hamming Code 3.5 Wireless LAN IEEE 802.11 standard Architecture, Features of IEEE 802.11 versions: 802.11,802.11a,802.11b,802.11g,802.11n,802.11p 3.6 Bluetooth Architecture: Piconet, Scatternet 3.7 Mobile Generations: 3G, 4G and 5G	Lecture Using Chalk-Board, Presentations, Video Demonstrations, Flipped Classroom

DATA COMMUNICATION AND COMPUTER NETWORK   Course Code : 314318

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Identify functions and features of the given layer of OSI Reference model. TLO 4.2 Compare the specified service on the given parameters. TLO 4.3 Classify IP Addresses on the basis of its class from the given set of addresses. TLO 4.4 Distinguish between IPv4 and IPv6 on the given parameters. TLO 4.5 Describe with sketches the procedure to configure the given TCP/IP service.	**Unit - IV Network Communication Models** 4.1 THE OSI MODEL: Layered Architecture, Encapsulation 4.2 Layers in OSI Model(Functions of each layer)-Physical Layer,Data-Link Layer,Network Layer,Transport Layer,Session Layer,Presentation Layer,Application Layer 4.3 TCP/IP Layers and their functions: Host To Network Layer,Internet Layer,Transport Layer,Application Layer 4.4 Protocols: Host To Network Layer-SLIP,PPP, Internet Layer-IP,ARP,RARP,ICMP, Transport Layer-TCP and UDP, Application Layer-FTP,HTTP,SMTP,TELNET,BOOTP,DHCP 4.5 Addressing: Physical Address, Logical Address, Port Address 4.6 IP Address-Concept, Notation, Address Space 4.7 IPv4 Addressing: Classful and Classless Addressing ,subnet mask,supernetting,subnetting 4.8 IPV6 Addressing scheme and basic structure	Lecture Using Chalk-Board, Presentations, Case Study, Flipped Classroom
5	TLO 5.1 Compare different computing models on the given parameter. TLO 5.2 Identify relevant network topology for the given situation. TLO 5.3 Compare different topologies on the given parameter. TLO 5.4 Select network connecting device for the given situation. TLO 5.5 Describe with sketches the procedure to configure the given networking device.	**Unit - V Network Topologies And Network Devices** 5.1 Network Computing Model: Peer To Peer, Client Server 5.2 Network Topologies: Introduction, Definition, Selection criteria, Types of Topology- Star ,Mesh, Tree, Hybrid 5.3 Network Connecting Devices: Switch, Router, Repeater, Bridge, Gateways and Modem	Lecture Using Chalk-Board, Video Demonstrations, Flipped Classroom

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Implement Amplitude Shift Keying(ASK)	1	* Amplitude Shift Keying(ASK) using any simulator	2	CO1
LLO 2.1 Implement Frequency Shift Keying(FSK)	2	Frequency Shift Keying(FSK) using any simulator	2	CO1
LLO 3.1 Implement Phase Shift Keying(PSK)	3	Phase Shift Keying(PSK) using any open source simulation software	2	CO1
LLO 4.1 Create standard network straight cable by using cable tester.	4	*Create and Test standard straight network cable(Universal Colour Code) using crimping tool	2	CO2
LLO 5.1 Create standard Cross network cable by using cable tester.	5	Create and Test standard Cross network cable(Universal Colour Code) using crimping tool	2	CO2

DATA COMMUNICATION AND COMPUTER NETWORK

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Use basic programming skills to simulate communication systems. LLO 6.2 Debug and execute the program for Time Division Multiplexing(TDM).	6	* Generate a Time Division Multiplexing(TDM) signal using relevant simulation software	2	CO2
LLO 7.1 Transfer data using Bluetooth.	7	*Create a Hybrid Network Using Bluetooth	2	CO3
LLO 8.1 Identify different error detection methods. LLO 8.2 Detect errors using Checksum.	8	*Locate the error bit in the given data string by applying checksum error detection method	2	CO3
LLO 9.1 create WI-FI environment.	9	*Implement Wireless network	2	CO3
LLO 10.1 Draw block diagram for parity check. LLO 10.2 Implement parity check with examples.	10	Write a 'C' program for parity check error detection	2	CO3
LLO 11.1 Implement C Program for CRC	11	*Write a 'C' program for Cyclic Redundancy Check(CRC) error detection	2	CO3
LLO 12.1 Implement Hamming code in any suitable programming language.	12	*Write a 'C' program for error correction using Hamming code	2	CO3
LLO 13.1 Use IP address and appropriate subnet mask for given problem statement.	13	*Configure static IP address in operating system along with appropriate subnet mask for given problem	2	CO4
LLO 14.1 Implement IP addresses for intranet in Class A, Class B, Class C.	14	* Implement Classful Address in a given network node i)Identify range of IP Address in various classes ii)Justify the reason to choose various IP address classes for creating given network	2	CO4
LLO 15.1 Troubleshoot computer network using commands.	15	*Execute TCP/IP network commands:ipconfig,ping,tracert	2	CO4
LLO 16.1 Troubleshoot computer network using commands.	16	*Execute TCP/IP network commands: netstat, pathping, route	2	CO4
LLO 17.1 Use wireshark packet sniffer software.	17	*1) Install Wireshark and configure as packet sniffer- i)Capture IP,TELNET, FTP packets using Wireshark	2	CO4
LLO 18.1 Measure various types of Delay by using Wireshark.	18	Capture TCP and UDP packet using Wireshark	2	CO4
LLO 19.1 Filter ARP and ICMP packet Traffic using Wireshark.	19	Capture ARP and ICMP packet Traffic using Wireshark	2	CO4
LLO 20.1 Install server operating system	20	Install Operating System Linux/Windows/Any other Server	2	CO4
LLO 21.1 Create FTP Server	21	Use FTP protocol to transfer file from one system to another system	2	CO4
LLO 22.1 Implement IPv6 addressing scheme on a network.	22	Create IPv6 environment in a small network using simulator	2	CO4

DATA COMMUNICATION AND COMPUTER NETWORK Course Code : 314318

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 23.1 Configure HTTP server on given operating system.	23	*Create HTTP server	2	CO5
LLO 24.1 Use star topology for a given situation.	24	*Create computers using Star topology with wired media	2	CO5
LLO 25.1 Use Network simulator CISCO packet tracer.	25	Create Tree topology using CISCO packet tracer software	2	CO5
LLO 26.1 Implement remote login feature.	26	Configure TELNET for remote login	2	CO5
LLO 27.1 Survey existing network infrastructure.	27	*Visit your computer laboratory- i)Identify the type of topology ii)Identify types of connecting devices with specifications iii)Identify types of cables with specifications iv)List the type of network applications commonly used in the laboratory iv)Draw the layout of installed network	4	CO5
LLO 28.1 Transfer a file from one computer to another. LLO 28.2 Print documents from remote system in a network.	28	Share folder and printer in a network	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Solve an assignment on any relevant topic given by the Teacher
- For a trading firm an organization with 10users, draw network architecture design of wireless LAN.
- Identify appropriate network topology and network connecting devices for following requirement. Draw network design for proposed network. An organization having its office in a building of 5 floor. Each floor it needs 20 machines. There is one File server. Each floor has 2 print servers to facilitate printer capacity using Tree topology.

Micro project

- Install and configure NIC and find MAC Address of Device
- Design a network using any topology and do fault identification
- Create a tool that monitors network bandwidth usage in real-time

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Desktop Computer with basic configuration	All
2	Network Tool Kit: Crimping Tool for RJ-45 connector ,3in 1 modular crimping tool for RJ-45 UTP CAT-5/CAT-6 Networking Cable,LAN Cutter 8P/6pP/4P All-in-One or similar,Cable Tester/LAN Tester(Specification: Network Cable Tester for LAN RJ-45/CAT5/CAT6 UTP Wire Test Tool or similar)	All
3	Network Accessories: RJ45 connector, UTP cable, optical fibre cable, Coaxial cable, various connectors,1000Mbps NIC	All
4	UPS 6 KVA online	All
5	Ethernet Switch- 4/8/16/24/32	All
6	Router-256MB Memory storage capacity, compatible with Desktop and Laptop, Rack Mountable, Wireless Connectivity	All
7	Printer	All
8	Wireshark(https://www.wireshark.org/download.html)or any other Packet Analyzer Tool	All
9	Simulation Software: CISCO Packet Tracer, CORE Network Emulator or Similar	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamentals of Data Communication and Computer Network	CO1	10	4	8	4	16
2	II	Transmission Media And Switching	CO2	10	4	4	6	14
3	III	Error Detection and Correction	CO3	8	4	4	6	14
4	IV	Network Communication Models	CO4	12	4	6	8	18
5	V	Network Topologies And Network Devices	CO5	5	2	2	4	8
		Grand Total		**45**	**18**	**24**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- A continuous assessment based term work.

Summative Assessment (Assessment of Learning)

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- End semester examination, Lab performance, Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	-	2	1	-	-	1			
CO2	1	1	2	1	-	1	1			
CO3	1	2	1	1	-	-	1			
CO4	1	2	2	1	-	1	1			
CO5	-	2	2	1	1	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Behrouz A. Forouzan	Data Communication and Networking	McGraw-Hill Higher Education ISBN-13 978-0-07-296775-3
2	Behrouz A. Forouzan:	TCP/IP Protocol Suit	McGraw Hill Education ISBN-13 978-0073376042
3	A.S. Tanenbaum	Computer Networks	PRENTICE HALL ISBN-10: 0-13-212695-8 ,ISBN-13:978-0-13-212695-3
4	Godbole Achyut	Data Communication and Networks	McGraw Hill Education ISBN-10 9780071077705,ISBN-13 978-0071077705
5	Comer Douglas E.	TCP/IP Principles, Protocols and Architectures	PEARSON ISBN 10: 0-13-608530-X ISBN 13: 978-0-13-608530-0

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/	Data Communication-Definition, Components,Types,Channels
2	https://www.tutorialspoint.com/data_communication_computer_network/index.htm	Data Communication and Computer Network
3	https://nptel.ac.in/courses/106105081	Computer Networks
4	https://nptel.ac.in/courses/106105183	Computer Networks and Internet Protocol
5	Introduction To Computer Networks	Studytonight	Introduction To Computer Networks

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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DATA COMMUNICATION AND COMPUTER NETWORK	Course Code : 314318

Programme Name/s	: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science
Programme Code	: AI/ AN/ BD/ CM/ CO/ CW/ DS/ HA/ IF/ IH/ SE
Semester	: Fourth
Course Title	: DATA COMMUNICATION AND COMPUTER NETWORK
Course Code	: 314318

I. RATIONALE

Data communication and computer networks are essential components of modern computing infrastructure, enabling seamless exchange of information and facilitating collaboration across various devices and locations. By considering various applications, students should be able to choose, classify, install, troubleshoot, and maintain various data communication networks. This course provides the important concepts and techniques related to networking and offer students to have valuable insights into technology behind network communication.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified Outcome through various teaching learning experiences:
• Manage Data Communication and Computer Network

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Analyze the functioning of Data Communication and Computer Network.
- CO2 - Select relevant Transmission Media and Switching Techniques as per need.
- CO3 - Analyze the Transmission Errors with respect to IEEE standards.
- CO4 - Configure different TCP/IP services.
- CO5 - Implement relevant Network Topology using Networking Devices.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Assessment Scheme										
				Actual Contact Hrs./Week			SLH	NLH	Credits	Paper Duration	Theory				Based on LL & TL				Based on SL	Total Marks
															Practical					
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA	
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314318	DATA COMMUNICATION AND COMPUTER NETWORK	DCN	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

DATA COMMUNICATION AND COMPUTER NETWORK   **Course Code : 314318**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :
1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the role of the given component in the process of data communication. TLO 1.2 Compare the characteristics of analog and digital signals on the given parameter. TLO 1.3 Explain the process of data communication using the given mode. TLO 1.4 Classify computer networks on the specified parameter.	**Unit - I Fundamentals of Data Communication and Computer Network** 1.1 Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol 1.2 Protocols, Standards, Standard organizations, Bandwidth, Data Transmission Rate, Baud Rate and Bits per second 1.3 Modes of Communication (Simplex, Half duplex, Full Duplex) 1.4 Analog Signal and Digital Signal, Analog and Digital Transmission: Analog To Digital, Digital To Analog Conversion 1.5 Fundamental Of Computer Network: Definition And Need Of Computer Network, Applications, Network Benefits 1.6 Classification Of Network: LAN, WAN,MAN	Lecture Using Chalk-Board, Presentations, Video Demonstrations

DATA COMMUNICATION AND COMPUTER NETWORK

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Explain with sketches the construction of a given type of cable. TLO 2.2 Explain with sketches the characteristics of the given type of unguided transmission media. TLO 2.3 Explain with sketches the working of the given Multiplexing technique. TLO 2.4 Describe with sketches the working principle of the given Switching technique. TLO 2.5 Compare different Switching techniques on the given parameter.	**Unit - II Transmission Media And Switching** 2.1 Communication Media: Guided Transmission Media Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable 2.2 Unguided Transmission Media: Radio Waves, Microwaves, Infrared, Satellite 2.3 Line-of-Sight Transmission, Point-to-Point, Broadcast 2.4 Multiplexing: Frequency-Division Multiplexing ,Time - Division Multiplexing 2.5 Switching: Circuit-switched network, Packet switched network	Lecture Using Chalk-Board, Presentations, Video Demonstrations
3	TLO 3.1 Explain working of the given error detection and correction method. TLO 3.2 Explain features of the given IEEE communication standard. TLO 3.3 Explain characteristics of the given layer in IEEE 802.11 architecture. TLO 3.4 Explain with sketches the process of creating a Bluetooth environment using the given architecture. TLO 3.5 Compare the specified generations of mobile telephone systems on the given parameter.	**Unit - III Error Detection and Correction** 3.1 Types of Errors, Forward Error Correction Versus Retransmission 3.2 Framing: Fixed Sized and Variable Sized Framing 3.3 Error Detection: Repetition codes, Parity bits, Checksums, CRC 3.4 Error Correction: Automatic Repeat Request (ARQ), Hamming Code 3.5 Wireless LAN IEEE 802.11 standard Architecture, Features of IEEE 802.11 versions: 802.11,802.11a,802.11b,802.11g,802.11n,802.11p 3.6 Bluetooth Architecture: Piconet, Scatternet 3.7 Mobile Generations: 3G, 4G and 5G	Lecture Using Chalk-Board, Presentations, Video Demonstrations, Flipped Classroom

DATA COMMUNICATION AND COMPUTER NETWORK   Course Code : 314318

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Identify functions and features of the given layer of OSI Reference model. TLO 4.2 Compare the specified service on the given parameters. TLO 4.3 Classify IP Addresses on the basis of its class from the given set of addresses. TLO 4.4 Distinguish between IPv4 and IPv6 on the given parameters. TLO 4.5 Describe with sketches the procedure to configure the given TCP/IP service.	**Unit - IV Network Communication Models** 4.1 THE OSI MODEL: Layered Architecture, Encapsulation 4.2 Layers in OSI Model(Functions of each layer)-Physical Layer,Data-Link Layer,Network Layer,Transport Layer,Session Layer,Presentation Layer,Application Layer 4.3 TCP/IP Layers and their functions: Host To Network Layer,Internet Layer,Transport Layer,Application Layer 4.4 Protocols: Host To Network Layer-SLIP,PPP, Internet Layer-IP,ARP,RARP,ICMP, Transport Layer-TCP and UDP, Application Layer-FTP,HTTP,SMTP,TELNET,BOOTP,DHCP 4.5 Addressing: Physical Address, Logical Address, Port Address 4.6 IP Address-Concept, Notation, Address Space 4.7 IPv4 Addressing: Classful and Classless Addressing ,subnet mask,supernetting,subnetting 4.8 IPV6 Addressing scheme and basic structure	Lecture Using Chalk-Board, Presentations, Case Study, Flipped Classroom
5	TLO 5.1 Compare different computing models on the given parameter. TLO 5.2 Identify relevant network topology for the given situation. TLO 5.3 Compare different topologies on the given parameter. TLO 5.4 Select network connecting device for the given situation. TLO 5.5 Describe with sketches the procedure to configure the given networking device.	**Unit - V Network Topologies And Network Devices** 5.1 Network Computing Model: Peer To Peer, Client Server 5.2 Network Topologies: Introduction, Definition, Selection criteria, Types of Topology- Star ,Mesh, Tree, Hybrid 5.3 Network Connecting Devices: Switch, Router, Repeater, Bridge, Gateways and Modem	Lecture Using Chalk-Board, Video Demonstrations, Flipped Classroom

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Implement Amplitude Shift Keying(ASK)	1	* Amplitude Shift Keying(ASK) using any simulator	2	CO1
LLO 2.1 Implement Frequency Shift Keying(FSK)	2	Frequency Shift Keying(FSK) using any simulator	2	CO1
LLO 3.1 Implement Phase Shift Keying(PSK)	3	Phase Shift Keying(PSK) using any open source simulation software	2	CO1
LLO 4.1 Create standard network straight cable by using cable tester.	4	*Create and Test standard straight network cable(Universal Colour Code) using crimping tool	2	CO2
LLO 5.1 Create standard Cross network cable by using cable tester.	5	Create and Test standard Cross network cable(Universal Colour Code) using crimping tool	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Use basic programming skills to simulate communication systems. LLO 6.2 Debug and execute the program for Time Division Multiplexing(TDM).	6	* Generate a Time Division Multiplexing(TDM) signal using relevant simulation software	2	CO2
LLO 7.1 Transfer data using Bluetooth.	7	*Create a Hybrid Network Using Bluetooth	2	CO3
LLO 8.1 Identify different error detection methods. LLO 8.2 Detect errors using Checksum.	8	*Locate the error bit in the given data string by applying checksum error detection method	2	CO3
LLO 9.1 create WI-FI environment.	9	*Implement Wireless network	2	CO3
LLO 10.1 Draw block diagram for parity check. LLO 10.2 Implement parity check with examples.	10	Write a 'C' program for parity check error detection	2	CO3
LLO 11.1 Implement C Program for CRC	11	*Write a 'C' program for Cyclic Redundancy Check(CRC) error detection	2	CO3
LLO 12.1 Implement Hamming code in any suitable programming language.	12	*Write a 'C' program for error correction using Hamming code	2	CO3
LLO 13.1 Use IP address and appropriate subnet mask for given problem statement.	13	*Configure static IP address in operating system along with appropriate subnet mask for given problem	2	CO4
LLO 14.1 Implement IP addresses for intranet in Class A, Class B, Class C.	14	* Implement Classful Address in a given network node i)Identify range of IP Address in various classes ii)Justify the reason to choose various IP address classes for creating given network	2	CO4
LLO 15.1 Troubleshoot computer network using commands.	15	*Execute TCP/IP network commands:ipconfig,ping,tracert	2	CO4
LLO 16.1 Troubleshoot computer network using commands.	16	*Execute TCP/IP network commands: netstat, pathping, route	2	CO4
LLO 17.1 Use wireshark packet sniffer software.	17	*1) Install Wireshark and configure as packet sniffer- i)Capture IP,TELNET, FTP packets using Wireshark	2	CO4
LLO 18.1 Measure various types of Delay by using Wireshark.	18	Capture TCP and UDP packet using Wireshark	2	CO4
LLO 19.1 Filter ARP and ICMP packet Traffic using Wireshark.	19	Capture ARP and ICMP packet Traffic using Wireshark	2	CO4
LLO 20.1 Install server operating system	20	Install Operating System Linux/Windows/Any other Server	2	CO4
LLO 21.1 Create FTP Server	21	Use FTP protocol to transfer file from one system to another system	2	CO4
LLO 22.1 Implement IPv6 addressing scheme on a network.	22	Create IPv6 environment in a small network using simulator	2	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 23.1 Configure HTTP server on given operating system.	23	*Create HTTP server	2	CO5
LLO 24.1 Use star topology for a given situation.	24	*Create computers using Star topology with wired media	2	CO5
LLO 25.1 Use Network simulator CISCO packet tracer.	25	Create Tree topology using CISCO packet tracer software	2	CO5
LLO 26.1 Implement remote login feature.	26	Configure TELNET for remote login	2	CO5
LLO 27.1 Survey existing network infrastructure.	27	*Visit your computer laboratory- i)Identify the type of topology ii)Identify types of connecting devices with specifications iii)Identify types of cables with specifications iv)List the type of network applications commonly used in the laboratory iv)Draw the layout of installed network	4	CO5
LLO 28.1 Transfer a file from one computer to another. LLO 28.2 Print documents from remote system in a network.	28	Share folder and printer in a network	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Solve an assignment on any relevant topic given by the Teacher
- For a trading firm an organization with 10users, draw network architecture design of wireless LAN.
- Identify appropriate network topology and network connecting devices for following requirement. Draw network design for proposed network. An organization having its office in a building of 5 floor. Each floor it needs 20 machines. There is one File server. Each floor has 2 print servers to facilitate printer capacity using Tree topology.

Micro project

- Install and configure NIC and find MAC Address of Device
- Design a network using any topology and do fault identification
- Create a tool that monitors network bandwidth usage in real-time

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Desktop Computer with basic configuration	All
2	Network Tool Kit: Crimping Tool for RJ-45 connector ,3in 1 modular crimping tool for RJ-45 UTP CAT-5/CAT-6 Networking Cable,LAN Cutter 8P/6pP/4P All-in-One or similar,Cable Tester/LAN Tester(Specification: Network Cable Tester for LAN RJ-45/CAT5/CAT6 UTP Wire Test Tool or similar)	All
3	Network Accessories: RJ45 connector, UTP cable, optical fibre cable, Coaxial cable, various connectors,1000Mbps NIC	All
4	UPS 6 KVA online	All
5	Ethernet Switch- 4/8/16/24/32	All
6	Router-256MB Memory storage capacity, compatible with Desktop and Laptop, Rack Mountable, Wireless Connectivity	All
7	Printer	All
8	Wireshark(https://www.wireshark.org/download.html)or any other Packet Analyzer Tool	All
9	Simulation Software: CISCO Packet Tracer, CORE Network Emulator or Similar	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamentals of Data Communication and Computer Network	CO1	10	4	8	4	16
2	II	Transmission Media And Switching	CO2	10	4	4	6	14
3	III	Error Detection and Correction	CO3	8	4	4	6	14
4	IV	Network Communication Models	CO4	12	4	6	8	18
5	V	Network Topologies And Network Devices	CO5	5	2	2	4	8
		Grand Total		45	18	24	28	70

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.
- A continuous assessment based term work.

Summative Assessment (Assessment of Learning)

DATA COMMUNICATION AND COMPUTER NETWORK   **Course Code : 314318**

- End semester examination, Lab performance, Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	-	2	1	-	-	1			
CO2	1	1	2	1	-	1	1			
CO3	1	2	1	1	-	-	1			
CO4	1	2	2	1	-	1	1			
CO5	-	2	2	1	1	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Behrouz A. Forouzan	Data Communication and Networking	McGraw-Hill Higher Education ISBN-13 978-0-07-296775-3
2	Behrouz A. Forouzan:	TCP/IP Protocol Suit	McGraw Hill Education ISBN-13 978-0073376042
3	A.S. Tanenbaum	Computer Networks	PRENTICE HALL ISBN-10: 0-13-212695-8 ,ISBN-13:978-0-13-212695-3
4	Godbole Achyut	Data Communication and Networks	McGraw Hill Education ISBN-10 9780071077705,ISBN-13 978-0071077705
5	Comer Douglas E.	TCP/IP Principles, Protocols and Architectures	PEARSON ISBN 10: 0-13-608530-X ISBN 13: 978-0-13-608530-0

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.geeksforgeeks.org/data-communication-definition-components-types-channels/	Data Communication-Definition, Components,Types,Channels
2	https://www.tutorialspoint.com/data_communication_computer_network/index.htm	Data Communication and Computer Network
3	https://nptel.ac.in/courses/106105081	Computer Networks
4	https://nptel.ac.in/courses/106105183	Computer Networks and Internet Protocol
5	Introduction To Computer Networks	Studytonight	Introduction To Computer Networks

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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MSBTE Approval Dt. 21/11/2024   **Semester - 4, K Scheme**

PYTHON PROGRAMMING	Course Code : 314004

Programme Name/s	: Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science & Information Technology/ Computer Science/
Programme Code	: BD/ CM/ CO/ CW/ HA/ IF/ IH/ SE
Semester	: Fourth
Course Title	: PYTHON PROGRAMMING
Course Code	: 314004

I. RATIONALE

Python is an open source, general-purpose and most versatile programming language. Python code is simple, readable, short, intuitive, and powerful, and thus it is effective for introducing computing and problem solving for beginners. This course covers basic fundamentals of Python programming, which also provides a foundation for further exploration of its more advanced applications in a variety of domains, including application development, data science, artificial intelligence, machine learning, and more.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop applications using python to solve given problem.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Develop python programs using control flow statements.
- CO2 - Perform operations on various data structures in Python.
- CO3 - Develop packages to solve given problem using python.
- CO4 - Apply object-oriented approach to solve given problem using python.
- CO5 - Use relevant built-in python package to develop application.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH	Credits	Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314004	PYTHON PROGRAMMING	PWP	AEC	2	-	4	-	6	3	-	-	-	-	-	50	20	50#	20	-	-	100

PYTHON PROGRAMMING | **Course Code : 314004**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V.   THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain given feature of python. TLO 1.2 Write python program to perform basic input output operations. TLO 1.3 Write python program to solve given expression. TLO 1.4 Implement given decision making statements and looping statements in python program.	**Unit - I Introduction to Python and Control flow statements** 1.1 Introduction: Features, History and Applications of Python, Python IDE's 1.2 Python building blocks: Indentation, Identifiers, Variable, Comments, Keywords 1.3 Basic input output operations: input(), print() 1.4 Operators: Arithmetic, Relational, Assignment, Logical, Bitwise, Membership and Identity operator 1.5 Control flow statements: Conditional statements (if, if-else, if-elif-else, nested if), Loops in python (while, for, nested loops), Loop manipulation statements (continue, pass, break, else)	Chalk-Board Demonstration Presentations

PYTHON PROGRAMMING

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Write python program to manipulate lists. TLO 2.2 Write python program to manipulate tuples. TLO 2.3 Write python program to manipulate sets. TLO 2.4 Write python program to manipulate dictionaries.	**Unit - II Data Structures in Python** 2.1 List: a) Defining lists, accessing values from list, deleting list values, updating lists b) Basic list operations c) Built-in list functions/methods 2.2 Tuple: a) Defining Tuple, accessing values from Tuple b) Basic Tuple operations c) Built in Tuple functions/methods 2.3 Set: a) Defining Sets, accessing values from set, deleting set values b) Basic set operations c) Built in set functions/methods 2.4 Dictionary: a) Defining Dictionary, accessing values from Dictionary, deleting Dictionary values, updating Dictionary b) Basic Dictionary operations c) Built in Dictionary functions/methods	Chalk-Board Demonstration Presentations Hands-on
3	TLO 3.1 Write relevant user defined functions for the given problem. TLO 3.2 Write relevant user defined module for the given problem. TLO 3.3 Write packages for the given problem.	**Unit - III Functions, Modules and Packages in Python** 3.1 Functions: Defining function, Calling function, Function arguments, Return statement, Scope of Variable, Lambda functions 3.2 Modules: Create user defined Module, Importing a module, Using python built-in modules, Namespace and scoping 3.3 Python Packages: Create user defined Package, Importing a Package, Using python built-in Packages, Installing packages using PIP	Chalk-Board Demonstration Presentations Hands-on
4	TLO 4.1 Write python program using classes and objects to solve given problem. TLO 4.2 Implement python program using different types of constructors. TLO 4.3 Write program to demonstrate polymorphism. TLO 4.4 Write python code using data abstraction for given problem. TLO 4.5 Apply inheritance for the given problem.	**Unit - IV Object Oriented Programming in Python** 4.1 Object oriented Concepts: Creating class, Creating object 4.2 Constructors in python (Parameterized & Non-Parameterized), the self parameter 4.3 Polymorphism: Method Overloading and Overriding 4.4 Data Hiding / Abstraction 4.5 Inheritance: Single Inheritance, Multiple Inheritance, Multilevel Inheritance	Chalk-Board Demonstration Presentations Hands-on

PYTHON PROGRAMMING   **Course Code : 314004**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Write python program to use pandas package for the given problem. TLO 5.2 Create GUI application using tkinter package for the given problem. TLO 5.3 Create a python application to connect with database.	**Unit - V Introduction to Built-in Packages in Python** 5.1 Pandas: Use of pandas, pandas series, pandas DataFrames, pandas Read CSV 5.2 Creating GUI using tkinter: Introduction to tkinter, Widgets (Entry, Label, Button, RadioButton, Checkbutton), Creating a simple GUI application 5.3 Connecting to Database using MySQL: Installing mysql-connector, cursor() object, execute() method, fetchall() method, Creating simple program to connect database	Lecture Using Chalk-Board Flipped Classroom Demonstration Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install the given Python IDE.	1	Install given Python IDE.	2	CO1
LLO 2.1 Write python program for performing basic input and output operation in given problem.	2	*1. Write python program to display welcome message on screen. 2. Implement the python program to read data from user and display data on screen.	2	CO1
LLO 3.1 Write python program to solve given expression.	3	*Implement a python programs using following operators: 1. Arithmetic 2. Relational & logical 3. Assignment 4. Bitwise 5. Membership 6. Identity	2	CO1
LLO 4.1 Write python program for solving given problem using various if statements.	4	*Implement a python program to demonstrate the use of following conditional statements: 1. if statement 2. if..else statement 3. if..elif..else statement 4. nested if statement	2	CO1
LLO 5.1 Write python program for solving given problems using a while loop. LLO 5.2 Write python program for solving given problem using for loop.	5	*Implement a python program to demonstrate the use of following looping statements: 1. while loop 2. for loop 3. nested loop	2	CO1
LLO 6.1 Use loop control statements in python for solving given problem.	6	Implement python program to demonstrate the use of loop control statements. [continue, pass, break, else]	2	CO1
LLO 7.1 Write python program to perform operations on list.	7	*Implement a python program to perform following operations on the List: 1. Create a List 2. Access List 3. Update List 4. Delete List	2	CO2

PYTHON PROGRAMMING | **Course Code : 314004**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 8.1 Write python program to use built-in functions on list.	8	Implement Python program to demonstrate the use of built-in functions/methods on List (Any Eight Functions/methods)	2	CO2
LLO 9.1 Write python program to perform operations on tuple.	9	*Implement python program to perform following operations on the Tuple: 1. Create a Tuple 2. Access Tuple 3. Print Tuple 4. Delete Tuple 5. Convert tuple into list and vice-versa	2	CO2
LLO 10.1 Write python program to manipulate the set.	10	*Implement a python program to perform following operations on the Set: 1. Create a Set 2. Access Set 3. Update Set 4. Delete Set	2	CO2
LLO 11.1 Use built-in functions/methods on sets in python for solving given problems.	11	Implement a python program to perform following functions on Set: 1. Union 2. Intersection 3. Difference 4. Symmetric Difference	2	CO2
LLO 12.1 Write python program to perform operations on dictionary.	12	*Implement a python program to perform following operations on the Dictionary: 1. Create a Dictionary 2. Access Dictionary 3. Update Dictionary 4. Delete Dictionary 5. Looping through Dictionary 6. Create Dictionary from list	2	CO2
LLO 13.1 Write function to solve given problem.	13	Write a user define function to implement following features: 1. Function without argument 2. Function with argument 3. Function returning value	2	CO3
LLO 14.1 Write python program to create function by selecting appropriate type of argument.	14	*Implement user defined function for given problem: 1. Function positional/required argument 2. Function with keyword argument 3. Function with default argument 4. Function with variable length argument	2	CO3
LLO 15.1 Write python program using anonymous function. LLO 15.2 Write python program to use function in argument.	15	Write Python program to demonstrate use of following advanced functions: 1. lambda 2. map 3. reduce	2	CO3
LLO 16.1 Write user defined module to solve given problem.	16	Write a python program to create and use a user defined module for a given problem.	2	CO3
LLO 17.1 Select appropriate module to solve given problem. LLO 17.2 Use given module to solve problem.	17	Write a python program to demonstrate the use of following module: 1. math module 2. random module 3. os module	2	CO3

PYTHON PROGRAMMING   **Course Code : 314004**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 18.1 Write user defined package to solve given problem.	18	*Write python program to create and use a user defined package for a given problem.	2	CO3
LLO 19.1 Use numpy and matplotlib package to solve given problem. LLO 19.2 Select appropriate methods from numpy and matplotlib package to solve given problem.	19	Write a python program to use of numpy package to perform operation on 2D matrix. Write a python program to use of matplotlib package to represent data in graphical form.	2	CO4
LLO 20.1 Write python program using classes and objects to solve a given problem.	20	*Develop a python program to perform following operations: 1. Creating a Class with method 2. Creating Objects of class 3. Accessing method using object	2	CO4
LLO 21.1 Write a python program to initialize objects of class using various types of constructors.	21	*Write a python program to demonstrate the use of constructors: 1. Default 2. Parameterized 3. Constructor Overloading	2	CO4
LLO 22.1 Write a python program to implement polymorphism.	22	*Implement a python program to demonstrate 1. Method Overloading 2. Method Overriding	2	CO4
LLO 23.1 Write a python program to use data hiding concept in python.	23	Write python program to demonstrate data hiding.	2	CO4
LLO 24.1 Select appropriate type of inheritance to solve given problem. LLO 24.2 Write python program using inheritance to solve given problem.	24	*Write a python program to implement 1. Single inheritance 2. Multiple Inheritance 3. Multilevel inheritance	2	CO4
LLO 25.1 Use panda package and its appropriate functions/methods to solve a given problem.	25	*Implement Python program to perform following operations using panda package: 1. Create Series from Array 2. Create Series from List 3. Access element of series 4. Create DataFrame using List or dictionary	2	CO5
LLO 26.1 Write python program to read CSV file using the panda package.	26	Implement python program to load a CSV file into a Pandas DataFrame and perform operations.	2	CO5
LLO 27.1 Use appropriate packages in a python program to create GUI applications.	27	*Write python GUI program to import Tkinter package and create a window and set its title.	2	CO5
LLO 28.1 Write python program to create GUI based python applications using appropriate python packages.	28	Write python GUI program that adds labels and buttons to the Tkinter window.	2	CO5
LLO 29.1 Write python program to connect database.	29	Write program to create a connection between database and python.	2	CO5
LLO 30.1 Write python program to display the content from database.	30	Implement python program to select records from the database table and display the result.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Activities

- Students are encouraged to use online tools to improve their learning, such as the e-Kumbh from AICTE and the Virtual Labs from IIT.
- Students should be encouraged to participate in various coding competitions, such as hackathons, online coding contests on websites like hackerrank, Codechef etc.
- At the institution level, encourage students to start a coding club.

Self Learning

- Students are encouraged to register themselves in various MOOC's such as Infosys Springboard, Swayam etc. to further enhance their learning.

Note :
- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.   - The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.   - If a microproject is assigned, it is expected to be completed as a group activity.   - SLA marks shall be awarded as per the continuous assessment record.   - For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.   - If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Any Database Software	29,30
2	Computer System (Any computer system with basic configuration)	All
3	Python Interpreter / IDE (Any open source python distribution such as anaconda etc) (Any open source IDE such IDLE, Jupyter Notebook, Spyder, PyCharm etc)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Python and Control flow statements	CO1	6	0	0	0	0
2	II	Data Structures in Python	CO2	8	0	0	0	0
3	III	Functions, Modules and Packages in Python	CO3	6	0	0	0	0
4	IV	Object Oriented Programming in Python	CO4	4	0	0	0	0
5	V	Introduction to Built-in Packages in Python	CO5	6	0	0	0	0
		Grand Total		**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

• Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering 1) 60% weightage is to process 2) 40% weightage to product

Summative Assessment (Assessment of Learning)

• End Semester Examination, Lab Performance, Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	1	-	-	-			
CO2	2	1	1	1	-	-	-			
CO3	3	2	2	2	-	-	-			
CO4	3	3	3	2	-	-	1			
CO5	3	2	3	3	-	-	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	R. Nageswara Rao	Core Python Programming	Dreamtech Press, ISBN-13:9789390457151
2	Mark Lutz	Learning Python	O'Reilly Media, Inc, ISBN: 9781449355739
3	David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler	Python Basics	Real Python, ISBN-13: 9781775093329
4	Dr. Jeeva Jose	Taming Python by Programming	Khanna Book Publishing CO(P) LTD, New Delhi, ISBN: 9789386173348
5	Rupesh Nasre	Python Programming	AICTE, ISBN 9788195986354 [Online available on AICTE e-Kumbh]

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://ekumbh.aicte-india.org/allbook.php	Python Programming
2	https://python-iitk.vlabs.ac.in/	Python Programming Lab
3	https://spoken-tutorial.org/watch/Python+3.4.3/Input-output/English/	Introduction to Python and control flow statements, Data Structures in Python, Function and module
4	https://onlinecourses.nptel.ac.in/noc19_cs41/preview	Python Programming Course
5	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01309443979350001602592_shared/overview	Python for Beginners
6	https://www.geeksforgeeks.org/python-gui-tkinter/	Python GUI Programming
7	https://www.w3schools.com/python/python_mysql_getstarted.asp	Python MySQL Database Connectivity

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Sr.No	Link / Portal	Description
8	https://www.tutorialspoint.com/python_pandas/index.htm	Python pandas package
9	https://www.programiz.com/python-programming/object-oriented -programming	OOP using Python

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 21/11/2024

Semester - 4, K Scheme

UI/UX DESIGN	Course Code : 314005

Programme Name/s	: **Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Cloud Computing and Big Data/ Computer Technology/** **Computer Engineering/ Computer Science & Engineering/ Data Sciences/ Computer Science/**
Programme Code	: **AI/ AN/ BD/ CM/ CO/ CW/ DS/ SE**
Semester	: **Fourth**
Course Title	: **UI/UX DESIGN**
Course Code	: **314005**

I. RATIONALE

In digital applications, the user communicates with the product via user interface. This course is designed to elicit fundamental principles and practical skills from stakeholders which are essential to design user friendly interfaces. The course will help students to apply design thinking concepts to create or re-create the prototype.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the students to attain the following industry identified outcome through various teaching learning experiences:
Design user-centered applications, websites, interfaces.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Explain design thinking concept.
- CO2 - Interpret user requirements.
- CO3 - Select appropriate visual design for given problem.
- CO4 - Create interactions using design tool.
- CO5 - Create innovative design prototype for given applications.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory			Based on LL & TL				Based on SL			
				CL	TL	LL					FA-TH	SA-TH	Total		Practical				SLA		
															FA-PR		SA-PR				
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314005	UI/UX DESIGN	UID	SEC	1	-	4	1	6	3	-	-	-	-	-	25	10	25@	10	25	10	75

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain design thinking concepts. TLO 1.2 Define User Interface. TLO 1.3 Describe User experience.	**Unit - I Design Thinking Fundamentals** 1.1 Introduction to Design thinking – Concept, Purpose, 5 stages of design thinking – Empathize, Define, Ideate, Prototype, Test 1.2 Introduction to User Interface / User Experience (UI/UX) – Definition of Design with respect to digital media, User Interface, User experience, Difference between UI and UX. History of UX. Need of UI and UX	Chalk-Board Demonstration Presentations Flipped Classroom
2	TLO 2.1 Explain research methods for user requirements. TLO 2.2 Describe requirement analysis techniques. TLO 2.3 Identify user persona.	**Unit - II User Requirements and its Analysis** 2.1 Introduction to research and analysis tool (freeware) such as FigJam 2.2 User requirements – Definition, Types of user research - Qualitative research, Quantitative research. Tools to collect user requirements – personal observation, interviews, questionnaire, User/ Expert reviews 2.3 User requirement analysis - Understanding target audience and client requirements, Competitive analysis, Affinity mapping, Defining User Persona	Chalk-Board Case Study Demonstration Hands-on Presentations
3	TLO 3.1 Demonstrate storyboarding for given problem. TLO 3.2 Demonstrate User journey mapping for given problem. TLO 3.3 Describe graphic design principles. TLO 3.4 Explain visual communication.	**Unit - III User Interface Design** 3.1 Storyboarding, User journey mapping 3.2 Gestalt principles of design - Aesthetics in UI design - Using Light, Color and Contrast Effectively in UI Design 3.3 Introduction to any freeware design tool such as Figma 3.4 Visual Communication Design - effective visual communication for graphical user interface	Chalk-Board Demonstration Hands-on Presentations

UI/UX DESIGN | **Course Code : 314005**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Explain User Experience design. TLO 4.2 Describe steps to create gamification techniques. TLO 4.3 Describe steps to create micro-animation. TLO 4.4 Write steps to create interactions using buttons, navigations etc. in any design tool.	**Unit - IV User Experience Design Tool** 4.1 Introduction to User Experience design 4.2 UX design open source tool such as - Figma features – Navigations, interactions, Buttons Creating library 4.3 Gamification, micro-animation 4.4 Creating visual identity of the project – design system, design theme	Chalk-Board Demonstration Hands-on Presentations
5	TLO 5.1 Create low fidelity prototyping of design on paper. TLO 5.2 Create medium fidelity prototype on paper. TLO 5.3 Write steps to create high fidelity prototype using design tool. TLO 5.4 Test the design prototype.	**Unit - V Prototyping and Testing** 5.1 Introduction to Wireframing - Purpose of wireframing, Types – low fidelity, medium fidelity, high fidelity 5.2 Basics of sketching, Creating low fidelity wireframes, medium fidelity and high fidelity in Figma 5.3 Basic considerations in wireframing – device, size, behavior, interaction 5.4 Elements used in wireframing – visual design, high fidelity elements 5.5 Prototyping and Testing	Chalk-Board Demonstration Hands-on Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify categories of website/ App such as government / e-commerce / tourism related etc. LLO 1.2 Compare different websites/ Apps under one category for design aesthetics. LLO 1.3 Use design tool to collect user requirements. LLO 1.4 Record observations using any design tool.	1	***Use Design tool for user requirement collection and analysis** • Visit minimum 5 websites/ Apps of the particular category. Identify problems in overall navigation, look and feel of websites, relevance of the information. Record all findings using Design tool	4	CO1 CO2
LLO 2.1 Observe various interfaces used in kiosk based applications. LLO 2.2 Prepare affinity mapping of User Requirements using design tools.	2	**Use Design tool for user requirement collection and analysis of various interfaces such as kiosks** • Visit minimum 5 interfaces. Identify problems in overall navigation, look and feel of the interface, relevance of the information. Record all findings using Design tool	4	CO1 CO2
LLO 3.1 Use any Design tool to create a 'blank project'. LLO 3.2 Use frame, shape, text of design tool to create screen layout of given user interface.	3	***Recreate a given user interface using any open source design tool** (For example, to recreate the first screen of personal mobile phone etc.)	4	CO1 CO2 CO3

UI/UX DESIGN   **Course Code : 314005**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Use frames, images, and colors to design given screen. LLO 4.2 Explore various plug-ins/ extensions in the design tool. LLO 4.3 Use different plug-ins/extensions in design tool.	4	* Create grid system for the given screen using any design tool (For example dashboard of particular application/ welcome screen of any blog portal etc.)	4	CO3 CO4 CO5
LLO 5.1 Use frames, components, auto-layouts to design given screen using Design tool. LLO 5.2 Create asset using design tool. LLO 5.3 Create library/repository of created assets in the design tool.	5	*Design given user interface using various components such as auto-layouts in the design tool (For example, design sample login page/ design registration form etc.)	4	CO2 CO3 CO4 CO5
LLO 6.1 Use horizontal scrolling component in the design tool to create given page(s).	6	*Use horizontal scrolling to create pages for given website/ App (For example, page(s) in social media Apps/ tourism related webpage(s))	4	CO4
LLO 7.1 Use vertical scrolling component in the design tool to create given page(s).	7	*Use vertical scrolling for a given website/ App (For example, Retail website/App or food ordering Apps etc.)	4	CO4
LLO 8.1 Use frame, shape, text tools, components of the design tool to replicate the design of given web page(s). LLO 8.2 Use interactions, menus to replicate web page design.	8	Recreate given website for UI design, color, images, interactions, menu	4	CO3 CO4 CO5
LLO 9.1 Use various menus - bottom menu, slide menu to demonstrate navigations in the screen.	9	*Create navigations for the given website/ App (For example, create navigation in App using bottom menu etc.)	4	CO4
LLO 10.1 Use components and navigations to design quiz like page in design tool.	10	Design a quiz for given user interface (For example, quiz for LMS / government web site / retail web sites etc.)	4	CO5
LLO 11.1 Observe gamification techniques used in existing user interfaces. LLO 11.2 Use files, templates to create gamification effect in given scenario using design tool.	11	Create any two gamification effects for given user interface in given scenario (For example, racing effect etc.)	4	CO3 CO4
LLO 12.1 Use files, templates to create gamification effect in given scenario using design tool.	12	Create gamification for task completion in website such as LMS/ retail website/ banking website (For example, popping up effect/ releasing balloons in the air etc. once a task is completed)	4	CO3 CO4 CO5
LLO 13.1 Observe micro-animations used in existing websites, Apps, interfaces. LLO 13.2 Use templates to create micro-animation for given user scenario.	13	Create any five micro animations for the given user interface in given scenario (For example, progress bar effect/ waitin for reply or responce effect/ status bar/ welcome page or opening page animatio etc.)	4	CO3 CO4

UI/UX DESIGN   **Course Code : 314005**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Use Interactions/ events to create Prototype in design tool.	14	*Create prototyping with different interactions – tab, click, hover, delay. for the given user interface	4	CO4 CO5
LLO 15.1 Use plug-in/ extension to convert the created prototype into html page(s). LLO 15.2 Use browser to run the generated HTML page(s).	15	Convert created prototype in HTML page(s)	4	CO5
Note : Out of above suggestive LLOs - '*' Marked Practicals (LLOs) Are mandatory. - Minimum 80% of above list of lab experiment are to be performed. - Judicial mix of LLOs are to be performed to achieve desired outcomes.			

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- The micro project has to be Industry Application Based, Internet-based, Workshop-based, Laboratory-based or Field-based as suggested by Teacher:

1. Prepare a prototype for online blog:
a. Prepare a competitive analysis of similar website
b. Define user persona and prepare user journey mapping using any design tool
c. Construct prototype using - navigation, interaction, frames in design tool
d. Validate the prototype by checking navigation and conditions given
e. Convert the design prototype into HTML code

2. Reconstruct given user interface such as kiosk system:
a. Observe the given user interface
b. Identify improvement in the user interface in terms of - look and feel, navigation, interactions
c. Prepare affinity mapping using design tool
d. Reconstruct the given interface using various components in design tool

3. Prepare a prototype for food ordering App:
a. Prepare a competitive analysis of similar Apps
b. Define user persona and prepare user journey mapping using any design tool
c. Construct prototype using - navigation, interaction, frames in design tool
d. Validate the prototype by checking navigation and conditions given

4. Rebuild smart TV user interface layout
a. Visit existing interfaces of smart television
b. Record findings related to color scheme, theme, look and feel, location on display of existing interfaces
c. Record minimum 10 different user reviews regarding the smart television user interface (chose user from different backgrounds)
d. Record improvements in look, navigation, and interactions
e. Redefine user persona for existing interface
f. Rebuild the interface prototype using design tool

Assignment

-

1. Prepare a case-study report -
a. Identify any dedicated interface such as Automated deposit cum Withdrawal machine.
b. Perform a user requirement analysis through any research method (e.g. Interview/ Questionnaire etc.).
c. Define user persona for the same.
d. Prepare a low fidelity prototype for it.
2. Prepare user storyboard and user journey mapping for given user interface -

a. Identify user requirements .
b. Perform a user requirement through research methods (e.g. Interview/ Questionnaire etc.).
c. Define user persona for the same.
d. Prepare a user journey mapping for the same.
e. Prepare a storyboard for the user interface.
3. Prepare low, medium, and high fidelity prototype for given user interface -
a. Identify user interface.
b. Collect user requirements by any two methods (e.g. Personal observation/ expert review etc.)
c. Define user persona for the same.
d. Prepare a low fidelity prototype on paper for the same.

Other

- Following are some suggestive self-learning topics or any relevant topics suggested by the Teacher:
1. Prepare a feature-based detailed report of similar types of website/portal(such as Flight/ bus Reservation websites/ MIS / e-commerce web sites / educational institutions websites etc).
2. Prepare affinity mapping in any design tool (e.g. FigJam) for user requirements in given domain of the project.
3. Define user persona and perform requirements mapping using design tools in any of the following category – Ticket booking kiosk/ Online examination system / Quiz App.
4. Prepare user journey mapping for given scenario in the given project
5. Prepare low, medium, and high-fidelity prototypes for a given scenario using any design tool.
6. Prepare a library/repository of design components using any design tool like Figma.
7. Reconstruct any ticket booking website to address improvements in look and feel, ease of use within it.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Design tool - preferably open-source based tool such as Figma	All
2	Computer system with minimum specifications as - Processor - 2.9 GHz or equivalents or higher with 10th generation or onwards Operating System - 64 bit RAM - 8GB DDR3 or higher Internet Connectivity	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Design Thinking Fundamentals	CO1	2	0	0	0	0
2	II	User Requirements and its Analysis	CO2	3	0	0	0	0
3	III	User Interface Design	CO3	4	0	0	0	0
4	IV	User Experience Design Tool	CO4	3	0	0	0	0

UI/UX DESIGN | **Course Code : 314005**

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
5	V	Prototyping and Testing	CO5	3	0	0	0	0
		Grand Total		**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

• 1. Continuous assessment based on process and product related performance indicators.
Each practical will be assessed considering:
60% weightage to process
40% weightage to product
2. A continuous assessment based term work

Summative Assessment (Assessment of Learning)

• End semester examination, Lab performance, Viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	2	1	-	1	1			
CO2	3	2	2	2	-	-	2			
CO3	3	3	3	3	1	-	1			
CO4	2	3	3	3	2	1	1			
CO5	2	3	3	3	2	2	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Jesse James Garrett	The Elements of User Experience: User-Centered Design for the Web and Beyond	New Riders Publishing, 201 West 103 Street, Indianapolis, IN 46290 800-545-5914 ISBN:978-0-321-68368-7
2	Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef	Design Thinking: The Handbook	World Scientific Publishing Co Pte Ltd, No.16, South West Boag Road T. Nagar, Chennai 600017, INDIA ISBN-10: 9811203504 ISBN-13: 978-9811203503

Sr.No	Author	Title	Publisher with ISBN Number
3	Fabio Staiano	Designing and Prototyping Interfaces with Figma	Packt Publishing Ltd, Grosvenor House, 11 St Paul's Square, Birmingham, B3 1RB ISBN-10: 180056418X ISBN-13: 978-1800564183
4	Kilian Langenfeld	Design Thinking for Beginners	Personal Growth Hackers ISBN-10: 3967160629 ISBN-13: 978-3967160628

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://aim.gov.in/pdf/Design_Thinking.pdf	Design thinking phases and learning resources
2	https://www.ideou.com/pages/design-thinking-resources	Design thinking resources
3	https://www.figma.com/resource-library/what-is-design-thinking/	Design thinking and its stages
4	https://www.figma.com/resource-library/what-is-ui-design/	Key elements of UI design
5	https://youtu.be/-wzNTPXVIyM?si=zET5z3GpIPl-cAry	User Experience and research methods
6	https://youtu.be/XT152i5asdQ?si=jPdLFFExnaZO8NRs	User Experience and research methods
7	https://usabilitypost.com/2008/08/14/using-light-color-and-contrast-effectively-in-ui-design/	Using Light, Color and Contrast Effectively in UI Design
8	http://web.cs.wpi.edu/~matt/courses/cs563/talks/smartin/int_design.html	Effective Visual Communication for Graphical User Interfaces
9	https://youtu.be/Y9ixRTTx5iU?si=vSCsbCr6gXD5eG-n	Visual Communication Design
10	https://youtu.be/K-DRTBMnzm8?si=DaUPM4iLW2CU3oSU	Low fidelity design
11	https://youtu.be/KCYLE78w074?si=xZsvSnO9qx7iVE2S	High fidelity design
12	www.figma.com	Figma - Design Tools - Figma and FigJam (Freeware)
13	https://www.figma.com/resource-library/design-basics/	Design basics using Figma (Freeware)
14	https://wireframe.cc/	Single-page, public wireframe without user account available in free version.
15	https://drive.google.com/file/d/1Od0G1mtlRHz5LkxgT3GPr7wDEIw7GV05/view	Design Thinking and user experience research (Notes by NPTEL)
16	https://www.mindmeister.com/	Collaborative mind mapping tool
17	https://miro.com/	UX tool
18	https://www.hotjar.com/	UIUX tool

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students