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ADVANCE COMPUTER NETWORK   **Course Code : 315321**

Programme Name/s	**: Cloud Computing and Big Data/ Computer Technology/ Computer Engineering/ Computer Science & Engineering/ Computer Hardware & Maintenance/ Information Technology/ Computer Science**
Programme Code	**: BD/ CM/ CO/ CW/ HA/ IF/ SE**
Semester	**: Fifth**
Course Title	**: ADVANCE COMPUTER NETWORK**
Course Code	**: 315321**

I. RATIONALE

The Advance Computer Network course provides a comprehensive exploration of networking concepts and technologies. It covers Internet architecture, IP addressing, routing protocols (RIP, OSPF, BGP), TCP/UDP, DNS, and advanced technologies like SDN, 5G, 6G, and IP security. It equips students with hands-on skills for designing, managing, and troubleshooting modern computer networks.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Implement and optimize network architectures and enhance problem-solving abilities specific to network issues

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 packet structure of IPv4 and IPv6.
- CO2 - Configure Static and Dynamic Routing Protocols Using Simulators.
- CO3 - Illustrate functions of Transport layer protocols.
- CO4 - Implement Application layer protocols on a network.
- CO5 - Work with various Wireless Networking Technologies.

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	
315321	ADVANCE COMPUTER NETWORK	ACN	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

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.* 10 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.

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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 Identify role of ISP and ICANN. TLO 1.2 Compare IPv4 and IPv6. TLO 1.3 Configure Subnets in network. TLO 1.4 Interpret role of ARP and RARP.	**Unit - I Internet Architecture and Network Layer** 1.1 Structure of Internet, Intranet, Role of Internet Service Provider (ISP) and Internet Corporation for Assigned Names and Numbers (ICANN) 1.2 IPv4-Header format, IPv6 -Header format 1.3 Subnet, subnet addressing and address masking, supernetting 1.4 Address Mapping- Address Resolution Protocol (ARP) - Mapping logical to physical addresses, working and message format , Reverse Address Resolution Protocol (RARP) – Mapping physical to logical addresses working and message format	Presentations Video Demonstrations Lecture Using Chalk-Board
2	TLO 2.1 Explain the mechanism of routing. TLO 2.2 Differentiate - Intra and Inter domain routing. TLO 2.3 Explain message structure of ICMP.	**Unit - II Routing Protocols** 2.1 Router architecture, routing table, queueing and switching 2.2 Routing protocols- Intra domain routing- Distance vector routing-Creating distance vector routing tables, Initialization, Sharing, Updating- Routing Information Protocol (RIPv2), Link State Routing-Open Shortest Path First (OSPF)-Types of links, Graphical representation, Inter domain Routing-Path Vector Routing- Border Gateway Protocol (BGPv4) 2.3 Internet Control Message Protocol (ICMP)-Types of messages, Message format, Error reporting messages	Video Demonstrations Presentations Lecture Using Chalk-Board
3	TLO 3.1 Explain the mechanism of process-to-process delivery. TLO 3.2 Compare multiplexing and demultiplexing. TLO 3.3 Explain functioning of TCP/UDP protocols with example. TLO 3.4 Explain various congestion control methods at Transport layer. TLO 3.5 Describe the functioning of TLS. TLO 3.6 Describe the functioning of SCTP.	**Unit - III Transport Layer Protocols** 3.1 Process to Process Delivery-Client/Server paradigm, Multiplexing and Demultiplexing, Connectionless vs. Connection-Oriented Service 3.2 User Datagram Protocol (UDP)-Ports-Well known ports for UDP header format, features and applications 3.3 Transmission Control Protocol(TCP)-TCP services, TCP features, Segment, Three way handshaking, Flow control, Error control, Congestion control-Open loop, Closed loop 3.4 TLS(Transport Layer Security)-working and applications 3.5 Stream Control Transmission Protocol (SCTP)- services and features	Presentations Flipped Classroom Lecture Using Chalk-Board

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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.
4	TLO 4.1 Explain functioning of DNS in internet. TLO 4.2 Explain the components of DNS Architecture. TLO 4.3 Explain the working of Message Transfer Agent. TLO 4.4 Explain the working of Message Access Agent. TLO 4.5 Explain the steps to transfer files using FTP. TLO 4.6 Describe the steps to access remote machine using command line and GUI tool. TLO 4.7 Explain the working of HTTP. TLO 4.8 Explain functions of PGP and allied algorithms.	**Unit - IV Application Layer Protocols** 4.1 Domain Name System (DNS) architecture, Domain types, DNS name space, Domain name resolution & mapping to physical addresses 4.2 Electronic mail i)Message Transfer Agent -Simple Mail Transfer Protocol (SMTP) Components, Working ii)Message Access Agent - Post Office Protocol (POP) and Internet Message Access Protocol (IMAP) 4.3 File Transfer Protocol (FTP), Anonymous FTP 4.4 Remote logging: Telnet, Remote Desktop 4.5 World Wide Web (WWW) and Hyper Text Transfer Protocol (HTTP)- Architecture, Types of web documents, HTTP transaction 4.6 Pretty Good Privacy (PGP)-Security Parameters, Services, A Scenario or Overview of -PGP algorithms, Key rings, PGP certificates	Presentations Video Demonstrations Flipped Classroom
5	TLO 5.1 Compare the characteristics of 3G, 4G, 5G TLO 5.2 Illustrate SDN Architecture. TLO 5.3 Explain Network Functions Virtualization. TLO 5.4 Describe the role of Edge Computing and Edge Networking. TLO 5.5 Describe role of various Multimedia wireless protocols.	**Unit - V Wireless Network Technologies** 5.1 Wireless Network Communication- 3G, 4G, 5G 5.2 SDN (Software Defined Network)- Architecture, Working, Applications 5.3 Network Functions Virtualization (NFV)-Architecture, Benefits, Applications 5.4 Edge Computing and Edge Networking-Definition, Components, Challenges, Applications 5.5 Multimedia Wireless Networks – Streaming Audio and Video, Voice Over Internet Protocol (VoIP), Protocols – Real-time Transport Protocol(RTP), Real-Time Streaming Protocol (RTSP)	Presentations Lecture Using Chalk-Board 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 Describe each component of output of WHOIS command LLO 1.2 Configure a network by assigning IP addresses and subnet masks.	1	*a)Identify IP allocations and Internet Service Providers for a student network Using WHOIS. b)Set up IP addresses and subnet masks on given network devices	2	CO1
LLO 2.1 Troubleshoot network problems.	2	Identify and resolve network issues using network diagnostic tools like ping, tracert, show,debug commands.	2	CO1
LLO 3.1 Develop and run a network communication script to monitor network communication at IP layer.	3	Run a Network Communication Script on "Kali Linux"	2	CO1

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Implement Routing Protocols.	4	*Configure basic routing protocols using any relevant software/virtual lab.	2	CO2
LLO 5.1 Tabulate and interpret the captured ICMPv4 packet parameters using relevant network analysis software.	5	Capture and Analyze ICMPv4 Packets using appropriate tool	2	CO2
LLO 6.1 Create and troubleshoot TCP and UDP connections.	6	*Configure, diagnose and troubleshoot TCP and UDP connection issues using diagnostic tools like netstat, wireshark, iperf	2	CO3
LLO 7.1 Setup Domain Name Server (DNS).	7	*Configure DNS using relevant software.	2	CO4
LLO 8.1 Configure and Test File Transfer Protocol (FTP).	8	*Configure FTP using relevant software	2	CO4
LLO 9.1 Inspect and debug HTTP traffic.	9	Monitor network traffic using browser developer tools	2	CO4
LLO 10.1 Implement SDN using Mininet.	10	*Design a simple network for SDN using Mininet	2	CO5
LLO 11.1 Measure latency and connectivity of wireless network.	11	Using Ping and Latency Tools i)Measure latency and packet loss over time using any suitable tool e.g. PingPlotter ii)Analyze network packets to detect performance bottlenecks using any suitable tool e.g.Wireshark	2	CO5
LLO 12.1 Capture and analyze traffic for multimedia applications over internet.	12	Multimedia traffic analysis i)Capture and analyze HTTP video streaming traffic using any suitable tool e.g.Wireshark ii)Monitor RTP (Real-time Transport Protocol) packets from a multimedia stream using any suitable tool e.g.Wireshark	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

- Explain the basic principles of wireless communication, including the electromagnetic spectrum, frequency bands, and signal propagation.
- Explain the structure of an IPv4 address.Include details on network and host portions, classes (A, B, C), and reserved IP addresses.
- Define the key metrics used in routing (e.g., hop count, bandwidth, delay, cost). Explain the effect of these metrics on route selection.
- Outline the step-by-step process of DNS resolution, from entering a domain name in a browser to receiving the corresponding IP address.

Other

- NA

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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	Wireshark or any other similar software to capture and investigate packets	2
2	Cisco Packet Tracer,MiniNet or any other similar software	4,10
3	Computer system (Any computer system with basic configuration, connected to LAN)	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	Internet Architecture and Network Layer	CO1	6	2	4	6	12
2	II	Routing Protocols	CO2	10	4	4	8	16
3	III	Transport Layer Protocols	CO3	8	2	6	6	14
4	IV	Application Layer Protocols	CO4	8	4	4	6	14
5	V	Wireless Network Technologies	CO5	8	4	4	6	14
		Grand Total		**40**	**16**	**22**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- A continuous assessment based on term work.
- Continuous assessment based on process and product related performance indicators.

Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester examination, Lab performance, Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

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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	2	1	1			
CO2	1	2	1	2	1	1	1			
CO3	2	1	1	2	1	1	1			
CO4	1	1	1	2	1	1	1			
CO5	1	1	1	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	Forouzan Behrouz A.	Data Communication and Networking 5E	McGraw Hill Education (India), New Delhi, 2005, ISBN-13:978-1-25-906475-3
2	Comer Douglas E.	Internetworking with TCP/IP, Volume I, Fourth Edition.	Prentice Hall of India Private Limited, New Delhi- 110001 ISBN-81-203-2065-4
3	Forouzan Behrouz A.	TCP/IP Protocol Suite	Tata McGraw-Hill Edition, New Delhi ISBN-0-07-043474-3
4	Tanenbaum Andrew S. ,Nick Feamster,David J. Wetherall	Computer Networks, Sixth Edition	Pearson ISBN-13: 9780136764052
5	B.M. Harwani & DT Editorial Services	Advanced Computer Network	Dreamtech ISBN 978-93-5004-013-3
6	Computer Networks Principles, Technologies And Protocols For Network Design	Natalia Olifer, Victor Olifer	Wiley ISBN
7	Thomas D. Nadeau, Ken Gray	SDN: Software Defined Networks	O'Reilly Media, Inc.ISBN: 9781449342302
8	Kurose	Computer Networking, 8th Edition	Pearson Education,ISBN-10 9356061319

XIII .   LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.coursera.org/courses?query=computer%20networks	Offers courses from top universities like Stanford and Princeton on topics like Internet architecture, IP addressing, and advanced networking technologies.
2	https://www.netacad.com/	Offers comprehensive courses on networking, including certifications like CCNA, which cover advanced topics and practical skills.
3	https://www.javatpoint.com/computer-network-tutorial	Focuses on networking tutorials and courses, including detailed lessons on routing protocols, TCP/IP, and advanced networking concepts.

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Sr.No	Link / Portal	Description
4	https://onlinecourses.nptel.ac.in/noc23_cs35/preview	NPTEL online course for Advance computer Network
5	https://www.geeksforgeeks.org/computer-network-tutorials/	Advance Computer Network concepts tutorial
6	https://www.javatpoint.com/software-defined-networking-sdn-b enefits-and-challenges-of-network-virtualization	Software defined network
7	https://www.tutorialspoint.com/5g-future-of-wireless-network s	5G

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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