



## Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

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Admin Off: 29-36-38, Museum Road, Govemcrpet, Vijayawada - 520 002, Ph: +91 - 866 - 3500122, 2576129

### Department of Computer Science & Applications


#### Minutes of 9<sup>th</sup> Board of Studies Virtual Meeting

The Department of Computer Science & Applications called for the 9<sup>th</sup> Board of Studies (BOS) virtual meeting, scheduled to take place on the on 26<sup>th</sup> June, 2023 from 3:00 pm to 5:00 pm onwards.

1. Dr.G. Krishna Mohan, HOD and BoS Chairman
2. Dr.P. Suresh Varma, Professor, Adikavi Nannaya University, External Member
3. Dr.E. Suresh Babu, Assistant Professor, NIT Warangal, External Member
4. Dr.B.B.V. Varaprasad, Senior Performance Engineer, ServiceNow, External Member
5. Mr. Sai Sateesh, CEO, Indian Servers, External Member
6. Dr.V.S. Bhagavan, Professor, Department of Mathematics, Member
7. Dr.K. Vishnu Divya, Assoc. Prof, Department of English, Member
8. Dr.M.Kameswara Rao, Assoc. Dean (Academics), Member
9. Mr.K. Rajeev, Department of CDOE, Member
10. Dr.M.N.V. Kiran Babu, Deputy HOD, RPAC, Member
11. Dr.C.M. Sheela Rani, Professor, Additional Controller, Member
12. Dr.K. Kiran Kumar, Professor, Member
13. Dr. V. Valli Mayil, Professor, Member
14. Dr. R. D. Sathiya, Professor, Member
15. Dr.B. Mouleswara Rao, Associate Professor, Member
16. Dr.P. Hari Prasad, Associate Professor, Member
17. Mr. K. Rohit Kumar, Assistant Professor, Member
18. Mr.Y. Rama Krishna, Assistant Professor, Member
19. Ms. Bhargavi Mopuru, Assistant Professor, Member
20. Dr.K. Subramanyam, Principal, KL College of Sciences, Special Invitee

#### Opening Remarks

Dr.G. Krishna Mohan, HOD, Department of CSA, opened the meeting, welcoming all the attendees.

  
**Dr.G. KRISHNA MOHAN**  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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### AGENDA and RESOLUTIONS

#### AGENDA ITEM-1

AGENDA ITEM DESCRIPTION	RESOLUTION PASSED
Course Structure of BCA and MCA for Y23 Admitted Students	APPROVED

- The chairperson Dr.G,KrishnaMohan has presented the course structure of Y23 admitted batch students of BCA and MCA to BoS members and discussion went on and decisions were made and approved by members. [Annexure-I]

#### AGENDA ITEM-2

AGENDA ITEM DESCRIPTION	RESOLUTION PASSED
<ul style="list-style-type: none"> <li>Revision of LTPS and change of name for "Research Exploration" course for MCA Y23 admitted students.</li> <li>Revision of Syllabus for the courses "Computer Organization" in BCA and "Operating System" in MCA</li> </ul>	APPROVED

- As recommended by Alumni Phanikanth Chintamaneni, the "Research Exploration" title is changed to "Essentials of Research Design" and L-T-P-S is modified from 2-1-0-0 to 1-1-0-0 from Y23 regulation of MCA.
- As recommended by Faculty Mrs. Thonepudi Hema Latha ,the syllabus is modified for the course "Computer Organization" in BCA from Y23 Regulation.
- As recommended by FacultyNagendra Babu Rajaboinathe syllabus is modified for the course "Operating Systems" in MCA from Y23 Regulation[Annexure-II]

#### Essentials of Research Design(MCA)

Sl#	Course Title	L	T	P	S	Cr	CH
1	Essentials of Research Design	1	1	0	0	2	2

#### AGENDA ITEM-3

AGENDA ITEM DESCRIPTION	RESOLUTION PASSED
<ul style="list-style-type: none"> <li>Inclusion of Open Electives and Tool Based Learning from MCA Y23 admitted students.</li> <li>Inclusion of Value Added Courses in both BCA and MCA programs from Y23 Regulation.</li> <li>Inclusion of Skill Development Courses for both BCA and MCA</li> </ul>	APPROVED

  
**Dr.G.KRISHNA MOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L.Deemed to be University)  
 Green Fields,Vaddeswaram-522302  
 Guntur District, Andhra Pradesh





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from Y23 Regulation

- Inclusion of maths related subject in the first year of BCA

- As per recommendation of Academic Peer Dr.M.Babu Reddy Open Elective-1 and Open Elective-2 are introduced in the final semester of MCA with LTPS:3-0-0-0.
- As per recommendation of Parents K.Mallikarjuna Rao ,K Lalitha, a Tool Based Learning was introduced in the MCA 4<sup>th</sup> semester with L-T-P-S :0-0-0-8.
- As per recommendation of Alumni Karasanil Venkata Srihitha,the Value Added Courses are introduced in both MCA and BCA programs.
- As per recommendation of Parents E. Rami Reddy, Skill Development Courses are introduced in the BCA and MCA curriculum from Y23 Regulation
- As per the recommendation of Parents VijayanirmalaVotra,Probability& Statistics was introduced in the first of BCA from Y23 Regulation.


### AGENDA ITEM-4

AGENDA ITEM DESCRIPTION	RESOLUTION PASSED
<ul style="list-style-type: none"> <li>• Inclusion of Cyber Security Specialization from Y22 BCA and for Y23 MCA students.</li> <li>• Inclusion of new Professional Elective in Cloud, AI and DataScience Specialization</li> </ul>	APPROVED

- As per the recommendations of Student Dilip(2200520049),"Cyber Security" Specialization is introducedin BCA with the following courses.
- As per the recommendations of Faculty Dr.G.Venkateswarlu, "Natural Language Processing" course is included as PE6 in AI Specialization.
- As per the recommendations of Faculty, Dr.M.N.V.Kiran Babu , "Cloud Computing" course is n is introducedas PE6 in Cloud Specialization..
- As per the recommendations of Faculty, Mr.Gobinda Chandra Das, "Graph and Web Analytics" course is introduced as PE6 in Data Science Specialization.
- [ANNEXURE -III]

### BCA:

Sl#	Course Title	L	T	P	S	Cr	CH
1	Fundamentals Of Cyber Security And Ethical Hacking	2	0	2	0	3	4
2	Cyber Forensics	2	0	2	0	3	4
3	Malware Analysis	2	0	2	0	3	4
4	Security Governance and Management	2	0	2	0	3	4
5	Cloud Security	3	0	0	0	3	3
6	Crypt Analysis & Cyber Defence	3	0	2	4	5	9

  
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- As recommended by Faculty Dr.Manivasagam "Cyber Security" Specialization is introduced in MCA from Y23 batch with the following courses.

### MCA:

Sl#	Course Title	L	T	P	S	Cr	CH
1	Fundamentals Of Cyber Security And Ethical Hacking	3	0	2	4	5	9
2	Cyber Forensics	3	0	0	0	3	3
3	Malware Analysis	3	0	2	4	5	9
4	Security Governance and Management	3	0	0	0	3	3
5	Cloud Security	3	0	2	0	4	5

### AGENDA ITEM-5


AGENDA ITEM DESCRIPTION	RESOLUTION PASSED
<ul style="list-style-type: none"> <li>Introducing MOOC's courses in the last semester for the students who are doing internship for both BCA and MCA programs.</li> </ul>	APPROVED

- As per recommendation of Student Thota Siva anshutha(2100520063), Certification courses are introduced for BCA and MCA students from Y21 Regulation

### AGENDA ITEM-6

AGENDA ITEM DESCRIPTION	RESOLUTION PASSED
<ul style="list-style-type: none"> <li>Introducing BCA with Specialization, BCA with Honors and Specialization, Experiential Learning, Entrepreneurship and Research from Y23 Regulation</li> <li>Introducing minor degree in BCA from Y23 Regulation.</li> <li>Introducing Flexi Core Courses in BCA from Y23 Regulation</li> </ul>	APPROVED

- As recommended by Academic Peer Dr.E.Suresh Babu, the department is introduced specialization in Honors, Experiential Learning, Entrepreneurship Learning and Research from Y23 Regulation in BCA.
- As per the recommendations of Industry person Dr.B.B.S.Varaprasad, the minor degree is offering for BCA from Y23 Regulation.
- As per the recommendations of Industry person Sai Satish, the flexi core courses are introducing for BCA from Y23 Regulation.[ANNEXURE -IV]

  
**Dr. G. KRISHNAMOORTHY**  
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## ANNEXURE – I

Koneru Lakshmaiah Education Foundation

### MASTER OF COMPUTER APPLICATIONS

Sl No	Category	Course Code	Course Title	Short Name	Mode	L	T	P	S	Cr	CH	Pre-Requisite
1	AUD	23UC5201	PROFESSIONAL COMMUNICATION SKILLS	PCS	R	0	0	4	0	0	4	NIL
2	SDC	23TBCA01	TOOL BASED LEARNING	TBL	R	0	0	0	8	2	8	NIL
3	PC	23CA5101	COMPUTER NETWORKS AND COMMUNICATIONS	CNC	R	3	0	2	0	4	5	NIL
4	PC	23CA5102	DATA STRUCTURES AND ALGORITHMS	DSA	R	3	0	2	4	5	9	NIL
5	PC	23CA5103	OPERATING SYSTEMS	OS	R	3	1	0	0	4	4	NIL
6	PC	23CA5104	DATABASE SYSTEMS	DBS	R	3	0	2	4	5	9	NIL
7	PC	23CA5205	OBJECT ORIENTED PROGRAMMING	OOP	R	3	0	2	4	5	9	NIL
8	PC	23CA5206	DATA ANALYTICS	DA	R	3	0	2	0	4	5	NIL
9	PC	23CA5207	COMPREHENSIVE SOFTWARE ENGINEERING	CSE	R	2	1	0	0	3	3	NIL
10	PC	23CA6108	WEB TECHNOLOGIES	WT	R	3	0	2	4	5	9	NIL
11	PC	23IE5201	ESSENTIALS OF RESEARCH DESIGN	ERD	R	1	1	0	0	2	2	NIL
12	PE		PE1	PE	R	3	0	2	4	5	9	NIL
13	PE		PE2	PE	R	3	0	0	0	3	3	NIL
14	PE		PE3	PE	R	3	0	2	4	5	9	NIL
15	PE		PE4	PE	R	3	0	0	0	3	3	NIL
16	PE		PE5	PE	R	3	0	2	0	4	5	NIL
17	OE		OE1	OE	R	3	0	0	0	3	3	NIL
18	OE		OE2	OE	R	3	0	0	0	3	3	NIL

*[Signature]*  
**Dr.G.KRISHNA MOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L.Deemed to be University)  
 Green Fields,Vaddeswaram-522,  
 Guntur District, Andhra Pradesh



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19	PR	23CA61 E1	MINOR PROJECT/INTERNS HIP1	MIP	R	0	0	6	0	3	6	NIL
20	PR	23CA62 E2	MAJOR PROJECT/INTERNS HIP2	MAP	R	0	0	2	0	12	24	NIL
			<b>TOTAL CREDITS</b>							<b>80</b>		

1	PE1	23CA52A1	APPLIED MAHINE LEARNING	ARTIFICIAL INTELLIGE NCE	R	3	0	2	4	5
2	PE2	23CA52A2	PATTERN RECOGNITION		R	3	0	0	0	3
3	PE3	23CA61A3	COMPUTER VISION		R	3	0	2	4	5
4	PE4	23CA61A4	APPLIED DEEP LEARNING		R	3	0	0	0	3
5	PE5	23CA61A5	APPLICATIONS OF NATURAL LANGUAGE PROCESSING		R	3	0	2	0	5
6	PE1	23CA52A1	APPLIED MAHINE LEARNING	DATA SCIENCE	R	3	0	2	4	5
7	PE2	23CA52D2	HADOOP AND BIGDATA		R	3	0	0	0	3
8	PE3	23CA61D3	DATA VISUALIZATION TECHNIQUES		R	3	0	2	4	5
9	PE4	23CA61D4	STATISTICS FOR DATA SCIENCE		R	3	0	0	0	3
10	PE5	23CA61D5	GRAPH AND WEB ANALYTICS		R	3	0	2	0	5
11	PE1	23CA52C1	CLOUD COMPUTING	CLOUD COMPUTIN G	R	3	0	2	4	5
12	PE2	23CA52C2	CLOUD INFORMATION SECURITY		R	3	0	0	0	3
13	PE3	23CA61C3	CLOUD ARCHITECTURES		R	3	0	2	4	5
14	PE4	23CA61C4	CLOUD AND SERVERLESS COMPUTING		R	3	0	0	0	3
15	PE5	23CA61C5	CLOUD WEB SERVICES		R	3	0	2	0	5
16	PE1	23CA52S1	CYBER SECURITY AND ETHICAL HACKING	CYBERSEC URITY	R	3	0	2	4	5
17	PE2	23CA52S2	CYBER FORENSICS		R	3	0	0	0	3
18	PE3	23CA61S3	MALWARE ANALYSIS		R	3	0	2	4	5
19	PE4	23CA61S4	SECURITY GOVERNANCE AND MANAGEMENT		R	3	0	0	0	3
20	PE5	23CA61S5	CLOUD SECURITY		R	3	0	2	0	5

*Dr. G. KRISHNA MOHA*  
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## Y23 REGULATION-BCA

SN O	CAT EGO RY	COURS COD	COURSE TITLE	M O DE	L	T	P	S	CR	CH	PRE REQUISITE
1	SDC	23SDCA01	WEB AND SOCIAL MEDIA TECHNOLOGIES	R	0	0	0	4	1	4	NIL
2	BS	23MT1112	MATHEMATICS FOR COMPUTER SCIENCE	R	2	2	0	0	4	4	NIL
3	HSS	23UC1101	INTEGRATED PROFESSIONAL ENGLISH	R	0	0	4	0	2	4	NIL
4	PC	23CA1101	COMPUTER ORGANIZATION	R	2	2	0	0	4	4	NIL
5	PC	23CA1102	ESSENTIALS OF INFORMATION TECHNOLOGY	R	2	0	2	0	3	4	NIL
6	PC	23CA1103	COMPUTATIONAL THINKING FOR STRUCTURED DESIGN	R	2	0	2	4	4	8	NIL
		23CA1103A	COMPUTATIONAL THINKING FOR STRUCTURED DESIGN	A	3	0	4	4	6	11	NIL
7	AUD	22UC0009	ECOLOGY & ENVIRONMENT	R	2	0	0	0	0	2	NIL
8	BS	23MT1213	PROBABILITY AND STATISTICS	R	2	2	0	0	4	4	NIL
9	HSS	23UC1202	ENGLISH PROFICIENCY	R	0	0	4	0	2	4	NIL
10	PC	23CA1204	SOFTWARE ENGINEERING	R	3	0	0	0	3	3	EIT
11	PC	23CA1205	ESSENTIALS OF OPERATING SYSTEM	R	3	0	2	0	4	5	CO
		23CA1205A	ESSENTIALS OF OPERATING SYSTEM	A	4	0	2	4	6	10	CO
12	PC	23CA1206	DATA STRUCTURES	R	3	0	2	4	5	9	CTSD

Dr.G.KRISHNA MOHAN

Head of the Department

Computer Science and Applications

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		23CA1206A	DATA STRUCTURES	A	4	0	4	4	7	12	CTSD
13	PC	23CA1207	OBJECT ORIENTED PROGRAMMING	R	3	0	2	4	5	9	CTSD
		23CA1207A	OBJECT ORIENTED PROGRAMMING	A	4	0	4	4	7	12	CTSD
14	AUD	22UC0011	GENDER & SOCIAL EQUALITY	R	2	0	0	0	0	2	NIL
15	SIL	22UC0021	SOCIAL IMMERSIVE LEARNING-1	R	0	0	0	4	1	4	NIL
16	PR	23CA21N1	TECHNICAL INTERNSHIP-1	R	0	0	0	4	1	4	NIL
17	HSS	22UC1203	DESIGN THINKING & INNOVATION	R	0	0	4	0	2	4	NIL
18	PC	23CA2108	COMPUTER NETWORKS	R	3	0	0	0	3	3	NIL
		23CA2108A	COMPUTER NETWORKS	A	4	0	2	0	5	6	NIL
19	PC	23CA2109	DATABASE MANAGEMENT SYSTEMS	R	3	0	2	4	5	9	NIL
		23CA2109A	DATABASE MANAGEMENT SYSTEMS	A	4	0	4	4	7	12	NIL
20	PE		PE1	R	2	0	2	0	3	4	NIL
			PE1	A	3	0	2	4	5	9	NIL
21	SDC	23SDCA02	WEB DEVELOPMENT USING PYTHON	R	0	0	4	4	3	8	NIL
22	FCC	23CA2121	CONTINUOUS DELIVERY AND DEPLOYMENT WITH DEVOPS	R	3	0	2	0	4	5	NIL
23	AUD	22UC0008	INDIAN CONSTITUTION	R	2	0	0	0	0	2	NIL
24	SIL	22UC0022	SOCIAL IMMERSIVE LEARNING-2	R	0	0	0	4	1	4	NIL
25	HSS	22UC2103	ESSENTIAL SKILLS FOR EMPLOYABILITY	R	0	0	4	0	2	4	NIL
26	HSS	22UC0010	UNIVERSAL HUMAN VALUES & PROFESSIONAL	R	2	0	0	0	2	2	NIL

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			ETHICS								
27	PC	23CA2210	OBJECT ORIENTED ANALYSIS & DESIGN	R	2	0	2	0	3	4	NIL
		23CA2210A	OBJECT ORIENTED ANALYSIS & DESIGN	A	3	0	2	4	5	9	NIL
28	PE		PE2	R	2	0	2	0	3	4	PE1
			PE2	A	3	0	2	4	5	9	PE1
29	PR	23CA22E1	MINOR PROJECT	R	0	0	8	8	6	16	NIL
30	SDC	23SDCA03	JAVA FULL STACK DEVELOPMENT	R	0	0	4	4	3	8	OOP
31	AUD	23UC0019	ESSENCE OF INDIAN KNOWLEDGE TRADITION	R	2	0	0	0	0	2	NIL
32	SIL	22UC0023	SOCIAL IMMERSIVE LEARNING-3	R	0	0	0	4	1	4	NIL
33	PR	23CA31N2	TECHNICAL INTERNSHIP-2	R	0	0	0	4	1	4	NIL
34	HSS	22FL-3055	FOREIGN LANGUAGE ELECTIVE - GERMAN LANGUAGE	R	2	0	0	0	2	2	NIL
35	HSS	22UC2204	CORPORATE READINESS SKILLS	R	0	0	4	0	2	4	NIL
36	OE		OE1	R/M	3	0	0	0	3	3	NIL
37	SDC	23SDCA04	ASPECTS OF MOBILE APPLICATION	R	0	0	4	4	3	8	OOP
38	PE		PE3	R	2	0	2	0	3	4	PE1
			PE3	A	3	0	2	4	5	9	PE1
39	PE		PE4	R	2	0	2	0	3	4	PE1
			PE4	A	3	0	2	4	5	9	PE1

*B. Mohan*  
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40	FCC	23CA3122	VISUAL PROGRAMMING AND HCI	R	3	0	2	0	4	5	NIL
41	PE		PE5	R	3	0	0	0	3	3	PE1
			PE5	A	4	0	2	0	5	6	PE1
42	OE		OE2	R/M	3	0	0	0	3	3	NIL
43	HSS		MANAGEMENT ELECTIVE	R	2	0	0	0	2	2	NIL
44	FCC	23CA3223	NETWORK AND INFRASTRUCTURE SECURITY	R	3	0	2	0	4	5	CN
45	PR	23CA32E2	MAJOR PROJECT	R	0	0	8	8	6	16	NIL

## PROFESSIONAL ELECTIVES

1	PE1	23CA21C1	CLOUD ARCHITECTURES	R	2	0	2	0	NIL		
		23CA21C1A	CLOUD ARCHITECTURES	A	3	0	2	4	NIL		
2	PE2	23CA22C2	CLOUD WEB SERVICES	R	2	0	2	0	PE1		
		23CA22C2A	CLOUD WEB SERVICES	A	3	0	2	4	PE1		
3	PE3	23CA31C3	CLOUD AND SERVERLESS COMPUTING	R	2	0	2	0	PE1		
		23CA31C3A	CLOUD AND SERVERLESS COMPUTING	A	3	0	2	4	PE1		
4	PE4	23CA31C4	DESIGN OF DISTRIBUTED APPLICATIONS ON CLOUD	R	2	0	2	0	PE1		
		23CA31C4A	DESIGN OF DISTRIBUTED APPLICATIONS ON CLOUD	A	3	0	2	4	PE1		
5	PE5	23CA32C5	CLOUD SECURITY	R	3	0	0	0	PE1		

**CLOUD COMPUTING**

*Dr. G. KRISHNA MOHAN*  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





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 Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
 Admin Off: 29-36-38, Museum Road, Govindapet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

		23CA32C5A	CLOUD SECURITY	A	4	0	2	0	PE1	
6	PE1	23CA21D1	DATA SCIENCE METHODOLOGIES	R	2	0	2	0	NIL	DATA SCIENCE
		23CA21D1	DATA SCIENCE METHODOLOGIES	A	3	0	2	4	NIL	
7	PE2	23CA22D2	DATA WAREHOUSING AND DATA MINING	R	2	0	2	0	PE1	
		23CA22D2A	DATA WAREHOUSING AND DATA MINING	A	3	0	2	4	PE1	
8	PE3	23CA31D3	APPLIED MAHINE LEARNING	R	2	0	2	0	PE1	
		23CA31D3A	APPLIED MAHINE LEARNING	A	3	0	2	4	PE1	
9	PE4	23CA31D4	INTRODUCTION TO BIG DATA ANALYTICS	R	2	0	2	0	PE1	
		23CA31D4A	INTRODUCTION TO BIG DATA ANALYTICS	A	3	0	2	4	PE1	
10	PE5	23CA32D5	DATA VISUALIZATION TECHNIQUES	R	3	0	0	0	PE1	
		23CA32D5A	DATA VISUALIZATION TECHNIQUES	A	3	0	2	4	PE1	
11	PE1	23CA21A1	APPLIED ARTIFICIAL INTELLIGENCE	R	2	0	2	0	NIL	ARTIFICIAL INTELLIGENC E
		23CA21A1A	APPLIED ARTIFICIAL INTELLIGENCE	A	3	0	2	4	NIL	
12	PE2	23CA22D2	DATA WAREHOUSING AND DATA MINING	R	2	0	2	0	PE1	
		23CA22D2A	DATA WAREHOUSING AND DATA MINING	A	3	0	2	4	PE1	
13	PE3	23CA31D3	APPLIED MAHINE LEARNING	R	2	0	2	0	PE1	
		23CA31D3A	APPLIED MAHINE LEARNING	A	3	0	2	4	PE1	
14	PE4	23CA31A4	APPLIED DEEP LEARNING	R	2	0	2	0	PE1	
		23CA31A4A	APPLIED DEEP LEARNING	A	3	0	2	4	PE1	
15	PE5	23CA32A5	PERCEPTION AND COMPUTER VISION	R	3	0	0	0	PE1	
		23CA32A5A	PERCEPTION AND COMPUTER VISION	A	4	0	2	0	PE1	

*[Signature]*  
 HOD-CSA/6/2023  
**Dr.G.KRISHNA MOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L.Deemed to be University)  
 Green Fields,Vaddeswaram-522502  
 Guntur District, Andhra Pradesh



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16	PE1	23CA21S1	FUNDAMENTALS OF CYBER SECURITY AND ETHICAL HACKING	R	2	0	2	0	NIL	CYBER SECURITY
		23CA21S1A	FUNDAMENTALS OF CYBER SECURITY AND ETHICAL HACKING	A	3	0	2	4	NIL	
17	PE2	23CA22S2	CYBER FORENSICS	R	2	0	2	0	PE1	
		23CA22S2A	CYBER FORENSICS	A	3	0	2	4	PE1	
18	PE3	23CA31S3	MALWARE ANALYSIS	R	2	0	2	0	PE1	
		23CA31S3A	MALWARE ANALYSIS	A	3	0	2	4	PE1	
19	PE4	23CA31S4	SECURITY GOVERNANCE AND MANAGEMENT	R	2	0	2	0	PE1	
		23CA31S4A	SECURITY GOVERNANCE AND MANAGEMENT	A	3	0	2	4	PE1	
20	PE5	23CA32C5	CLOUD SECURITY	R	3	0	0	0	PE1	
		23CA32C5A	CLOUD SECURITY	A	4	0	2	0	PE1	

## Y23 Regulation -BCA with Specialization

SN O	CATE GOR Y	COURS COD	COURSE TITLE	MOD E	L	T	P	S	CR	CH	PRE REQUISITE
1	SDC	23SDCA01	WEB AND SOCIAL MEDIA TECHNOLOGIES	R	0	0	0	4	1	4	NIL
2	BS	23MT1112	MATHEMATICS FOR COMPUTER SCIENCE	R	2	2	0	0	4	4	NIL
3	HSS	23UC1101	INTEGRATED PROFESSIONAL ENGLISH	R	0	0	4	0	2	4	NIL
4	PC	23CA1101	COMPUTER ORGANIZATION	R	2	2	0	0	4	4	NIL

Dr. G. KRISHNA MOHAN  
 Head of the Department  
 Computer Science and Application  
 Koneru Lakshmaiah Education Found  
 K.L. Deemed to be University  
 Green Fields, Vaddeswaram-522  
 Guntur District, Andhra Pradesh





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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2579129

5	PC	23CA1102	ESSENTIALS OF INFORMATION TECHNOLOGY	R	2	0	2	0	3	4	NIL
6	PC	23CA1103	COMPUTATIONAL THINKING FOR STRUCTURED DESIGN	R	2	0	2	4	4	8	NIL
7	AUD	22UC0009	ECOLOGY & ENVIRONMENT	R	2	0	0	0	0	2	NIL
8	BS	23MT1213	PROBABILITY AND STATISTICS	R	2	2	0	0	4	4	NIL
9	HSS	23UC1202	ENGLISH PROFICIENCY	R	0	0	4	0	2	4	NIL
10	PC	23CA1204	SOFTWARE ENGINEERING	R	3	0	0	0	3	3	EIT
11	PC	23CA1205	ESSENTIALS OF OPERATING SYSTEM	R	3	0	2	0	4	5	CO
12	PC	23CA1206	DATA STRUCTURES	R	3	0	2	4	5	9	CTSD
13	PC	23CA1207	OBJECT ORIENTED PROGRAMMING	R	3	0	2	4	5	9	CTSD
14	AUD	22UC0011	GENDER & SOCIAL EQUALITY	R	2	0	0	0	0	2	NIL
15	SIL	22UC0021	SOCIAL IMMERSIVE LEARNING-1	R	0	0	0	4	1	4	NIL
16	PR	23CA21N1	TECHNICAL INTERNSHIP-1	R	0	0	0	4	1	4	NIL
17	HSS	22UC1203	DESIGN THINKING & INNOVATION	R	0	0	4	0	2	4	NIL

*Dr. G. Krishna Mohan*  
**Dr. G. KRISHNA MOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh



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18	PC	23CA2108	COMPUTER NETWORKS	R	3	0	0	0	3	3	NIL
19	PC	23CA2109	DATABASE MANAGEMENT SYSTEMS	R	3	0	2	4	5	9	NIL
20	PE		PE1	R	2	0	2	0	3	4	NIL
21	SDC	23SDCA02	WEB DEVELOPMENT USING PYTHON	R	0	0	4	4	3	8	NIL
22	FCC	23CA2121	CONTINUOUS DELIVERY AND DEPLOYMENT WITH DEVOPS	R	3	0	2	0	4	5	NIL
23	AUD	22UC0008	INDIAN CONSTITUTION	R	2	0	0	0	0	2	NIL
24	SIL	22UC0022	SOCIAL IMMERSIVE LEARNING-2	R	0	0	0	4	1	4	NIL
25	HSS	22UC2103	ESSENTIAL SKILLS FOR EMPLOYABILITY	R	0	0	4	0	2	4	NIL
26	HSS	22UC0010	UNIVERSAL HUMAN VALUES & PROFESSIONAL ETHICS	R	2	0	0	0	2	2	NIL
27	PC	23CA2210	OBJECT ORIENTED ANALYSIS & DESIGN	R	2	0	2	0	3	4	NIL
28	PE		PE2	R	2	0	2	0	3	4	PE1
29	PR	23CA22E1	MINOR PROJECT	R	0	0	8	8	6	16	NIL
30	SDC	23SDCA03	JAVA FULL STACK DEVELOPMENT	R	0	0	4	4	3	8	OOP

**Dr. G. KRISHNA**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





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31	AUD	23UC0019	ESSENCE OF INDIAN KNOWLEDGE TRADITION	R	2	0	0	0	0	2	NIL
32	SIL	22UC0023	SOCIAL IMMERSIVE LEARNING-3	R	0	0	0	4	1	4	NIL
33	PR	23CA31N2	TECHNICAL INTERNSHIP-2	R	0	0	0	4	1	4	NIL
34	HSS	22FL 3055	FOREIGN LANGUAGE ELECTIVE - GERMAN LANGUAGE	R	2	0	0	0	2	2	NIL
35	HSS	22UC2204	CORPORATE READINESS SKILLS	R	0	0	4	0	2	4	NIL
36	OE		OE1	R/M	3	0	0	0	3	3	NIL
37	SDC	23SDCA04	ASPECTS OF MOBILE APPLICATION	R	0	0	4	4	3	8	OOP
38	PE		PE3	R	2	0	2	0	3	4	PE1
39	PE		PE4	R	2	0	2	0	3	4	PE1
40	FCC	23CA3122	VISUAL PROGRAMMING AND HCI	R	3	0	2	0	4	5	NIL
41	PE		PE5	R	3	0	0	0	3	3	PE1
42	PE		PE6	R	3	0	2	4	5	9	PE1
43	OE		OE2	R/M	3	0	0	0	3	3	NIL

*[Signature]*  
 Dr.G.KRISHNA MOHAN  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L.Deemed to be University)  
 Green Fields,Vaddeswaram-522302  
 Guntur District, Andhra Pradesh



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44	HSS		MANAGEMENT ELECTIVE	R	2	0	0	0	2	2	NIL
45	FCC	23CA3223	NETWORK AND INFRASTRUCTURE SECURITY	R	3	0	2	0	4	5	CN
46	PR	23CA32E2	MAJOR PROJECT	R	0	0	8	8	6	16	NIL

## List of Professional Electives for 2023-24 admitted batch of BCA with Specialization

1	PE1	23CA21C1	CLOUD ARCHITECTURES	R	2	0	2	0	NIL	CLOUD COMPUTING
2	PE2	23CA22C2	CLOUD WEB SERVICES	R	2	0	2	0	PE1	
3	PE3	23CA31C3	CLOUD AND SERVERLESS COMPUTING	R	2	0	2	0	PE1	
4	PE4	23CA31C4	DESIGN OF DISTRIBUTED APPLICATIONS ON CLOUD	R	2	0	2	0	PE1	
5	PE5	23CA32C5	CLOUD SECURITY	R	3	0	0	0	PE1	
6	PE6	23CA32C6	CLOUD COMPUTING	R	3	0	2	4	PE1	
7	PE1	23CA21D1	DATA SCIENCE METHODOLOGIES	R	2	0	2	0	NIL	DATA SCIENCE
8	PE2	23CA22D2	DATA WAREHOUSING AND DATA MINING	R	2	0	2	0	PE1	
9	PE3	23CA31D3	APPLIED MACHINE LEARNING	R	2	0	2	0	PE1	
10	PE4	23CA31D4	INTRODUCTION TO BIG DATA ANALYTICS	R	2	0	2	0	PE1	
11	PE5	23CA32D5	DATA VISUALIZATION TECHNIQUES	R	3	0	0	0	PE1	
12	PE6	23CA32D6	GRAPH AND WEB ANALYTICS	R	3	0	2	4	PE1	
13	PE1	23CA21A1	APPLIED ARTIFICIAL INTELLIGENCE	R	2	0	2	0	NIL	ARTIFICIAL INTELLIGENCE

Dr. G. KRISHNA  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





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 Admin Off: 29-36-39, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

14	PE2	23CA22D2	DATA WAREHOUSING AND DATA MINING	R	2	0	2	0	PE1	<b>E</b>
15	PE3	23CA31D3	APPLIED MACHINE LEARNING	R	2	0	2	0	PE1	
16	PE4	23CA31A4	APPLIED DEEP LEARNING	R	2	0	2	0	PE1	
17	PE5	23CA32A5	PERCEPTION AND COMPUTER VISION	R	3	0	0	0	PE1	
18	PE6	23CA32A6	NATURAL LANGUAGE PROCESSING	R	3	0	2	4	PE1	
19	PE1	23CA21S1	FUNDAMENTALS OF CYBER SECURITY AND ETHICAL HACKING	R	2	0	2	0	NIL	<b>CYBER SECURITY</b>
20	PE2	23CA22S2	CYBER FORENSICS	R	2	0	2	0	PE1	
21	PE3	23CA31S3	MALWARE ANALYSIS	R	2	0	2	0	PE1	
22	PE4	23CA31S4	SECURITY GOVERNANCE AND MANAGEMENT	R	2	0	2	0	PE1	
23	PE5	23CA32C5	CLOUD SECURITY	R	3	0	0	0	PE1	
24	PE6	23CA32S6	CRYPT ANALYSIS & CYBER DEFENCE	R	3	0	2	4	PE1	

## Minor Degree in BCA

Sl No	Course Title	L	T	P	S	Cr	CH
1	Web Technologies	2	0	2	4	4	8
2	Database Systems Concepts & Applications	2	0	2	4	4	8
3	Principles of Software Engineering	2	0	2	4	4	8
4	Robotic Process Automation	2	0	2	4	4	8
5	Linux Programming	0	0	6	4	4	10

*[Signature]*  
**Dr. G. KRISHNA MOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh



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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-38-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

### ANNEXURE-II

#### COMPUTER ORGANIZATION

Course Code: 23CA1101

LTPS : 2-2-0-0

PRE-REQUISITE: NIL

#### Syllabus:

Number Systems: Representation of numbers in different radix ,Conversions from one radix to another, Integer - unsigned, signed (sign magnitude, 1's complement, 2's complement). Boolean Algebra: Logic Gates-OR, AND, NOR, NAND, XOR & XNOR, Truth Tables, Demorgan's theorems (2&3 Variable), Boolean laws, Circuit designing techniques: Karnaugh Map- 2, 3 and 4 Variable K Maps. Minimization Techniques – Min-terms and Max-terms, Sum of Product (SOP), Product of Sum (POS). Combinational Building Blocks: Adders and Subtractors, Multiplexers, Decoders. Sequential Circuits – Flip Flops, Types of Flip Flop – SR Flip Flop, J K Flip Flop, D flip flop, T Flip flop. Basic Structure of Computers: Computer Types, Functional Units. Register Transfer & Micro -Operations: Register Transfer Language, Register Transfer, Bus & memory Transfers, Arithmetic Micro-operations, Logic Micro Operations, Shift Micro-operation, Arithmetic Logic Shift Unit. Basic Computer Organization and Design: introduction codes, Computer Registers, Computer instructions, Timing and Control-Hardwired & Micro Programmed control, Instruction Cycle, Memory-Reference Instruction, Input-Output and interrupt, Design of Basic Computer, Design of accumulator Logic. Micro Programmed Control Unit-Address Sequencing, Micro-Program example , Central Processing Unit: General registers Organization, Stack Organization-types, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced instruction Set Computer (RISC). Memory Organization: Memory Hierarchy, Main Memory, Associative Memory, Cache Memory, Virtual Memory.

#### Text Books:

- 1) Computer System Architecture, Morris Mano , Pearson/PHI, 3rd Edition, 2007
- 2) Computer Organization and Architecture , William Stallings , Prentice Hall of India , 6<sup>th</sup> edition, 2006
- 3) Digital Logic and Computer Design, M. Morris Mano , Pearson, 2<sup>nd</sup> Edition

Dr. G. KRISHNA  
Head of the Department  
HOD-CSA  
Computer Science and Application  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Phone No. +91-8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2579129

### OPERATING SYSTEMS

Course Code: 23CA5103

LTPS : 3-1-0-0


PRE-REQUISITE: NIL

#### Syllabus:

Basics: Operating System Functionalities, Types of Operating Systems, Computer Architecture support to Operating Systems .**Process Management:** Process Concept - Process States, **Process structure:** PCB and components, Operations on Processes . Overview – Thread API, Common concurrency problems, Locks, Locked Data Structures, Condition Variables, Semaphores.**CPU Scheduling:** - Scheduling Algorithms - Multiprocessor Scheduling -Thread Scheduling. **Deadlock:** System Model - Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention- Deadlock Avoidance- Deadlock Detection- Recovery from Deadlock. Storage Management: Overview of Mass Storage Structure - Disk Structure – Disk Attachment - Disk Scheduling - Disk Management- Swap Space Management –RAID Structure. **Memory:** Memory management requirements, Partitioning, Paging and Segmentation, Virtual memory - Hardware and control structures, operating system software, Linux memory management, Windows memory management.**Paging:** Introduction to Paging, Demand Paging, Page Replacement, Page Replacement Algorithms, Advanced Page Tables. **Swapping:** Mechanisms, Policies. Persistence: I/O Devices, Hard Disk Drives. **File System Interface:** File System Implementation, Distributed systems, Data Integrity and Protection.

#### Textbooks:

1. William Stallings, "Operating Systems – internals and design principles", Prentice Hall, 7th Edition, 2011.(Ch 1-9,11,12)..
2. Operating System Concepts - Operating System Concepts, Sixth Edition, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, John Wiley & Sons Inc, (2013).
3. The Design of The Unix Operating System by Maurice J. Bach, PHI Publishing,(2013).

  
Dr. G. KRISHNA  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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### ANNEXURE-III

#### CLOUD COMPUTING

Course Code: 23CA32C6

LTPS : 3-0-4-2

PRE-REQUISITE: CA


Introduction to Cloud Computing: meaning of Cloud Computing, variations of cloud computing from other models, Essential Characteristics, Cloud computing Architectures, Technological Influences. Cloud Computing Architecture, the three-deployment model's IaaS, PaaS, SaaS, and Types of clouds (Public, Private and Hybrid) CLOUD INFRASTRUCTURE: Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources. Service Models (XaaS): Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS); Deployment Models: Public cloud, Private cloud, Hybrid cloud, Communitycloud. Establishing and using a private cloud: Network topology, HW-SE specification, installing open stack, configuring open stack availing services through open stacks, establishing virtual networks Infrastructure as a Service (IaaS): Introduction to IaaS, IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, and Virtual Machine (VM). Resource Virtualization: Server, Storage, Network, Virtual Machine (resource) provisioning and manageability, Storage as a service, Examples Applications: Amazon EC2, Google Drive, one drive, drop box. Developing applications Using IaaS.

#### Text Books :

1. Kris Jamsa, Cloud Computing, Jones & Bartlett, 2012
2. Russell Dean Vines and Ronald L. Krutz, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley India Pvt Ltd, 2010
3. Barrie Sosinsky, Cloud Computing Bible, Wiley India, 2011

#### Reference Books :

1. Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly, 2009.

  
Dr. G. KRISHNAMOORTHY  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

### GRAPH & WEB ANALYTICS

Course Code: 23CA32D6

LTPS : 3-0-2-0

PRE-REQUISITE: DSM

#### Syllabus:

Graph Analytics: Origin of Graph Theory, Graph Basics, types of Graphs, Finding the best path, Dijkstra's Algorithm, operation on graphs. Network Basics Types Social Networks: Properties of social network, scalefreeNetwork, SmallworldNetworks, NetworkNavigation. Node\_LevelAnalysis: Degree centrality, closeness centrality, betweenness centrality, Eigenvector Centrality, pagerank Slice K-Cores. Community Detection: Graph partitioning, Hierarchical clustering Web Analytics: Introduction- State of the analytics union, state of the industry, Rethinking w imperative, tactical shift. Strategy for choosing the optimal analytics tool- vendor selection analysis, running an effective tool pilot, checking SLA's for web-analytics vend engagement, attributes of great metrics, strategically aligned tactics for impactful web metrics Web Traffic Data: Practical solutions- Sources of traffic, outcomes, foundation measuring the search quality, search engine optimization analysis, google example, content coverage, indexing by search engines, paid search analysis, direct traffic analysis Testing, actionable testing ideas. Component of Web Analytics Strategy: Competitive Intelligence Analysis- Data Sources, webs traffic analysis, search and keyword and the performance of Videos.

#### Text Books:

- 1) "Python for graph and Network Analysis", Mohammad Zuhair Al Taie Seifedine Kadry Springer Publications, 2017
- 2) Web Analytics 2. Visualization , Avinash Kaushik, Willey , 2012
- 3) Advanced Web Metrics with Google Analytics", 3rd Edition, Brian Clifton, Syrex , 2012
- 4) Mining the Social Web: Matthew A. Russell, 2019
- 5) Graph-Based Natural Language Processing and Information Retrieval Rada Mihalcea and Dragomir , R. Radev , 2011

Dr. G. KRISHNA  
Head of the Department  
Computer Science and Application  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh

25/6/2021





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Phone No. +91 8645 - 350 200; www.klof.ac.in; www.klof.edu.in; www.kluuniversity.in

Admin Off: 25-36-38, Museum Road, Governorpet, Vijayawada - 520 002, Ph: +91 - 866 - 3500122, 2576129

### NATURAL LANGUAGE PROCESSING

Course Code: 23CA32A6

LTPS : 3-0-2-4


PRE-REQUISITE: AAI

#### Syllabus:

Introduction: overview of NLP, Statistical machine translation, Language models and their role in speech processing. The problem of ambiguity, NLP tasks in syntax, semantics, and pragmatics, Words: Structure, Semantics, Parts of Speech, Sentences: Basic ideas in compositional semantics, Classical Parsing (Bottom up, top down, Dynamic Programming: CYK parser), Sentences: Parsing using Probabilistic Context Free Grammars and EM based approaches for learning PCFG parameters, N-gram Language Models, and Information Theory: The role of language models, Simple N-gram models. Entropy, relative entropy, cross entropy, Statistical estimation and smoothing for language models, Parts of Speech Tagging and Sequence Labelling, Lexical syntax, Hidden Markov Models (Forward and Viterbi algorithms and EM training), n-gram models. Syntactic parsing: Grammar formalisms and treebanks, Efficient parsing for context-free grammars (CFGs), Statistical parsing and probabilistic CFGs (PCFGs), Top-down and bottom-up parsing, empty constituents, left recursion. Modern Statistical Parsers Search methods in parsing: Agenda-based chart, A\*, and "best-first" parsing, Dependency parsing. Discriminative parsing, Semantic Analysis: Lexical semantics and word-sense disambiguation. Discourse: Reference resolution and phenomena, syntactic and semantic constraints on Coreference, pronoun resolution algorithm, text coherence, discourse structure. Semantic Role Labelling and Semantic Parsing, Learning to Classify text : Supervised Classification, Evaluation, Decision trees, Naive bayes Classifier, Text Classification: Neural model for Document classification, Train Convolutional Neural Network (CNN) Model for Embedding layer. Casestudies: Develop n-gram CNN Model for Sentimental Analysis.

#### Text Books:

- 1) An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition , Daniel Jurafsky and James H. Martin , MIT Press
- 2) Natural Language Processing with Python , Bird, S., Klein, E., Loper, E. , O'Reilly
- 3) Natural language Understanding , James A , Pearson Education
- 4) Natural language processing: A Paninian perspective , Bharati Akshar, Chaitanya Vineet, Sangal, Rajeev , PHI
- 5) Foundations of Statistical Natural Language Processing , I. Manning, Christopher D.; HinrichSchuetze; MIT Press

  
**Dr. G. KRISHNAM**  
HOD - CS  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3900122, 2578129

### CYBER SECURITY AND ETHICAL HACKING

Course Code: 23CA21S1

LTPS : 2-0-2-0

PRE-REQUISITE: NIL

#### Syllabus:

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis. Application security (Database, E-mail and Internet), Data Security Considerations- Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software. Digital Signature, public Key Cryptography. Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management. Introduction to Ethical Hacking: Hacking Methodology, Process of Malicious Hacking, Foot printing and Scanning: Foot printing, Scanning. Enumeration: Enumeration. System Web and Network Hacking: SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security.

#### Text Books:

- 1) "Analysing Computer Security ", Charles P. Pfleeger, Shari Lawerance Pfleeger, Pearson Education India. 2012
- 2) "Cryptography and information Security", V.K. Pachghare , PHI Learning Private Limited, Delhi , 2004
- 3) "Introduction to Information Security and Cyber Law", Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla , Willey Dreamtech Press , 2008
- 4) " Information Assurance for the Enterprise", Schou, Shoemaker , Tata McGraw Hill, 2006
- 5) Hacking Exposed 7th Edition , Stuart McClure, Joel Scambray, George Kurtz , Tata McGraw Hill , 2009

*Belan*  
HOD-CS/6/6/2023  
U.S. KRISHNA  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2578129

### CYBER FORENSICS

Course Code: 23CA22S2

LTPS : 2-0-2-0


PRE-REQUISITE:CSEH

#### Syllabus:

Computer Forensics: Introduction to Computer Forensics, Forms of Cyber Crime, First Responder Procedure- Non-technical staff, Technical Staff, Forensics Expert and Computer Investigation procedure, Case Studies Storage Devices & Data Recover Methods : Data Acquisition, Data deletion and data recovery method and techniques, volatile data analysis, Case Studies . Forensics Techniques I : Windows forensic, Linux Forensics, Network forensics – sources of network-based evidence, other basic technical fundamentals, Network forensic investigative strategies, technical aspects, statistical flow analysis, packet analysis, forensics of wireless networks, network intrusion detection analysis, event log aggregation and correlation analysis, switches, routers and firewalls, Case Studies, Mobile Forensics – data extraction & analysis, Steganography, Password cracking, Case Studies. Forensics Techniques II : Cross-drive analysis, Live analysis, deleted files, stochastic forensics, Dictionary attack, Rainbow attack, Email Tacking – Header option of SMTP, POP3, IMAP, examining browsers, Case Studies . Cyber Law: Corporate espionage, digital evidence handling procedure, Chain of custody, Main features of Indian IT Act 2008 (Amendment), Case Studies, Incident specific procedures .

#### Text Books:

- 1) Computer Forensics: Computer Crime Scene Investigation , John Vacca , Laxmi Publications , 2015
- 2) Digital Forensic: The Fascinating World of Digital Evidences , Nilakshi Jain , Wiley , 2016
- 3) Hacking Exposed Computer Forensics , Aaron Philipp, David Cowen , McGraw Hill , 2009
- 4) Mastering Mobile Forensics , Soufiane Tahiri , Packt Publishing , 2016
- 5) Computer Forensics: A Beginners Guide, David Cowen , McGraw Hill , 2013

  
**Dr. G. KRISHNA MOHAN**  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 888 - 3500122, 2576129

### MALWARE ANALYSIS

Course Code: 23CA31S3

LTPS : 2-0-2-0

PRE-REQUISITE:CSEH

#### Syllabus:

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots, Creating fake networks. X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets, Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism, Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques.

#### Text Books:

- 1) Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware, Monnappa KA, Packt Publishing Ltd, 2018 Jun 29
- 2) Practical malware analysis: the hands-on guide to dissecting malicious software, Sikorski M, Honig A, no starch press, 2012 Feb 1
- 3) Cuckoo malware analysis, Oktavianto D, Muhandianto I, Packt Publishing Ltd, 2013 Oct 16
- 4) Windows malware analysis essentials, Marak V, Packt Publishing Ltd, 2015 Sep 1
- 5) Malware Analysis and Detection Engineering, Mohanta A, Saldanha A, Apress, New York, NY, 2020

  
Dr. G. KRISHNA MOHAN

Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Phone No. +91 8845 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
Admin Off: 28-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 888 - 3500122, 2576129

### SECURITY GOVERNANCE AND MANAGEMENT

Course Code: 23CA31S4


LTPS : 2-0-2-0

PRE-REQUISITE: CSEH

Introduction to Virtualization and Cloud- Introduction & IT Governance Concepts, Role of Governance in Information Security, Corporate Governance, Best Practices for IT Governance, Six outcomes of effective Security Governance, benefits of good governance, Cultural aspects in governance, IT Governance-Roles and Responsibilities. Role of IT Strategy Committee and Security Steering Committee, Standard IT Balanced Scorecard. Val-IT framework of ISACA, Governance in multi-department and multi-country enterprises, Importance of Governance in establishing a sustainable Security Culture in the organization. Information System Strategy: Role of Strategic Planning for IT, Role of Steering committee, Policies and Procedures, Strategic Direction and Alignment of Security Strategy with Business Objectives, Role of CISO, Security Metrics Program. Information Security Management: Introduction, Performance Optimization, IT Security roles & responsibilities, Management Information Security Forum, Segregation of Duties, Description of COBIT and other Frameworks, Security Program Effectiveness, Continuous Assessment and Improvement, Insourcing versus Out-sourcing, Impact of ISM program across organization.

#### Textbooks:

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole.
2. Information Security Governance by S.H. Solms, Rossouw Solms, Springer; 1st Edition. 2nd Printing, 2008 edition (12 December 2008).
3. IT Governance: How Top Performers Manage IT Decision Rights for Superior Results by Weill, Harvard Business Review Press; First edition (1 June 2004). ISACA publications

  
Dr. G. KRISHNAKRISHNAN  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2578129

### CRYPT ANALYSIS & CYBER DEFENSE

Course Code: 23CA32S6

LTPS : 3-0-2-4


PRE-REQUISITE: CSEH

#### Syllabus:

Introduction to Security: Security Concepts, Security Attacks, A Security Model, Security, Services and Mechanisms, Antivirus bypassing, Password Attacks and Web browser exploitation. Block Ciphers: DES, DES Example, Strength of DES, Differential and Linear Cryptanalysis., AES: Finite Field Arithmetic, AES Structure, AES Transformation Functions, AES Example. Multiple Encryption and Triple DES. Modes of Operation. Pseudo random Number Generation: Principles and Pseudorandom Number, Generators, Pseudorandom Number Generation using a Block Cipher, Stream Ciphers. Stream Ciphers: RC4. Public-key Cryptography: RSA algorithm, Diffie-Hellman Key Exchange, ElGamal Cryptosystem, Elliptic Curve Arithmetic, Elliptic Curve Cryptography. Cryptographic Hash Functions: Applications of Cryptographic Hash functions, Two Simple Hash Functions, Requirements and Security, SHA 512, MD5.

#### Text Books:

- 1) Cryptography and Network Security Principles and Practice, William Stallings Pearson, 5th Edition.
- 2) Applied Cryptography: Protocols, Algorithms, and Source Code in C, Bruce Schneier, John Wiley & Sons, Second Edition
- 3) Cyber Security Incident Management Guide, Gerard Johansen, Packet Publishing Ltd, 2017
- 4) Applied Cryptography for Cyber Security and Defence: Information Encryption and Cyphering, Hamid R. Nemati and Li Yang IGI Global, 2011
- 5) Cryptography and Network Security, Forouzon B., Indian Edition, TMH (2010).

  
Dr. G. KRISHNA MOHAN  
HOD-CSA  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

### CYBER SECURITY AND ETHICAL HACKING

Course Code:23CA52S1

LTPS: 3-0-2-4

PRE-REQUISITE : NIL

#### Syllabus:

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis. Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control. Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography. Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures. Introduction to Ethical Hacking : Hacking Methodology, Process of Malicious Hacking, Footprinting and Scanning: Footprinting, Scanning. Enumeration: Enumeration. System Web and Network Hacking : SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security. Linux Hacking: Linux Hacking, Evading IDS and Firewalls: Evading IDS and Firewalls Report writing & Mitigation :Introduction to Report Writing & Mitigation, requirements for low level reporting & high level reporting of Penetration testing results, Demonstration of vulnerabilities and Mitigation of issues identified including tracking

#### Text Books:

1. "Analysing Computer Security ", Charles P. Pfleeger, Shari Lawerance Pfleeger, Pearson Education India. 2012
2. "Cryptography and information Security", V.K. Pachghare , PHI Learning Private Limited, Delhi , 2004
3. "Introduction to Information Security and Cyber Law", Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla , Willey Dreamtech Press , 2008

  
**Dr. G. KRISHNA MOHAN**  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Admin Off: 23-38-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 888 - 3500122, 2575129

### CYBER FORENSICS

Course Code:23CA52S2

LTPS 3-0-0-0


PRE-REQUISITE : NIL

#### Syllabus:

Computer Forensics : Introduction to Computer Forensics, Forms of Cyber Crime, First Responder Procedure- Non-technical staff, Technical Staff, Forensics Expert and Computer Investigation procedure, Case Studies Storage Devices & Data Recover Methods : Data Acquisition, Data deletion and data recovery method and techniques, volatile data analysis, Case Studies Forensics Techniques I : Windows forensic, Linux Forensics, Network forensics – sources of network-based evidence, other basic technical fundamentals, Network forensic investigative strategies, technical aspects, statistical flow analysis, packet analysis, forensics of wireless networks, network intrusion detection analysis, event log aggregation and correlation analysis, switches, routers and firewalls, Case Studies, Mobile Forensics – data extraction & analysis, Steganography, Password cracking, Case Studies. Forensics Techniques II : Cross-drive analysis, Live analysis, deleted files, stochastic forensics, Dictionary attack, Rainbow attack, Email Tacking – Header option of SMTP, POP3, IMAP, examining browsers, Case Studies, Cyber Law : Corporate espionage, digital evidences handling procedure, Chain of custody, Main features of Indian IT Act 2008 (Amendment), Case Studies, Incident specific procedures

#### Text Books:

- 1) Computer Forensics: Computer Crime Scene Investigation , John Vacca , Laxmi Publications , 2015
- 2) Digital Forensic: The Fascinating World of Digital Evidences , Nilakshi Jain , Wiley , 2016
- 3) Hacking Exposed Computer Forensics , Aaron Philipp, David Cowen , McGraw Hill , 2009
- 4) Mastering Mobile Forensics , SoufianeTahiri , Packt Publishing , 2016
- 5) Computer Forensics: A Beginners Guide, David Cowen , McGraw Hill , 2013

  
Dr. G. KRISHNA MOHAN  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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Phone No. +91 8645 - 350 200; www.klof.ac.in; www.klof.edu.in; www.kluniversity.in

Admin Off: 29-35-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2579129

### MALWARE ANALYSIS

Course Code :23CA61S3

LTPS: 3-0-2-4

PRE-REQUISITE: NIL

#### Syllabus:

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots, Creating fake networks. X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism. Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, . Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching. Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection, YARA rule based detection, Tools - Process Hacker, Process Hacker, Wireshark, Cuckoo Sandbox.

#### Text Books:

- 1) Learning Malware Analysis: Explore the concepts, tools, and techniques to analyze and investigate Windows malware, Monnappa KA, Packt Publishing Ltd, 2018 Jun 29
- 2) Practical malware analysis: the hands-on guide to dissecting malicious software, Sikorski M, Honig A, no starch press, 2012 Feb 1
- 3) Cuckoo malware analysis, Oktavianto D, Muhandianto I, Packt Publishing Ltd, 2013 Oct 16
- 4) Windows malware analysis essentials, Marak V, Packt Publishing Ltd, 2015 Sep 1
- 5) Malware Analysis and Detection Engineering, Mohanta A, Saldanha A, Apress, New York, NY, 2020

  
Dr. G. KRISHNA MOHAN  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Admin Off: 29-35-38, Museum Road, Governorpet, Vijayawada - 520 002. Pin: +91 - 866 - 3500122, 2576129

### SECURITY GOVERNANCE AND MANAGEMENT

Course Code:23CA 61S4


L-T-P-S: 3-0-0-0

Pre-requisites: NIL

Introduction to Virtualization and Cloud- Introduction & IT Governance Concepts, Role of Governance in Information Security, Corporate Governance, Best Practices for IT Governance, Six outcomes of effective Security Governance, benefits of good governance, Cultural aspects in governance, IT Governance-Roles and Responsibilities. Role of IT Strategy Committee and Security Steering Committee, Standard IT Balanced Scorecard. Val-IT framework of ISACA, Governance in multi-department and multi-country enterprises, Importance of Governance in establishing a sustainable Security Culture in the organization. Information System Strategy: Role of Strategic Planning for IT, Role of Steering committee, Policies and Procedures, Strategic Direction and Alignment of Security Strategy with Business Objectives, Role of CISO, Security Metrics Program, Information Security Management: Introduction, Performance Optimization, IT Security roles & responsibilities, Management Information Security Forum, Segregation of Duties, Description of COBIT and other Frameworks, Security Program Effectiveness, Continuous Assessment and Improvement, Insourcing versus Out-sourcing, Impact of ISM program across organization.

#### Textbooks:

1. Information Systems Security: Security Management, Metrics, Frameworks and Best Practices by Nina Godbole.
2. Information Security Governance by S.H. Solms, Rossouw Solms, Springer; 1st Edition. 2nd Printing, 2008 edition (12 December 2008).
3. IT Governance: How Top Performers Manage IT Decision Rights for Superior Results by Weill, Harvard Business Review Press; First edition (1 June 2004). ISACA publications

  
HOD-CSE  
**Dr. G. KRISHNA MOHAN**  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





## Koneru Lakshmaiah Education Foundation

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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.  
Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
Admin Off: 26-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

### CLOUD SECURITY

Course Code :23CA61S5

L-T-P-S: 3-0-2-0

Pre-requisite: NIL

#### Syllabus:


Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, availability, access control, defense in depth, least privilege, the importance of security in the cloud, Importance in PaaS, IaaS and SaaS; Cryptographic Systems: Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, public-key infrastructures, key management, X.509 certificates, OpenSSL. Multi-tenancy Issues: Isolation of users/VMs from each other. Virtualization System Security Issues: e.g. ESX and ESXi Security, ESX file system security, storage considerations, backup, and recovery; Virtualization System Vulnerabilities: Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, and malware (botnets, etc). Virtualization System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyperjacking. Technologies for virtualization-Based Security Enhancement: IBM security virtual server protection, virtualization-based sandboxing; Storage Security: HIDPS, log management, Data Loss Prevention. Location of the Perimeter, Legal and Compliance Issues: Responsibility, ownership of data, right to penetration test. Local laws, examination of modern Security Standards (eg PCIDSS), Standards to deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.

#### Text Books :

1. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reilly Media Inc, 2009

#### Reference Books :

1. Ronald L. Krutz, Russell Dean Vines, Cloud Security, 2010.
2. John Rittinghouse, James Ransome, Cloud Computing, 2009.
3. J.R. ("Vic") Winkler, Securing the Cloud, 2011

  
**Dr. G. KRISHNA RAO**  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2578129

### ANNEXURE-IV

#### CONTINUOUS DELIVERY & DEVOPS

Course Code: 23CA2121 LTPS : 3-0-2-0


PRE-REQUISITE: NIL

#### Syllabus:

Introduction to DevOps: Introduction to DevOps, Overview of DevOps, Relationship Between Agile and DevOps, Principles of DevOps, DevOps Tools, Best Practices for DevOps, Version Control Systems: Role of Version Control System in DevOps Environment, GitHub, Deploy the files to Bitbucket via Git. Need of Cloud in DevOps: Popular Cloud Providers, CI/CD in AWS and Azure, CI/CD Services in AWS. Continuous Integration and Continuous Deployment: Continuous Integration and Continuous Deployment using Jenkins, Continuous Integration with Jenkins, Git, and Maven, Build Applications using Pipeline on azure platform. Software and Automation Testing Frameworks: Popular Testing Tools, Test Driven Development Cycle, Behavior driven development is an extension of test driven development, Automated Testing using Cucumber. Docker as Containerization: Virtualization, Docker on Windows Desktop, Creating an Account in Docker Hub, MySQL in Docker. Kubernetes: Components, Kubernetes Architecture, Minikube, Pod Configuration on Windows. Configuration Management: Configuration Management Process, Role of Infrastructure as Code in DevOps Environment, Puppet. Continuous Monitoring: Role of Monitoring Systems, Types of Monitoring, Popular Monitoring Tools: Nagios. Orchestrating application deployment.

#### Text Books:

1. DevOps for Web Development MiteshSoni, PACKT Publishing 2016.
2. Migrating a Two-Tier Application to Azure\_ A Hands-on Walkthrough of Azure Infrastructure, Platform, and Container Services Peter De Tender A press 2021.
- 3 A Complete DevOps Cookbook\_ Build and manage your applications, orchestrate containers, and deploy cloud-native services Murat Karslioglu – Kubernetes Packt Publishing 2020.
- 4 Docker for Developers\_ Develop and run your application with Docker containers using DevOps tools for continuous delivery Richard Bullington-McGuire, Andrew K. Dennis, Michael Schwartz Packt Publishing 2020.
- 5 Beginning DevOps with Docker Joseph Muli, ACKT Publishing 2018

  
HOD 05/06/2023  
**Dr. G. KRISHNA MOHAN**  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





*G. Krishnan*  
Dr. G. KRISHNAN  
HOD: CSA  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L.Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 25-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

### NETWORK SECURITY

Course Code: 23CA3223

LTPS : 3-0-2-0

PRE-REQUISITE: CN

#### Syllabus:

Physical Network Security: Physical layer security, Copper and Optical Media, Data Centre and Enterprise network: LAN Security and Resilient Network Topologies. Router Mechanisms for security: Router and Switch Architectures, Lookup and Classification Algorithms, Packet scheduling and fair queuing, Queuing and Scheduling Algorithms, Network configuration security: Internet Policy Routing Securing Distributed and networked systems: Securing Distributed Algorithms, Big picture: Physical Security, Wireless Media, Malware, QoS and Multicast. Current topics in Network security: Web and DNS security, Wireless Security, Covert Channels in Networks, Quantum Cryptography/ Communication, Security of Internet Architectures, Secure Multiparty Computation, Anomaly Detection and Traffic Analysis, Operational Network Security, Intrusion Detection Algorithms, Data Mining for Intrusion Detection, Traffic Anomaly Detection and DHT Security.

#### Textbooks:

- 1) Network security: the complete reference. Taylor, Art, and Ben Rothke. McGraw-Hill, Inc. 2003.
- 2) "Network Security Essentials", William Stallings, Pearson Education 6th Edition, 2017
- 3) "Cryptography and Network Security", William Stallings, Prentice Hall, 5th edition, 2005
- 4) Network security: the complete reference. Taylor, Art, and Ben Rothke, McGraw-Hill, Inc., 2003.
- 5) "Cryptography and Network Security", Forouzon B, Indian Edition 2010.

*[Signature]*  
28/6/2023  
HOD-  
**Dr. G. KRISHNA MOHAN**  
Head of the Department  
Computer Science and Application  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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 Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.  
 Phone No. +91 8845 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
 Admin Off: 29-35-38, Museum Road, Govarnapet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2578129

## Reference for Program Structures and Syllabus Revision- BCA

S. N o.	Cour se Code	Cours e Name	Co urs e Cat ego ry	L	T	P	S	C R	Pre - Requi si te	New/Revi sed/Retai ned	Stak ehol der feed back base d on whic h chan ge was prop osed	Focused on Employability/E ntrepren eurship /Skill Development or Carrer Advancement	Justification (Detailed Justification on how the course content maps to employability/e ntrepren eurshi p/skill category.)
1	Y23 MT1 112	Mathe matics For Comp uter Scienc e	BS C	2	2	0	0	4	NIL	Retained Course	NA	Employability	Enhance the skilling and knowledge of coding
2	Y23 MT1 213	Proba bility And Statist ics	BS C	2	2	0	0	4	NIL	Retained Course	NA	Employability	Proficiency in probability and statistics enhances employability by providing students with the ability to analyze data, make informed decisions, and solve complex problems
3	Y23 CA1 101	Comp uter Organ ization	PC C	2	2	0	0	4	NIL	Revised Course	Facul ty	Employability	Provide basic understanding of operating Computer
4	Y23 CA1 102	Essent ials Of Infor matio n Techno logy	PC C	2	0	2	0	3	NIL	Retained Course	NA	Employability	Enhances knowledge on architecture of computer
5	Y23 CA1 103	Comp utatio nal	PC C	2	0	2	4	4	NIL	Retained Course	NA	Employability	Enhance Programming skills for coding

*[Signature]*  
**Dr.G.KRISHNA MOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L.Deemed to be University)  
 Green Fields,Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-38-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

		Thinki ng For Struct ured Desig n											competition
6	Y23 CA1 104	Softw are Engin eering	PC C	3	0	0	0	3	EIT	Retained Course	NA	Entrepreneurship	Enhance Knowledge in SDLC and Software project Management.
7	Y23 CA1 205	Essent ials Of Operat ing Syste m	PC C	3	1	0	0	4	CO	Retained Course	NA	Employability	Enhance knowledge on Internal working of devices
8	Y23 CA1 206	Data Struct ures	PC C	3	0	2	4	5	CT SD	Retained Course	NA	Employability	Enhance Programming skills and participate in coding competitions
9	Y23 CA1 207	Object Orient ed Progra mming	PC C	3	0	2	4	5	CT SD	Retained Course	NA	Skill Development	Equips students with fundamental programming concepts, fosters problem-solving skills.
10	Y23 CA2 108	Comp uter Netwo rks	PC C	3	0	0	0	3	NIL	Retained Course	NA	Entrepreneurship	Enhance networking knowledge for Entrepreneurshi p
11	Y23 CA2 109	Datab ase Mana gemen t Syste ms	PC C	3	0	2	0	4	NIL	Retained Course	NA	Employability	Enhance the knowledge om SQL Queries for employability
12	Y23 CA2 210	Object Orient ed Analy sis & Desig n	PC C	3	0	2	0	4	NIL	Retained Course	NA	Employability	Enhance knowledge in designing UML diagrams.
13	Y23S	Web	SD	0	0	0	4	1	NIL	Retained	NA	Skill	Fosters skill

**Dr. G. KRISHNA MOHAN**

Head of the Department

Computer Science and Application

Koneru Lakshmaiah Education Foundation

(K.L. Deemed to be University)

Green Fields, Vaddeswaram-522502

Guntur District, Andhra Pradesh



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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-38-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2578\*29

	DCA 01	And Social Media Technologies	C							Course		Development	development by training students in the latest tools and techniques.
14	Y23S DCA 02	Web Development Using Python	SD C	0	0	4	4	3	NIL	Retained Course	NA	Skill Development	Providing students with hands-on experience in building dynamic and interactive websites using Python.
15	Y23S DCA 03	Java Full Stack Development	SD C	0	0	4	4	3	OO P	Retained Course	NA	Skill Development	Equips students with comprehensive proficiency in both front-end and back-end development using Java.
16	Y23S DCA 04	Aspects Of Mobile Application	SD C	0	0	4	4	3	OO P	Retained Course	NA	Skill Development	Providing students with expertise in mobile app development, focusing on object-oriented programming principles.
17	23CA 21N1	Technical Internship-1	PRI	0	0	0	4	1	NIL	Retained Course	NA	Employability	Enhance the skilling and knowledge of coding
18	23CA 31N2	Technical Internship-2	PRI	0	0	0	4	1	NIL	Retained Course	NA	Employability	Able to build the projects by analysing the problems in existing system.
19	23CA 22E1	Minor Project	PRI	0	0	0	8	2	NIL	Retained Course	NA	Employability	Able to build the projects by analysing the problems in existing system.
20	23CA 32E2	Major Project	PRI	0	0	0	8	2	NIL	Retained Course	NA	Employability	Able to build the projects by analysing the

*[Signature]*  
**Dr. G. KRISHNA MOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 886 - 3500122, 2576129

													problems in existing system.
21	23C A21 C1	Cloud Architectures	PE C	2	0	2	0	3	NIL	Retained Course	NA	Employability	Understanding cloud architecture is essential for designing scalable, reliable, and secure cloud-based solutions
22	23C A22 C2	Cloud Web Services	PE C	2	0	2	0	3	PE1	Retained Course	NA	Employability	Cloud web services are fundamental for developing and deploying web applications on cloud platforms efficiently.
23	23C A22 C3	Cloud Serverless Computing	PE C	2	0	2	0	3	PE1	Retained Course	NA	Employability	Serverless computing is gaining popularity due to its cost-effectiveness and scalability.
24	23C A31 C4	Design And Development Of Cloud Application	PE C	2	0	2	0	3	PE1	Retained Course	NA	Employability	This course is crucial for teaching students how to design and develop cloud-native applications.
25	23C A32 C5	Cloud Security	PE C	3	0	0	0	3	PE1	Retained Course	Student	Entrepreneurship	Understanding cloud security measures and best practices is vital for protecting data and systems.
26	23C A21 D1	Data Science Methodologies	PE C	2	0	2	0	3	NIL	Retained Course	NA	Employability	Various methodologies are essential for effectively analyzing and interpreting data to extract valuable insights.

  
**Dr. G. KRISHNA MURTHY**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh



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27	23C A22 D2	Data Warehousing & Mining	PE C	2	0	2	0	3	PE1	Retained Course	NA	Employability	Enhances students to efficiently store, manage, and analyze large volumes of data
28	23C A22 D3	Applied Machine Learning	PE C	2	0	2	0	3	PE1	Retained Course	NA	Employability	Machine learning is integral to many modern applications, from recommendation systems to predictive analytics.
29	23C A31 D4	Introduction Big Data Analytics	PE C	2	0	2	0	3	PE1	Retained Course	NA	Skill Development	Big data analytics is becoming increasingly important for organizations to make data- driven decisions.
30	23C A31 D5	Data Visualization Techniques	PE C	3	0	0	0	3	PE1	Retained Course	NA	Skill Development	Proficiency in data visualization techniques is crucial for effectively communicating insights from complex datasets
31	23C A21 A1	Applied Artificial Intelligence	PE C	2	0	2	0	3	NIL	Retained Course	NA	Skill Development	Artificial intelligence is revolutionizing various industries, and having hands-on experience prepares students for AI roles.
32	23C A31 A4	Applied Deep Learning	PE C	2	0	2	0	3	PE1	Retained Course	NA	Skill Development	Deep learning has shown remarkable success in various tasks such as image

*[Signature]*  
HOD-CAA  
Dr. G. KRISHNA MOHAN  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-36, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2578129

													recognition and natural language processing.
33	23C A31 A5	Percep tion And Comp uter Vision	PE C	3	0	0	0	3	PEI	Retained Course	NA	Employability	Understanding perception and computer vision is essential for various applications .
34	23C A21S 1	Cyber Securi ty And Ethica l Hacki ng	PE C	2	0	2	0	3	NIL	New Course	Stud ent	Employability	With the increasing frequency of cyber attacks, there is a growing demand for professionals skilled in cybersecurity.
35	23C A22S 2	Cyber Forens ics	PE C	2	0	2	0	3	PEI	New Course	Stud ent	Skill Development	Cyber forensics skills are crucial for investigating cybercrimes and analyzing digital evidence effectively.
36	23C A22S 3	Malw are Analy sis	PE C	2	0	2	0	3	PEI	New Course	Stud ent	Employability	With the increasing threat of malware attacks, the ability to analyze and mitigate malware is in high demand.
37	23C A31S 4	Securi ty Gover nance And Mana gemen t	PE C	2	0	2	0	3	PEI	New Course	Stud ent	Employability	Understanding principles and practices is essential for shaping effective governance strategies.
38	23UC 1101	Integr ated Profes sional Englis h	HA S	0	0	4	0	2	NIL	Retained Course	NA	Employability	Enhances employability by developing students' proficiency in communication
39	23UC 1202	Englis h	HA S	0	0	4	0	2	NIL	Retained Course	NA	Employability	Fosters employability by

Dr. G. KRISHNA  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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 Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

		Proficiency											refining students' abilities to convey ideas effectively.
40	23UC1203	Design Thinking & Innovation	HAS	0	0	4	0	2	NIL	Retained Course	NA	Employability	Cultivates employability by nurturing students' capacity for creative problem-solving and innovative thinking for driving organizational success.
41	22UC0010	Universal Human Values & Professional Ethics	HAS	2	0	0	0	2	NIL	Retained Course	NA	Entrepreneurship	Preparing individuals to lead with integrity and inclusivity in entrepreneurial endeavors.
42	22FL3055	Foreign Language Elective - Japanese Language	HAS	2	0	0	0	2	NIL	Retained Course	NA	Employability	Enhances employability by equipping students with language proficiency in German, expanding their global communication skills.
43	22UC2103	Essential Skills for Employability	HAS	0	0	4	0	2	NIL	Retained Course	NA	Employability	-

*Dr. G. Krishna Mohan*  
**Dr. G. KRISHNA MOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2575129

44	22UC 2204	Corporate Readiness Skills	HA S	0	0	4	0	2	NIL	Retained Course	NA	Employability	-
45		Management Elective	HA S	2	0	0	0	2	NIL	New Course	NA	Employability	
46	22UC C0009	Ecology & Environment	AU C	2	0	0	0	0	NIL	Retained Course	NA	Employability	-
47	22UC C0008	Indian Constitution	AU C	2	0	0	0	0	NIL	Retained Course	NA	Employability	-
48	22UC 0011	Gender & Social Equality	AU C	2	0	0	0	0	NIL	Retained Course	NA	Employability	-
49	23UC 0019	Essence of Indian Knowledge Tradition	AU C	2	0	0	0	0	NIL	Retained Course	NA	Employability	-
50	23CA 2121	Continuous Delivery and Deployment with DevOps	FC C	3	0	2	0	4	NIL	New Course	Industry	Employability	
5	23CA	Visual Program	FC C	3	0	2	0	4	NIL	New Course	Industry	Employability	

*Dr. G. KRISHNA MOHANA*  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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1	3122	mming and HCI											
52	23CA 3223	Network and Infrastructure Security	FC C	3	0	2	0	4	CN	New Course	Industry	Employability	
53	22U C002 1	Social Immersive Learning-1	SIL	0	0	0	4	1	NIL	Retained Course	NA	Employability	Facilitating hands-on experiential learning opportunities for success in professional environments.
54	22U C002 2	Social Immersive Learning-2	SIL	0	0	0	4	1	NIL	Retained Course	NA	Employability	Facilitating hands-on experiential learning opportunities for success in professional environments.
55	22U C002 3	Social Immersive Learning-3	SIL	0	0	0	4	1	NIL	Retained Course	NA	Employability	Facilitating hands-on experiential learning opportunities for success in professional environments.

Percentage of Syllabus Revision = 16% (9 out of 55)

Percentage of Courses focusing on Employability= 74.5% ( 41 out of 55)

Percentage of Courses focusing on Entrepreneurship= 7.5% (4 out of 55)

Percentage of Courses focusing on Skill Development = 18% (10 out of 55)

*Dr. G. KRISHNA DESSAN*  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh



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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. +91 8645 - 350 200; www.kief.ac.in; www.kief.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

## Reference for Program Structures and Syllabus Revision- MCA

S. N O.	Course Code	Course Name	Course Category	L	T	P	S	C R	Pre-Requisite	New Course/ Revised Course/ Retained Course	Changes Proposed by	Focused on Employability /Entrepreneurship/Skill Development	Justification
1	23UC 5201	Professional Communication Skills	AUC	0	0	4	0	0	NA	Retained Course	NA	Employability	Covering communication skills for employability
2	23CA 5101	Computer Networks And Communications	PCC	3	0	2	0	4	NA	Retained Course	NA	Employability	Enhance networking knowledge for employability
3	23CA 5102	Data Structures And Algorithms	PCC	3	0	2	4	5	NA	Retained Course	NA	Skill Development	Enhance data structure knowledge
4	23CA 5103	Operating Systems	PCC	3	1	0	0	4	NA	Revised Course	Faculty	Employability	Provide basic understanding of operating through for employability
5	23CA 5104	Database Systems	PCC	3	0	2	4	5	NA	Retained Course	NA	Employability	Enhance database knowledge for employability.
6	23CA 5205	Object Oriented Programming	PCC	3	0	2	4	5	NA	Retained Course	NA	Skill Development	Enhance the awareness of object-oriented programming
7	23CA 5206	Data Analytics	PCC	3	0	2	0	4	NA	Retained Course	NA	Employability	Enhance knowledge for statistics in term of computer

Dr. G. KRISHNA MOHAN  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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 Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.  
 Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
 Admin Off: 29-38-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2579129

8	23CA 5207	Comprehensive Software Engineering	PCC	2	1	0	0	3	NA	Retained Course	NA	Entrepreneurship	Enhance Knowledge on Software Project Management
9	23CA 6108	Web Technologies	PCC	3	0	2	4	5	NA	Retained Course	NA	Employability	Enhance the knowledge of web development for employability
10	23IE5 201	Research Exploration	HAS	1	1	0	0	2	NA	Retained Course	NA	Employability	Enhance Knowledge to design the projects on existing problems
11	23CA 52A1	Applied Machine Learning	PEC	3	0	2	4	5	NA	Retained Course	NA	Skill Development	Enhance Knowledge on different Machine algorithms.
12	23CA 52C1	Cloud Computing	PEC	3	0	2	4	5	NA	Retained Course	NA	Skill Development	Enhance knowledge on cloud services, cloud types.
13	23CA 52S1	Cyber Security And Ethical Hacking	PEC	3	0	2	4	5	NA	New Course	NA	Skill Development	Analysing security threats and electronic payment systems
14	23CA 52A2	Pattern Recognition	PEC	3	0	0	0	3	NA	Retained Course	NA	Employability	Enhance Knowledge on pattern recognition algorithms.
15	23CA 52D2	Hadoop And Bigdata	PEC	3	0	0	0	3	NA	Retained Course	NA	Entrepreneurship	Enhance knowledge on Bigdata algorithms
16	23CA 52C2	Cloud Information Security	PEC	3	0	0	0	3	NA	Retained Course	NA	Entrepreneurship	Enhance the knowledge of Information storage and its security

*Dr. G. KRISHNA MOHAN*  
 HOD-CA  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh



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Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

17	23CA 52S2	Cyber Forensic s	PEC	3	0	0	0	3	NA	New Course	NA	Employabilit y	Analysing Network Forensics and Mobile Device Forensics
18	23CA 61A3	Compute r Vision	PEC	3	0	2	4	5	NA	Retained Course	NA	Skill Development	Apply the techniques and transformatio n methods for image enhancement and image restoration.
19	23CA 61D3	Data Visualiz ation Techniq ues	PEC	3	0	2	4	5	NA	Retained Course	NA	Skill Development	Enhance knowledge on various graphs and plots to visualize the data
20	23CA 61C3	Cloud Architec tures	PEC	3	0	2	4	5	NA	Retained Course	NA	Employabilit y	Enhance Knowledge on Cloud Architectures
21	23CA 61S3	Malware Analysis	PEC	3	0	2	4	5	NA	New Course	NA	Employabilit y	With the increasing threat of malware attacks, the ability to analyze and mitigate malware is in high demand.
22	23CA 61A4	Applied Deep Learning	PEC	3	0	0	0	3	NA	Retained Course	NA	Employabilit y	Enhance different Deep Learning Algorithms
23	23CA 61D4	Statistics For Data Science	PEC	3	0	0	0	3	NA	Retained Course	NA	Employabilit y	Explains the various methods of descriptive data collection and analysis

*Dr. G. Krishna*  
Dr. G. KRISHNA  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. +91 8645 - 350 200; www.klof.ac.in; www.klof.edu.in; www.kluniversity.in

Admin Off: 29-38-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2579129

24	23CA 61C4	Cloud And Serverless Computing	PEC	3	0	0	0	3	NA	Retained Course	NA	Employability	Experiment with the appropriate methodologies of testing and debugging serverless functions
25	23CA 61S4	Security Governance And Management	PEC	3	0	0	0	3	NA	New Course	NA	Employability	Applying Security Strategy and Strategy Constraints to various organizations
26	23CA 61A5	Applications Of Natural Language Processing	PEC	3	0	2	0	5	NA	Retained Course	NA	Employability	Applying Rule based Techniques and Statistical Machine translation
27	23CA 61D5	Graph And Web Analytics	PEC	3	0	2	0	5	NA	Retained Course	NA	Employability	Analysing Web Analytics Strategy and website traffic analysis
28	23CA 61C5	Cloud Web Services	PEC	3	0	2	0	5	NA	Retained Course	NA	Employability	Enhance the knowledge of services to develop and storage data in cloud
29	23CA 61S5	Cloud Security	PEC	3	0	2	0	5	NA	New Course	Employability	Employability	Enhance the knowledge of information and cloud security data in cloud
30	23CA 61E1	INTERNSHIP	INT1					3	NA	Retained Course	NA	Employability	Enhance Knowledge by working on real time applications.
31	23CA 62E2	Major Project	MPROJ	0	0	2	0	1	NA	Retained Course	NA	Employability	Enhance Knowledge

Dr. G. KRISHNA SIVA  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

													to design the projects on existing problems
32	23TB CA01	TOOL BASED LEARNIN G	TBL	0	0	0	8	2	NA	New Course	Emplo yabilit y	Employabilit y	Enhance Knowledge to design the projects on existing problems

Percentage of Syllabus Revision = **21.8% (7 out of 32)**

Percentage of Courses focusing on Employability = **69% (22 out of 32)**

Percentage of Courses focusing on Entrepreneurship = **9% (3 out of 32)**

Percentage of Courses focusing on Skill Development = **22% (7 out of 32)**

*Dr. G. KRISHNA MOHAN*  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh



# Koneru Lakshmaiah Education Foundation

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Accredited by NAAC as 'A++' ♦ Approved by AICTE ♦ ISO 21001:2018 Certified


Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. +91 8845 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 886 - 3500122, 2576129

## Course wise Syllabus Revision of approved structure BCA

S No	C o u r s e C o d e	C o u r s e T i t l e	Percentage Change in syllabus AY2023-24				T o p i c s  a d d e d / r e m o v e d / r e p l a c e d	C h a n g e s i n C o u r s e O u t c o m e ( s )	J u s t i f i c a t i o n f o r n o t c h a n g e i n p e r	R e v i s i o n P e r c e n t a g e
			Existing Syllabus		New Syllabus					

  
**Dr. G. KRISHNAMOHAN**  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





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Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. +91 8645 - 350 200; www.klof.ac.in; www.klof.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Govenorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

										Percentage of changes in syllabus		
1	Y	Co	<b>Boolean Algebra</b> - Boolean Algebra, Properties of Boolean Algebra and De Morgan's Theorem , Operations of Boolean Algebra, Logic Gates, Truth Table and Logic Design.Karnaugh Map (K-Map) and Simplification of Boolean functions.Karnaugh	<b>Algebra:</b> Logic Gates-OR, AND, NOR, NAND, XOR & XNOR, Truth Tables, Demogran's theorms(2&3 Variable), Boolean laws, <b>Circuit designing techniques:</b> Karnaugh Map- 2, 3 and 4 Variable K Maps. Minimization			<b>Added:</b> Representation of numbers in different radix ,Conversions from one radix to			Y	P	4
2	mp									e	r	0
3	ute									s	o	%
C	r										p	
A	Or										o	

*Dr. G. KRISHNA MOHAN*  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





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 Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
 Admin Off: 29-36-38, Museum Road, Govarnorpet, Vijayawada - 520 002 Ph: +91 - 866 - 3500122, 2576129

1	ga	Map- 2, 3 and 4 Variable K Maps. Minimization Techniques – Min-terms and Max-terms, Sum of Product (SOP), Product of Sum (POS). <b>Combinational Circuits</b> - Half Adder, Full Adder, Half Subtractor, Full Subtractor, Multiplexer and De-multiplexer. Conversion Sequential Circuits – Flip Flops, Types of Flip Flop – SR Flip Flop, J K Flip Flop, D flip flop, T Flip flop, Master-Slave JK Flip Flop, Conversion. <b>Register Transfer &amp; Micro-Operations:</b> Register Transfer Language, Register Transfer, Bus & memory Transfers, Arithmetic Micro-operations, Logic Micro Operations, Shift Micro-operation, Arithmetic Logic Shift Unit. <b>Basic Computer Organization and Design:</b> introduction codes, Computer Registers, Computer instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output and interrupt, Design of Basic Computer, Design of accumulator Logic, <b>MICRO Programmed Control:</b> Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit. <b>Central Processing Unit:</b> General registers Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced instruction Set Computer (RISC). <b>Memory Organization:</b> Memory Hierarchy, Main Memory, Associative Memory, Cache Memory, Virtual	Techniques – Min-terms and Max-terms, Sum of Product (SOP), Product of Sum (POS).  <b>Combinational Building Blocks:</b> Adders and Subtractors, Multiplexers, Decoders. Sequential Circuits – Flip Flops, Types of Flip Flop – SR Flip Flop, J K Flip Flop, D flip flop, T Flip flop. <b>Basic Structure of Computers:</b> Computer Types, Functional Units. <b>Register Transfer &amp; Micro-Operations:</b> Register Transfer Language, Register Transfer, Bus & memory Transfers, Arithmetic Micro-operations, Logic Micro Operations, Shift Micro-operation, Arithmetic Logic Shift Unit.  <b>Basic Computer Organization and Design:</b> introduction codes, Computer Registers, Computer instructions, Timing and Control- Hardwired & Micro Programmed control, Instruction Cycle, Memory-Reference Instruction, Input-Output and interrupt, Design of Basic Computer, Design of accumulator Logic. <b>Micro Programmed Control Unit-</b> Address Sequencing, Micro-Program example  <b>Central Processing Unit:</b> General registers Organization, Stack Organization- types, Instruction Formats, Addressing Modes,	another, Integer - unsigned, signed (sign magnitude, 1's complement, 2's complement).  <b>Removed:</b> Control Memory, Design of Control Unit	s e d b y th e A c a d e m ic p e e r s
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*Dr. G. Krishna Mohan*  
 Dr. G. KRISHNA MOHAN  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh



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Phone No. : +91 8645 - 350 200; [www.klef.ac.in](http://www.klef.ac.in); [www.klef.edu.in](http://www.klef.edu.in); [www.kluniversity.in](http://www.kluniversity.in)

Admin Off: 29-35-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

			Memory	Data Transfer and Manipulation, Program Control, Reduced instruction Set Computer (RISC). <b>Memory Organization:</b> Memory Hierarchy, Main Memory, Associative Memory, Cache Memory, Virtual Memory-Paging, and Segmentation.			
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*Dr. G. R. Lakshmaiah*  
HOD-CSI  
Dr. G. R. Lakshmaiah  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





# Koneru Lakshmaiah Education Foundation

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 Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.  
 Phone No. +91 8645 - 350 200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in  
 Admin Off: 25-36-38, Museum Road, Govindapet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2570129

## Course wise Syllabus revision of approved structure MCA

S - N o	C o u r s e C o d e	Cours e Title	Existing Syllabus	Percentage Change in syllabus AY2023-24			Changes in Course Outcome(s)	Justific ation for no change in percent age of change in syllabu s	Rev isio n Per cent age
				New Syllabus		Topics added/removed/replaced			
1	23 C A5 10 3	Opera ting Syste m	Basics: Operating System Functionalities, Types of Operating Systems, Computer Architecture support to Operating Systems Process Virtualization: Processes, Process API code, Direct Execution, CPU Scheduling, Multi-level Feedback, Lottery Scheduling	<b>CO1</b> : Basics: Operating System Functionalities, Types of Operating Systems, Computer Architecture support to Operating Systems . <b>Process Management:</b> Process Concept - Process States, <b>Process structure:</b> PCB and components, Operations on Processes . Overview – Thread API, Common concurrency problems,		<b>Removed:</b> Multi-level Feedback, Lottery Scheduling code, Locks, Locked Data Structures, Condition Variables, Event-based Concurrency Memory Virtualization: Address Spaces, Translation Look aside Buffers  <b>Added:</b> Deadlock: System Model - Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention- Deadlock Avoidance- Deadlock Detection- Recovery from Deadlock.  Storage Management: Overview of Mass	Yes	Propose d by the Acade mic Peers	40 %

*Dr. G. KRISHNA MOHAN*  
 Head of the Department  
 Computer Science and Applications  
 Koneru Lakshmaiah Education Foundation  
 (K.L. Deemed to be University)  
 Green Fields, Vaddeswaram-522502  
 Guntur District, Andhra Pradesh





# Koneru Lakshmaiah Education Foundation

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Phone No. +91 8645 - 350 200; www.klof.ac.in; www.klof.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Govenorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

		code, Multiprocessor Scheduling Concurrency: Concurrency and Threads Thread code, API, Common concurrency problems, Locks, Locked Data Structures, Condition Variables, Semaphores, Event- based Concurrency Memory Virtualization: Address Spaces, Memory API, Address Translation, Segmentation, Free Space Management, Introduction to Paging, Translation Look aside Buffers, Advanced Page Tables, Swapping: Mechanisms, Swapping: Policies. Persistence: I/O	Locks, Locked Data Structures, Condition Variables, Semaphores  <b>CO2 :CPU Scheduling:</b> - Scheduling Algorithms - Multiprocessor Scheduling - Thread Scheduling. <b>Deadlock:</b> System Model - Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention- Deadlock Avoidance- Deadlock Detection- Recovery from Deadlock.  <b>CO3:Storage Management:</b> Overview of Mass Storage Structure - Disk Structure – Disk Attachment - Disk Scheduling - Disk Management- Swap Space Management –RAID Structure. <b>Memory:</b> Memory management requirements, Partitioning,	Storage Structure - Disk Structure – Disk Attachment - Disk Scheduling - Disk Management- Swap Space Management		
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*[Signature]*  
Dr. G. KRISHNA MOHAN  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
- Deemed to be University  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh



## Koneru Lakshmaiah Education Foundation

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 Admin Off: 25-35-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2576129

			<p>Devices, Hard Disk Drives, Redundant Disk Arrays (RAID), Files and Directories, File System Implementation, Distributed systems, Data Integrity and Protection.</p> <p>Paging and Segmentation, Virtual memory - Hardware and control structures, operating system software, Linux memory management, Windows memory management.</p> <p><b>CO4: Paging:</b> Introduction to Paging, Demand Paging, Page Replacement, Page Replacement Algorithms, Advanced Page Tables.</p> <p><b>Swapping:</b> Mechanisms, Policies. Persistence: I/O Devices, Hard Disk Drives.</p> <p><b>File System Interface:</b> File System Implementation, Distributed systems, Data Integrity and Protection.</p>				
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**Dr. G. KRISHNA MOHAN**

Head of the Department

Computer Science and Applications

Koneru Lakshmaiah Education Foundation

(K.L. Deemed to be University)

Green Fields, Vaddeswaram-522502

Guntur District, Andhra Pradesh

18/6/2023



## Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

Accredited by NAAC as 'A++' ♦ Approved by AICTE ♦ ISO 9001-2015 Certified

Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. 08645 - 350200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2577715, 2576129.


### Department of Computer Science & Applications

#### Recommendations of Department Academic Committee Meeting held on 16/06/2023

The Department Academic Committee has suggested the following changes.

##### **1. MCA Program**

- a) Rename the title of "Research Exploration" to "Essentials of Research Design" and modify the L-T-P-S structure from 2-1-0-0 to 1-1-0-0 from Y23 Regulation.
- b) Introduce Cybersecurity Specialization with focus on security related courses from Y23 Regulation.
  - Cyber Security and Ethical Hacking
  - Cyber Forensics
  - Malware Analysis
  - Security Governance and Management
  - Cloud Security
- c) Modify the Syllabus of Operating System from Y23 Regulation
- d) Introduce MOOC's courses in the last semester for the students who are doing internship for Y22 and Y23 Regulation.
- e) Include one new course in each specialization from Y23 Regulation
  - Natural Language Processing in AI Specialization
  - Graph & Web Analytics in Data Science Specialization
  - Cloud Computing in Cloud Specialization.
- f) Introduce Open Electives from Y23 Regulation
- i) Suggested to introduce Tool Based Learning courses appropriate to curriculum from Y23 Regulation
- J) Introduce few Value Added Course (VAC) from Y23 Regulation.

  
**Dr. G. KRISHNA MOH**  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh





## Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

Accredited by **NAAC** as 'A++' ♦ Approved by **AICTE** ♦ ISO 9001-2015 Certified

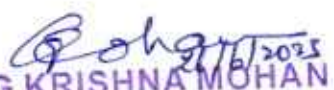
Campus: Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.

Phone No. 08645 - 350200; www.klef.ac.in; www.klef.edu.in; www.kluniversity.in

Admin Off: 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2577715, 2576129.

### 2. BCA Program

- a) Introduce Cybersecurity Specialization with focus on security related courses for Y22 and Y23 Regulation.
  - Fundamentals Of Cyber Security And Ethical Hacking
  - Cyber Forensics
  - Malware Analysis
  - Security Governance and Management
  - Cloud Security
  - Crypt Analysis & Cyber Defence
- b) Introduce MOOC's courses in the last semester for the students who are doing internship for Y21, Y22 and Y23 Regulation.
- c) Modify the Syllabus of Computer Organization from Y23 Regulation.
- d) Introduce Flexi Core Courses from Y23 Regulation.
- e) Introduce Minor Course in BCA Programme.
- f) Introduce Skill Development Courses on par with industry requirements.
- g) Introduce specialization in Honors, Experiential Learning, Entrepreneurship Learning and Research in BCA from Y23 Regulation.
- h) Introduce Probability & Statistics in Basic Sciences category.
- i) Include one new course in each specialization from Y23 Regulation
  - Natural Language Processing in AI Specialization
  - Graph & Web Analytics in Data Science Specialization
  - Cloud Computing in Cloud Specialization

  
**Dr. G. KRISHNA MOHAN**  
Head of the Department  
Computer Science and Applications  
Koneru Lakshmaiah Education Foundation  
(K.L. Deemed to be University)  
Green Fields, Vaddeswaram-522502  
Guntur District, Andhra Pradesh