



## 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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### XXXIII Academic Council - Annexure 2.7

#### Department of Computer Science & Applications

#### Minutes of 7<sup>th</sup> Board Of Studies Virtual Meeting

The Department of Computer Science & Applications called for the 6<sup>th</sup> Board of Studies (BOS) meeting, scheduled to take place on the 11<sup>th</sup> May 2021, starting from 11:00 a.m. onwards.

#### The following members attended:

1. Dr. K. Bhagavan, HOD, Department of CSA, Chairperson.
2. Dr. P. Suresh Varma, Professor, Adikavi Nannaya University, Member.
3. Dr. M. Babu Reddy, Principal, Krishna University, Member.
4. Mr. Sai Satish, Founder & CEO, Indian Servers, Member.
5. Mrs. S. Siva Leela, Team Leader, Hexaware, Member.
6. Dr. KVS N Rama Rao, Professor, KLH, Member.
7. Dr.S. Lavanya, HOD, English, Member.
8. Dr.V.S.Bhagavan, Professor, Mathematics, Member.
9. Dr. G. Siva Nageswara Rao, Professor, CSE, Member.
10. Dr.K. Kiran Kumar, Professor, CSA, Member.
11. Dr.C.M.Sheela Rani, Professor, CSA, Member.
12. Dr. Nitin Tyagi, Professor, CSA, Member.
13. Dr.M.N.V. Kiran Babu, Associate Professor, CSA, Member.
14. Dr.B.Mouleswara Rao, Associate Professor, CSA, Member.
15. Mr.N.Venkata Ramana, Assistant Professor, CSA, Member.
16. Mrs.B.Aruna, Assistant Professor, CSA, Member.
17. Mr.K. Rohit Kumar, Assistant Professor, CSA, Member.
18. Ms.V Nandini, Assistant Professor, CSA, Member.
19. Mr.G.Venkateswarlu, Assistant Professor, CSA, Member.
20. Ms.Papiya Mukherjee, Assistant Professor, CSA, Member.
21. Dr. T. Thiru Venkadam, Assistant Professor, CSA, Member.
22. Dr.A.Sabena Banu, Assistant Professor, CSA, Member.
23. Dr.V.S.Narayana, Professor, CSA, Member.
24. Mr.S.Parabrahma Chari, Assistant Professor, CSA, Member.
25. Ms.M.Radha, Assistant Professor, CSE, Member.
26. Dr. K. Subrahmanyam, Principal, KL College of Sciences, Special Invitee, Member.

#### Opening Remarks

Dr. K. Bhagavan, HOD, Department of CSA opened the meeting, welcoming all attendees.

*[Signature]*  
Head of the Department  
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### Agenda 1:

Proposal to introduce course structure for Y21 Admitted Students based on feedback received from stakeholders.

### Discussion

The chairperson Dr. K. Bhagavan has presented the course structure of Y21 admitted batch BCA to BoS members and discussion went on and decisions were made and approved by members.

### Resolutions:

- A proposal has been put forth to enrich the academic offerings of the University by introducing new Course Structure in response to the evolving needs of students and industry demands.

### Agenda 2:


Proposal to be rename the titles for the courses based on the feedback received from Stakeholders.

### Discussion

Dr. S. Lavanya & Dr. G. Siva Nageswara Rao suggested to rename the following course names for Y21 BCA.

### The following courses are suggested for renaming:

Title of the Course	New Title of the Course
DLD & CO	Computer Organization and Architectures
Fundamentals of Mathematics	Mathematics for Computer Science
Programming in C	Problem Solving through Programming
Object Oriented Programming through Java	Object Oriented Programming
Probability and Statistics	Statistics for Data Science
Professional Communication Skills	Essential Skills for Employment

  
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### Resolutions:

- A resolution has been passed to modify the titles of the courses as per discussions and recommendations or suggestions provided by industrial faculty and external members to meet the industry standards.

### Agenda 3:

Proposed to introduce a new program—MCA from the academic year 2021-22.

### Discussion:

- As per recommendation of Academic peers and Industry Feedback a two-year MCA program was introduced from academic year 2021-22.
- The detailed program structure is shown in **ANNEXURE-II**.

### Resolution:

A proposal has been put forth to the Academic council to offer a new program MCA for academic year:2021-2022.

### Agenda 4:


Proposal to introduce the following courses in AY:2021-22 based on the feedback received from Stakeholders. Web and social media Technologies Essentials of Information Technology Mobile Application Development

### Discussion:

- As per the recommendation of Industry person Mr. Sai Satish, Web & Social Media, and Mobile Application Development courses are introduced in 2nd semester for Y21 BCA admitted students.
- As per recommendation of academic peer Dr. M. Babu Reddy, a new course Essentials of Information Technology is introduced in 1st semester for Y21 BCA admitted students.

List of Courses introduced:

S.No	Course code	Course Title	Course Type	L	T	P	S	Remarks
1	21CA1209	Web and social media Technologies	Core	3	0	2	4	Introduced in place of Technology Management

  
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2	21CA1103	Essentials of Information Technology	Core	3	0	2	0	Introduced in place of Client side scripting based on feedback of Academic Peer.
3	21CA1208	Mobile Application Development	Core	0	0	4	0	Introduced in place Technical skills-1

The detailed syllabus is shown in **ANNEXURE-III**.

### Resolutions:

- A resolution has been passed to add the Web & Social Media and Mobile Application Development courses as per discussions and recommendations or suggestions provided by industrial faculty and external members to meet the industry standards.

### Action Taken:

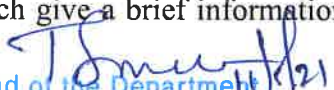
- The Board of Studies authorizes the respective Heads of Departments and Academic Deans to undertake essential measures for the implementation of new courses as per industry standards.

### Agenda 5:

Proposal to introduce new professional core and electives in various specializations from AY:2021-22 based on the feedback received from stakeholders.

### Discussion:

- Industry expert Ms. Siva Leela, Team Leader, Hexaware suggest introducing “Cloud Architecture” for designing solutions that align with business objectives while considering factors like performance, security, cost, and compliance.
- Faculty member Ms. Sabeena Banu Suggested to introduce the course “Essentials of IoT” to have a basic understanding of the devices, sensor, layers, and communication.
- Industry expert Ms. Sravani suggested introducing the course “Java Full Stack Development” to gain knowledge on front end and backend languages used for web development.
- Faculty member Dr. G. Siva Nageswara Rao, suggested to introduce the course “Object Oriented Analysis and Design” for generating the diagrams which give a brief information about the project.

  
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- Academic peer Dr. R. Kiran Kumar, Krishna University suggested to introduce the course “Statistics for Data Science”, which gives fundamental statistical concepts and techniques that are essential for working with data, conducting data analysis, and making data-driven decisions.
- Alumni Mr. M. Sumanth Kumar suggested to introduce “Business Intelligence” refers to the processes, technologies, tools, and practices.
- Faculty member Dr. T. Tiruvenkadham suggested introducing “Microprocessor and Micro Controller” with high processing capabilities, extensive memory, and support for advanced communication protocols.
- Faculty member Dr. C. M. Sheela Rani suggested “Electronics and Sensor Technology” with electronic components and sensors to measure, monitor, control, and process various physical phenomena.
- Industry expert Mr. K. Srinivas suggested introducing the course “Robotics Process Automation” to automate repetitive, rule-based tasks.
- Academic peer Dr. P. Suresh Varma, suggested introducing the course “IoT Design & Development” involve creating interconnected devices in various domains, including smart homes, industrial automation, healthcare, agriculture.
- Academic peer Dr. E. Babu Reddy, Suggested to Introduce the course “Deep Learning” is a subfield of machine learning and artificial intelligence (AI) that focuses on the development and training of artificial neural networks, particularly deep neural networks, to solve complex problems.
- Alumni L. Swetha Shireen, suggested to introduce the course “Advance Embedded Systems” involve complex hardware and software configurations and are used in various industries and applications, including aerospace, automotive, medical devices, industrial automation, and consumer electronics for the IoT specialization students.

### List of Completely New Courses :

S.No	Course code	Course Title	Course Type	Remarks
1	21CA2213	Java Full Stack Development	Core	Newly Introduced Course
2	21CA2214	Object Oriented Analysis and Design	Core	Newly Introduced Course
3	21CA21C1	Cloud Architecture	Professional Elective	Newly Introduced Course
4	21CA21I1	Essentials of IoT	Professional Elective	Newly Introduced Course

  
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5	21CA22D2	Statistics for Data Science	Professional Elective	Newly Introduced Course
6	21CA22A2	Business Intelligence	Professional Elective	Newly Introduced Course
7	21CA22I2	Microprocessor and Micro Controller	Professional Elective	Newly Introduced Course
8	21CA31I3	Electronics and Sensor Technology	Professional Elective	Newly Introduced Course
9	21CA32A4	Robotics Process Automation	Professional Elective	Newly Introduced Course
10	21CA32I4	IoT Design & Development	Professional Elective	Newly Introduced Course
11	21CA32A5	Deep Learning	Professional Elective	Newly Introduced Course
12	21CA32I5	Advance Embedded Systems.	Professional Elective	Newly Introduced Course

The detailed syllabus is shown in **ANNEXURE-III**.

### Resolutions:

- A resolution was passed to introduce new specialization courses as per discussions and recommendations or suggestions provided by industrial faculty and external members to meet the industry standards.

### Agenda 6:


- Proposed to introduce Term Paper with L-T-P-S 0-0-4-0 from the academic year 2021-22
- Proposed to introduce Essential Skills for Employability with L-T-P-S 0-0-4-0 for both BCA and MCA from the academic year 2021-22

### Discussion:

- As per the recommendations from Academic Peer Dr. Anil Kumar, Term Paper is introduced to the Y21 BCA students to understand the standards of the problems in Research papers.
- As per the recommendations from Industry person Mr. M. Tarun, "Essentials Skills for Employability is introduced to the Y21 BCA and MCA students to get aware of the skills required to acquire a job in IT Industry.

### Resolutions

- A recommendation has been made to academic council as per the recommendations from Industrial and external experts to introduce Term Paper and Essential Skills for Employability to improve skills among students.

  
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- The Department of Computer Science Applications will continue to monitor and enhance its curriculum to align with industry standards.

### Action taken

- The University proposes to enrich its academic offerings by introducing new courses to address the evolving needs of students and industry demands.
- The Board of Studies has authorized the respective Heads of Departments and Academic Deans to undertake essential measures for the implementation of new courses.
- The titles of certain courses have been revised based on discussions and recommendations from industrial faculty and external members to meet industry standards.
- The Department of Computer Science Applications will continue to monitor and enhance its curriculum to align with industry standards. Regular reviews and updates will be conducted to ensure the relevance and quality of the courses offered.

  
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## ANNEXURE – I

### Koneru Lakshmaiah Education Foundation Department of Computer Science Applications Bachelor of Computer Applications (BCA)

Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH
1	21UC1101	Integrated Professional English (HSS1)	HS S	0	0	4	0	2	4
2	21UC1202	English Proficiency (HSS2)	HS S	0	0	4	0	2	4
3	21UC1203	Design Thinking & Innovation (HSS3)	HS S	0	0	4	0	2	4
4	21UC2103	Essential Skills for Employability (HSS4)	HS S	0	0	4	0	2	4
5	21UC0010	Universal Human Values & Professional Ethics (HSS5)	HS S	2	0	0	0	2	2
6	21FL3055	Spanish Language (HSS6)	HS S	2	0	0	0	2	2
7	21UC2204	Corporate Readiness Skills (HSS7)	HS S	0	0	4	0	2	4
8	21CA1104	Mathematics for Computer Science (BS1)	BS	3	1	0	0	4	4
9	21UC0009	Ecology & Environment (BS2)	BS	2	0	0	0	2	2
10	21CA1101	Problem Solving through Programming	PC	3	0	2	4	5	9
11	21CA1102	Computer Organization & Architecture	PC	4	0	0	0	4	4
12	21CA1103	Essentials of Information Technology	PC	3	0	2	0	4	5
13	21CA1205	Operating System	PC	4	0	0	0	4	4
14	21CA1206	Data Structures	PC	3	0	2	0	4	5
15	21CA1207	Object Oriented Programming	PC	3	0	2	4	5	9
16	21CA2110	Database Management Systems	PC	3	0	2	4	5	9
17	21CA1209	Web and Social Media Technologies	PC	0	0	4	0	2	4
18	21CA2109	Software Engineering	PC	2	1	0	0	3	3
19	21CA1208	Mobile Application Development	PC	3	0	2	4	5	9
20	21CA2111	Computer Networks	PC	3	0	0	0	3	3
21	21CA2112	Web Development using Python	PC	3	0	2	4	5	9
22	21CA2213	Java Full Stack Development	PC	3	0	2	4	5	9
23	21CA2214	Object Oriented Analysis & Design	PC	3	0	2	4	5	9

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24	21CA21C1/ 21CA21D1/ 21CA21A1/ 21CA21I1	Cloud Architecture Data Warehousing & Mining Artificial Intelligence Essentials of IoT	PE	2	0	2	0	3	4
25	21CA22C2/ 21CA22D2/ 21CA22A2/ 21CA22I2	Cloud Information Security Statistics for Data Science Business Intelligence Microprocessor and Microcontroller	PE	2	0	2	0	3	4
26	21CA31C3/ 21CA31D3/ 21CA31I3	Ethical Hacking Machine Learning Electronics and Sensor Technology	PE	2	0	2	0	3	4
27	21CA32C4/ 21CA32D4/ 21CA32A4/ 21CA32I4	Cloud Web Services Big Data Analytics Robotic Process Automation IoT Design and Development	PE	2	0	2	0	3	4
28	21CA32C5/ 21CA32D5/ 21CA32A5/ 21CA32I5	Design and Development of Cloud- Application Data Visualization Deep Learning Advance Embedded System	PE	2	0	2	4	4	8
29	21GN40D1/ 21GN40D4/ 21CE40A5/ 20ME40B4	National Caded Cops(NCC)-1 National Service Scheme(NSS)- 1 Disaster Management Robotics	OE	3	0	0	0	3	3
30	21GN40D2/ 21GN40D5/ 20ME40B6/ 21EL40B2	National Caded Cops(NCC)-2 National Service Scheme(NSS)-2 Operations Research E-Commerce	OE	3	0	0	0	3	3
31	21GN40D3/ 21GN40D6/ 21MB4055/ 21MB4051	National Caded Cops(NCC)-3 National Service Scheme(NSS)-3 Organization Management Paradigms in Management Thought	OE	3	0	0	0	3	3
32	21CA21N0	Internship-1	PR	0	0	4	0	2	4
33	21CA 22E1	Term Paper	PR	0	0	4	0	2	4
34	21CA31N1	Internship-2	PR	0	0	4	0	2	4
35	21CA32E2	Major Project	PR	0	0	2 0	0	10	2 0
<b>Total Credits</b>								<b>120</b>	

  
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## ANNEXURE – II

### Koneru Lakshmaiah Education Foundation Department of Computer Science and Applications Master of Computer Applications (MCA)

Sl No	Course Code	Course Title	Category	L	T	P	S	Cr	CH
1	21UC2103	ESSENTIAL SKILLS FOR EMPLOYABILITY	HSS	0	0	4	0	2	4
2	21CA4101	COMPUTATIONAL THINKING AND DATA STRUCTURES	PC	4	0	2	4	6	10
3	21CA4102	RESEARCH EXPLORATION	PC	3	0	0	0	3	3
4	21CA4103	OPERATING SYSTEMS	PC	4	0	0	0	4	4
5	21CA4104	DATABASE MANAGEMENT SYSTEM	PC	3	0	2	4	5	9
6	21CA4205	DATA ANALYTICS	PC	3	0	2	4	5	9
7	21CA4206	OBJECT ORIENTED PROGRAMMING	PC	3	0	2	4	5	9
8	21CA4207	SOFTWARE ENGINEERING	PC	3	0	0	0	3	3
9	21CA4208	COMPUTER NETWORKS	PC	4	0	0	0	4	4
10	21CA4209	IOT TECHNOLOGY AND APPLICATIONS	PC	3	0	0	0	3	3
11	21CA5110	WEB TECHNOLOGIES	PC	3	0	2	4	5	9
12	21CA5111	AUTOMATION AND INTELLIGENCE	PC	3	0	0	0	3	3
13	21CA5213	INTELLECTUAL PROPERTY RIGHTS	PC	3	0	0	0	3	3
14	21CA5115/ 21CA5123	MACHINE LEARNING CLOUD COMPUTING	PE1	3	0	2	0	4	5
15	21CA5116/ 21CA5120/ 21CA5124	SOFT COMPUTING BIGDATA ANALYTICS CLOUD INFORMATION SECURITY	PE1	3	0	2	0	4	5
16	21CA5217/ 21CA5221/ 21CA5225	PATTERN RECOGNITION DATA VISUALISATION CLOUD ARCHITECTURES	PE2	3	0	2	0	4	5
17	21CA5218/ 21CA5222/ 21CA5226	DEEP LEARNING COGNITIVE COMPUTING CLOUD WEB SERVICES	PE2	3	0	2	4	5	9
18	21CA5112	INTERNSHIP/RESEARCH WORK	PR	0	0	4	0	2	4
19	21CA5214	PROJECT /DISSERTATION WORK	PR	0	0	20	0	10	20
<b>Total Credits</b>								<b>80</b>	<b>121</b>

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## BCA Program Structure for 2021-22 Batch

Course Code	Course Name	Course Category	L	T	P	S	C R	Pre - Requisite	New Course/Revised Course/Retained Course	Changes Proposed by	Justification
21UC1101	Integrated Professional English	HS S	0	0	4	0	2	NA	Retained Course	NA	Covering communication skills for employability
21CA1104	Mathematics for Computer Science	BS	3	1	0	0	4	NA	Newly Introduced Course	Faculty Member	Enhance the skilling and knowledge of coding
21CA1101	Problem Solving Through Programming	PC	3	0	2	4	5	NA	Retained Course	NA	Enhance Programming skills for employability
21CA1102	Computer Organization & Architecture	PC	4	0	0	0	4	NA	Newly Introduced Course	Faculty Member	Provide basic understanding the basic organization of computer for employability
21UC0009	Ecology & Environment (BS2)	BS	2	0	0	0	2	NA	Retained Course	NA	Enhance the awareness of environment.
21CA1103	Essentials of Information Technology	PC	3	0	2	0	4	NA	Newly Introduced Course	Academic Peer	Enhance the knowledge on basic functionality and office tools for employability
21UC1202	English Proficiency	HS S	0	0	4	0	2	NA	Retained Course	NA	Covering communication skills for employability
21CA1205	Operating System	PC	4	0	0	0	4	NA	Retained Course	NA	Enhance the knowledge on Operating the

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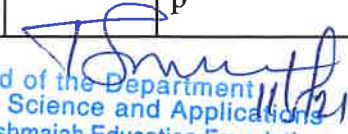
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												OS directly and memory management
21CA1206	Data Structures	PC	3	0	2	0	4	NA	Retained Course	NA		Enhance the knowledge on applications of data structures for employability
21CA1207	Object Oriented Programming	PC	3	0	2	4	5	NA	Newly Introduced Course	Faculty Member		Enhance Programming skills for employability
21CA2210	Mobile Application Development	PC	3	0	2	4	5	NA	Newly Introduced Course	Industry Person		Enhance knowledge on designing of mobile applications for employability
21CA1209	Web and Social Media Technologies	PC	0	0	4	0	2	NA	Newly Introduced Course	Industry Person		Enhance Knowledge on creating blogs and social media for Employability and entrepreneurship
21CA2109	Software Engineering	PC	2	1	0	0	3	NA	Retained Course	NA		Provide the entire knowledge of software engineering for employability
21CA1210	Database Management Systems	PC	3	0	2	4	5	NA	Retained Course	NA		Enhance database knowledge for employability and Entrepreneurship

  
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21CA2111	Computer Networks	PC	3	0	0	0	3	NA	Retained Course	NA	Enhance networking knowledge for employability and Entrepreneurship
21CA2112	Web Development using Python	PC	3	0	2	4	5	NA	Retained Course	NA	Enhance scripting knowledge for employability and Entrepreneurship
21UC2103	Design Thinking & Innovation	HS S	1	0	0	4	2	NA	Retained Course	NA	Enhance the knowledge of thinking in respect of start-up
21CA21N0	Internship-1	PROJ	0	0	4	0	2	NA	Retained Course	NA	Enhance the knowledge of real time working environment for employability
21UC2103	Essential Skills for Employability (HSS4)	HS S	0	0	4	0	2	NA	Newly Introduced Course	Industry Person	Enhance the skills required for the employability
21UC0010	Universal Human Values & Professional Ethics	HS S	2	0	0	0	2	NA	Retained Course	NA	Enhance knowledge for human values and professional ethics
21CA2213	Java Full Stack Development	PC	3	0	2	4	5	NA	Newly Introduced Course	Industry Person	Enhance the knowledge of web development for employability and Entrepreneurship

  
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21CA2214	Object Oriented Analysis & Design	PC	3	0	2	4	5	NA	Newly Introduced Course	Faculty Member	Enhance the knowledge of showing the project with diagrammatic notation.
21CA 22E1	Term Paper	PROJ	0	0	4	0	2	NA	Newly Introduced Course	Academic Peer	Enhance the knowledge on analyzing the research paper
21FL3055	Foreign Language	HS S	2	0	0	0	2	NA	Retained Course	NA	Gain the knowledge of Communication skills on foreign languages for employability and Entrepreneurship
21UC2204	Corporate Readiness Skills	HS S	0	0	4	0	2	NA	Retained Course	NA	Enhance the knowledge skills required for employability
21CA31N1	Internship-2	PROJ	0	0	4	0	2	NA	Retained Course	NA	Enhance the knowledge project for Skill Development and Entrepreneurship
21CA32E2	Major Project	PROJ	0	0	1	0	6	NA	Retained Course	NA	Enhance the knowledge project for Skill Development and Entrepreneurship
21CA21C1	Cloud Architecture	PE	2	0	2	0	3	NA	Newly Introduced Course	Industry Person	Enhance the knowledge cloud architecture for employability

  
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												and Entrepreneurshi p
21CA22C2	Cloud Information Security	PE	2	0	2	0	3	NA	Retained Course	NA	Enhance the knowledge of Security concepts on cloud for employability and Entrepreneurship	
21CA31C3	Ethical Hacking	PE	2	0	2	0	3	NA	Retained Course	NA	Enhance the knowledge of ethical hacking for employability and Entrepreneurship	
21CA32C4	Cloud Web Services	PE	2	0	2	0	3	NA	Retained Course	NA	Enhance the knowledge of cloud web services for employability and Entrepreneurship	
21CA32C5	Design and Development of Cloud Application	PE	2	0	2	4	4	NA	Retained Course	NA	Enhance the skilling and knowledge for developing the cloud environment to store data for employability	
21CA21D1	Data Warehousing & Mining	PE	2	0	2	0	3	NA	Retained Course	NA	Enhance the knowledge on mining techniques which leads to employability	

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21CA22D2	Statistics for Data Science	PE	2	0	2	0	3	NA	Newly Introduced Course	Academic Peer	Enhance the knowledge on statistics for solving problems employability
21CA32D4	Big Data Analytics	PE	2	0	2	0	3	NA	Retained Course	NA	Enhance the knowledge on Bigdata & Hadoop
21CA32D5	Data Visualization	PE	2	0	2	4	4	NA	Retained Course	NA	Enhance the knowledge to analyze the large data sets using graphs for employability
21CA31D3	Machine Learning	PE	2	0	2	0	3	NA	Retained Course	NA	Enhance the knowledge of Machine learning algorithms for employability
21CA21A1	Artificial Intelligence	PE	2	0	2	0	3	NA	Retained Course	NA	Enhance the knowledge Algorithms used in AI for employability
21CA22A2	Business Intelligence	PE	2	0	2	0	3	NA	Newly Introduced Course	Alumni	Enhance the knowledge on Business Intelligence employability
21CA32A4	Robotic Process Automation	PE	2	0	2	0	3	NA	Newly Introduced Course	Industry	Enhance the knowledge of designing bots or code to automate the process for employability
21CA32A5	Deep Learning	PE	2	0	2	4	4	NA	Newly Introduced Course	Academic Peer	Enhance knowledge on machine

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												learning algorithms used in deep learning for employability
21CA21I1	Essentials of IoT	PE	2	0	2	0	3	NA	Newly Introduced Course	Faculty Member		Enhance knowledge on the basic needs for building IoT for employability
21CA22I2	Microprocessor and Microcontroller	PE	2	0	2	0	3	NA	Newly Introduced Course	Faculty Member		Enhance knowledge on Micro operations and control of devices in IoT for employability
21CA31I3	Electronics and Sensor Technology	PE	2	0	2	0	3	NA	Newly Introduced Course	Faculty Member		Enhance knowledge on Electronics and sensors used for employability and Entrepreneurship
21CA32I4	IoT Design and Development	PE	2	0	2	0	3	NA	Newly Introduced Course	Academic Peer		Enhance knowledge on Designing and developing of the IoT platforms for Employability
21CA32I5	Advance Embedded System	PE	2	0	2	4	4	NA	Newly Introduced Course	Alumni		Enhance knowledge on Embedded systems for Employability
21CE40A5	Disaster Management	OE	3	0	0	0	3	NA	Retained Course	NA		Enhance knowledge to understand

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												about disaster management
20ME40B4	Robotics	OE	3	0	0	0	3	NA	Retained Course	NA	Enhance knowledge of writing the logic for the working of Robots for employability	
20ME40B6	Operations Research	OE	3	0	0	0	3	NA	Retained Course	NA	Enhance knowledge on Operations research for employability	
21EL40B2	E-Commerce	OE	3	0	0	0	3	NA	Retained Course	NA	Enhance knowledge on E-commerce business for employability & entrepreneurship	
21MB4051	Paradigms in Management Thought	OE	3	0	0	0	3	NA	Retained Course	NA	Enhance knowledge on management elective.	

**Percentage of Syllabus Revision = 48.88% (22 out of 45)**

**Percentage of Courses focusing on Employability= 86.66% (39 out of 45)**

**Percentage of Courses focusing on Entrepreneurship= 57.77% (26 out of 45)**

**Percentage of Courses focusing on Skill Development = 55.55% (25 out of 45)**

  
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## ANNEXURE – II

### MCA Program Structure for 2021-22 admitted Batch

Course Code	Course Name	Course Category	L	T	P	S	C	Pr-Req- site	New Course/Revised Course/Retained Course	Changes Proposed by	Justification
21UC2103	Essential Skills for Employability	HS S	0	0	4	0	2	NA	Newly Introduced Course	Academic Peer and Industry person	Covering communication skills for employability
21CA4208	COMPUTER NETWORKS	PC	3	1	0	0	3	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance networking knowledge for employability and Entrepreneurship
21CA4101	COMPUTATIONAL THINKING AND DATA STRUCTURES	PC	3	0	2	4	5	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge on applications of data structures for employability
21CA4102	RESEARCH EXPLORATION	PC	2	1	0	0	3	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge on analyzing the research paper and writing skills
21CA4103	OPERATING SYSTEMS	PC	3	1	0	0	4	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge on Operating the OS directly and memory management

  
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21CA4104	DATABAS E MANAGE MENT SYSTEM	BS	3	0	2	4	5	NA	Newly Introduced Course	Academi c Peer and Industry person	Enhance the knowledge on Operating the OS directly and memory management
21CA4205	DATA ANALYTI CS	PC	3	0	2	4	5	NA	Newly Introduced Course	Academi c Peer and Industry person	Enhance knowledge to analyze huge amount of data for employabilit y
21CA4206	OBJECT ORIENTED PROGRAM MING	PC	3	0	2	4	5	NA	Newly Introduced Course	Academi c Peer and Industry person	Enhance Programming skills for employability
21CA4207	SOFTWAR E ENGINEER ING	PC	2	1	0	0	3	NA	Newly Introduced Course	Academi c Peer and Industry person	Provide the entire knowledge of software engineering for employability
21CA4209	IOT TECHNOL OGY AND APPLICAT IONS	PC	3	1	0	0	4	NA	Newly Introduced Course	Academi c Peer and Industry person	Enhance knowledge on Designing and developing of the IoT platforms for Employabilit y
21CA5110	WEB TECHNOL OGIES	PC	3	0	2	4	5	NA	Newly Introduced Course	Academi c Peer and Industry person	Enhance the knowledge of web development for employability and

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												Entrepreneurship
21CA5111	AUTOMATION AND INTELLIGENCE	PC	3	0	0	0	3	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge of designing bots or code to automate the process for employability	
21CA5116	SOFT COMPUTING	PE	3	0	2	0	4	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance knowledge on Genetic algorithms, Neural networks for employability	
21CA5115	MACHINE LEARNING	PE	3	0	2	0	4	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge of Machine learning algorithms for employability	
21CA5123	CLOUD COMPUTING	PE	3	0	2	0	4	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge of cloud computing for employability and Entrepreneurship	
21CA5120	BIGDATA ANALYTICS	PE	3	0	2	0	4	NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge on Bigdata & Hadoop	
21CA5124	CLOUD INFORMA	PE	3	0	2	0	4	NA	Newly Introduced Course	Academic Peer and	Enhance the knowledge of Security concepts on	

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	TION SECURITY									Industry person	cloud for employability and Entrepreneur ship
21CA5113	INTERNSH IP/RESEAR CH WORK	PR OJ	0	0	4	0	2	NA	<b>Newly Introduced Course</b>	Academi c Peer and Industry person	Enhance the knowledge project for Skill Development and Entrepreneur ship
21CA5212	INTELLEC TUAL PROPERT Y RIGHTS	PC	3	0	0	0	3	NA	<b>Newly Introduced Course</b>	Academi c Peer and Industry person	Enhance the knowledge on how to safeguard the rights for our own ideas for employability
21CA5217	PATTERN RECOGNI TION	PE	3	0	2	0	4	NA	<b>Newly Introduced Course</b>	Academi c Peer and Industry person	Enhance knowledge on recognizing and analyzing the patterns for employability
21CA5221	DATA VISUALIS ATION	PE	3	0	2	0	4	NA	<b>Newly Introduced Course</b>	Academi c Peer and Industry person	Enhance the knowledge to analyze the large data sets using graphs for employability
21CA5225	CLOUD ARCHITEC TURES	PE	3	0	2	0	4	NA	<b>Newly Introduced Course</b>	Academi c Peer and Industry person	Enhance the knowledge cloud architecture for employability

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											and Entrepreneurship
21CA5218	DEEP LEARNING	PE						NA	Newly Introduced Course	Academic Peer and Industry person	Enhance knowledge on machine learning algorithms used in deep learning for employability
21CA5222	COGNITIVE COMPUTING	PE						NA	Newly Introduced Course	Academic Peer and Industry person	Enhance knowledge on cognitive radio, software defined radios concepts for employability
21CA5226	CLOUD WEB SERVICES	PE						NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge of cloud web services for employability and Entrepreneurship
21CA5214	PROJECT /DISSERTATION WORK	PROJ						NA	Newly Introduced Course	Academic Peer and Industry person	Enhance the knowledge project for Skill Development and Entrepreneurship

Percentage of Syllabus Revision =100%

Percentage of Courses focusing on Employability= 52.63% (10 out of 19)

Percentage of Courses focusing on Entrepreneurship= 78.94% (15 out of 19)

Percentage of Courses focusing on Skill Development = 52.63% (10 out of 19)

  
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### Annexure-III

#### New Syllabus for BCA:

#### 21CA1103: Essentials of Information Technology

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

Credits:4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	Understand the architectural design of a computer, hardware peripherals and various concepts of Operating systems	PO1	2
CO 2	Outline Programming fundamentals and User interface designs	PO1,PO2,PO3	3
CO 3	Summarize the fundamentals of Computer networks.	PO1	2
CO 4	Construct Software attributes, Specifications and Software Requirement Specification Document	PO1,PO2,PO3,PO10	3
CO 5	Analyze and Explore data through Word Processing, Spreadsheet applications and Presentations	PO1,PO2,PO5, PO10	4

#### Syllabus:


**Hardware Essentials:** Fundamentals of Computers, block diagram of Computer, Central Processing Unit (CPU), Execution cycle, Instruction Categories, Measures of CPU performance, Memory, Input/output devices, BUS and addressing modes. System Software types, Operating System concepts, Memory management, Process management, Scheduling, Threads. **Programming Essentials:** Problem solving with algorithms, flowchart, Programming styles, Programming Fundamentals, Testing and Debugging, Coding Standards and Best practices, User Interface Design introduction, Elements of UI design & reports. **Network Essentials:** Network Types, Network terms, Network models, Network Architectures, Network Topologies, Transmission media, WWW and Protocols, Email, Telnet, DNS. **Software Development Essentials:** Software and its types, Software development Life Cycle, Problem identification and Feasibility analysis, Requirement's determination, Requirement's Specifications, Software Requirement Specification Document, System design, System implementation, System evaluation, System modification, Role of systems analyst and administrator.

#### Text Books:

1. Dromey R.G., How to solve it by Computers PHI,1994
2. Siberschatz and Galvin, Operating System Concepts, 4th ed., Addison-Wesley,1995
3. Kernighan, Ritchie, ANSI C language PHI,1992

#### Reference Books :

1. Alfred V Aho, EHopcroft, Jeffrey D Ullman, Design and Analysis of computer algorithms, Addison Wesley publishing Co.,1998
2. Andrew S. Tanenbaum, Structured Computer Organization, PHI, 3rd ed, 1991

  
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### 21CA1209: Web and social media Technologies

L-T-P-S: 0-0-4-0

Credits:2

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	Understand semantics of web page, its elements and attributes.	PO1	2
CO 2	Outline the basic concepts of CSS and utilize them for making of static web pages.	PO2,PO3,PO5	3
CO 3	Demonstrate the various social media platforms and their usages	PO2, PO3,PO8,PO9,PO10	3
CO 4	Understand the usage of outcasts of social media	PO8,PO9,PO10, PO2	3
CO 5	Develop web pages using HTML, CSS and makes use of social media platforms for creating accounts.	PO2,PO3,PO5,PO8,PO9	5

#### Syllabus:

**HTML:** Syntaxes, HTML structure, Basic Text Markup Language, HTML styles, Element Attributes, Heading, Layouts, I-frame Images, Hypertext Links, List, tables, forms, GET and POST method, Frames

**CSS:** Introduction to CSS, Levels, Style Specification formats, Selector forms, the box model, Conflict resolution, CSS3. **Social Media:** Definition of Social Media, Evolution of Social Media, types of social media, positive and negative influence of social media on individuals, businesses and society as a whole, identifying the uses of social media platforms. **LinkedIn:** Opening accounts in LinkedIn, Authentication and Security issues, strategically build network on LinkedIn, searching connections and developing tracking sheet for network connection, adding recruiter and people from the company to work, review and update profile, achieving academic and professional realms strategies for LinkedIn Platform. **Facebook & Twitter:** Introduction, Evolution of Facebook & Twitter, Uses of the platforms in personal, academic and professional realms, creating accounts in each platforms, Guidelines and security features for each platform, strategies for achieving academic and professional goals using Facebook and Twitter. **The Outcasts of Social Media: Blogs, Videos, Wikis and more:** Introduction to various outcasts of social media platforms, history and evolution of each social media outcasts – its usage- implementation, overall impact of social media outcasts on academics, professions and society in general.

#### TextBooks:

1. Programming the World Wide Web, Robert W Sebesta, 7ed, Pearson.
2. Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012
3. Tuten, Tracy, L. Social Media Marketing. First Edition. ISBN -10: 0132551799

#### Reference Books:

1. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.
2. Web Technologies, Uttam K Roy, Oxford
3. An Introduction to Web Design, Programming, Paul S Wang, Sanda S Katila, Cengage

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### 21CA1208: Mobile Application Development

L-T-P-S: 3-0-2-4

Credits:5

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	Explain various concepts of mobile programming that make it unique from programming for other platforms.	PO1	2
CO 2	Classify mobile applications on their design pros and cons	PO1	3
CO 3	Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,	PO1	3
CO 4	Summarize mobile applications for the Android operating system that use basic and advanced phone features.	PO1,PO3,PO8	2
CO 5	Evaluate applications to the Android marketplace for distribution.	PO1,PO4,PO5,PO7	5

#### Syllabus:


Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file. Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application fundamentals for android. Android design guidelines. Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

#### TEXT BOOKS:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

#### REFERENCE BOOKS:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

  
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### 21CA2213: Java Full Stack Development

L-T-P-S: 3-0-2-4

Credits:5

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

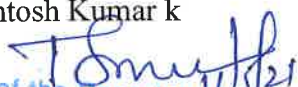
CO No	Course Outcomes	PO	BTL
CO 1	Apply JDBC API, JUnit Testing Framework and XML Concepts to build Console and Web Applications	PO1,PO2	3
CO 2	Solve Servlets, JSP, Hibernate, Spring and Spring Boot to build web applications and Enterprise Level applications.	PO2,PO3,PO4	3
CO 3	Analyze the design of linear data structures for real world problems	PO2,PO3	4
CO 4	Analyze alternate algorithm techniques to solve optimization related problems in the real-world scenario.	PO3,PO2,PO7	5
CO 5	Evaluate applications using JDBC and JSP	PO2,PO3,PO5	5

#### Syllabus:

JDBC API - Introduction to JDBC API, Type of Drivers in JDBC, Statement, Prepared Statement, Callable Statement, ResultSet MetaData, Database MetaData, Scrollable & Updatable ResultSet, Transaction Management in JDBC. JUnit - Introduction to JUnit framework, JUnit Environment Setup, Features of Junit Framework, Junit Framework and its Implementation. XML - Introduction to XML, Advantages of XML, XML Tree, XML Attributes, XML DOM, DTD, XSD, XML with CSS, XSLT. Servlets - Introduction to Servlets, Lifecycle, Init and context parameters, Servlet Collaboration, Session Tracking Techniques, Servlet CRUD Operations. JSP – Servlets Vs JSP, JSP Architecture and Lifecycle, JSP Scripting Elements, Session Tracking Techniques, JSP Implicit Objects, JSP Directive Elements, JSP Action Tags, JSP MVC Architecture, JSP CRUD Operations. Hibernate – JDBC Vs Hibernate, Introduction to Hibernate Framework, Advantages, XML & Annotation based Hibernate CRUD Operations, Generator Classes in Hibernate, HQL, HCQL. Spring and Spring Boot – Introduction to Spring, Spring Architecture, Spring Vs Spring Boot, Maven Repository, Introduction to Spring Boot, Advantages of Spring Boot over Spring, Dependency Injection (DI), Inversion of Control (IoC), Creating Spring starter project, Hello World Application using Spring Boot, Spring Boot Autowire, Web Application MVC using Spring Boot, Spring Boot CRUD Operations with Spring MVC, Spring Boot with RESTful Web Service, Spring Boot and RESTful API Vs REST API with JSON, Spring Boot and Hibernate CRUD Operations, Microservices with Spring – monolithic vs micro-service Architecture, SOA vs Microservices, Spring Boot Microservices with Spring Cloud.

#### Text Books :

1. Web Technologies: Concepts, Methodologies, Tools, and Applications, Information Science Reference, 4th edition, Arthur Tatnall
2. Spring and Hibernate, Tata McGraw-Hill Education, 2009, Santosh Kumar k

  
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### Reference Books :

1. Java The Complete Reference - Eleventh Edition, Herbert Schildt
2. J2EE: The complete reference by James Keogh, publisher: McGraw-Hill Osborne Media, 1st Edition, 2002.
3. Spring in Practice by Willie Wheeler with Joshua White, publisher: Manning, shelter Island

  
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### 21CA2214: Object Oriented Analysis & Design

L-T-P-S: 3-0-2-4

Credits:5

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	understand the fundamentals of object modeling	PO2	2
CO 2	understand and differentiate Unified Process from other approaches.	PO1,PO2,PO3	2
CO 3	Compare static and dynamic UML diagrams with implementation.	PO1,PO2,PO3,PO5	4
CO 4	Develop the software design with design patterns.	PO3,PO4,PO5,PO8	4
CO 5	Evaluate the software against its requirements specification	PO3,PO4,PO5,PO9,PO10	5

#### Syllabus:

**UNIFIED PROCESS AND USE CASE DIAGRAMS:** Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case – Case study – the Next Gen POS system, Inception - Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases. **STATIC AND DYNAMIC UML DIAGRAMS:** Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams, UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling – When to use State Diagrams - Activity diagram – When to use activity. **DESIGN PATTERNS:** Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller **Design Patterns – creational** – factory method – **structural** – Bridge – Adapter – **behavioural** – Strategy – observer – Applying GoF design patterns – Mapping design to code. **TESTING:** Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans

#### Text Books:

1. Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education, 2005.
2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition 1999

#### Reference Books:

1. Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.
2. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003. www.padeepz.net

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### 21CA21C1: Cloud Architecture

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

Credits:3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Classify cloud computing importance and services	PO1	2
CO2	Relate cloud services & models.	PO1, PO2	2
CO3	Explain Virtualization and its applications.	PO3	2
CO4	Apply cloud services using web services Cloud to utilize cloud resources.	PO3	3
CO5	Measure various cloud services using web services Cloud for building and deploying applications.	PO4	5

#### Syllabus:


**Overview of Cloud Computing** - Brief history and Evolution of Cloud Computing, Traditional vs. Cloud Computing, Importance of Cloud Computing, Benefits and Challenges of Cloud Computing. **Cloud Computing Architecture:** Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services 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, Community cloud. **Infrastructure as a Service(IaaS):** Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) **Platform as a Service(PaaS):** Introduction to PaaS What is PaaS, Service Oriented Architecture (SOA) Cloud Platform and Management Computation Storage. **Software as a Service (SaaS:)** Introduction to SaaS, Web services, Web 2.0, Web OS. **Overview of Multi-Cloud Management Systems** - Explain concept of multi- cloud management, Challenges in managing heterogeneous clouds, benefits of multi-cloud management systems. **Overview of Cloud Security** - Security concerns in Traditional IT, Challenges in Cloud Computing in terms of Application, Server, and Network Security. **Service Management in Cloud Computing:** Service Level Agreements (SLAs).

#### Text Books:

1.Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski (2011), Cloud Computing: Principles and paradigms.

#### Reference Book:

1.Krutz, Ronald L.; Vines, Russell Dean, Cloud Security, A comprehensive Guide to Secure Cloud Computing.

  
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### 21CA22D2: Statistics for Data Science

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

Credits:3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Explain the basic concepts of statistics and explains the various methods of descriptive data collection and analysis	PO1	2
CO2	Show the probability distribution of a random variable, based on real-world situation, and use it to compute expectation and variance	PO3	2
CO	Construct the linear and non-linear regression lines for the given data.	PO1	3
CO4	Apply basic concepts of statistics and explains the various methods of descriptive data collection and analysis	PO2	3
CO5	Measure Statistical data using SPSS or Minitab tools	PO6	5

#### Syllabus:

**Basic Statistics:** Importance of Statistics-Primary and secondary data-Data collection methods Presentation of numerical and categorical data. Concepts of central tendency and dispersion-Mean, median and mode-Partition values-Quartiles for grouped and ungrouped data-Range-Quartile deviation-Standard deviation and coefficient of variation for grouped and ungrouped data.**Probability Distribution:** Random Variable- Discrete Random and Continuous Random variable, Probability Distribution of a Random Variable, Mathematical Expectation Types: Binomial, Poisson, Normal Distribution, Mean and Variance of Binomial, Poisson, and Normal Distribution.**Correlation:** Introduction, Types, Properties, Methods of Correlation: Karl Pearson's Coefficient of Correlation, concept of point biserial correlation, Rank Correlation and Phi-coefficient.**Regression:** Introduction, Aim of Regression Analysis, Types of Regression Analysis, Lines of Regression, Properties of Regression Coefficient and Regression Lines, Comparison with Correlation.**Working on Statistical data with Ms-Excel:** Working with Data using MS-Excel, Importing Data Sort, Data Filter, Advance Filter, Data Validation, Data Consolidation, What-If Analysis, Data Grouping, Subtotal, Data regression, Working with function; statistical functions.**Index numbers**-Laspeyere-Pasche-Fisher's price and quantity index numbers Time reversal and factor reversal tests.

#### Text Books:

1. Ronald E. Walpole, Sharon L. Myers and Keying Ye, "Probability and Statistics for Engineers and Scientists", 8<sup>th</sup> Edition, Pearson.

#### Reference Books :

1. B. Sooryanarayana : "A textbook of probability and statistics", S. Chand 2008

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### 21CA22A2: Business Intelligence

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

Credits:3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Explain the concepts of Business Intelligence and data warehouse	PO3	2
CO2	Summarize trends in data warehousing and data Mining	PO2,PO3	2
CO3	Outline classification, Cleaning and description of Data Mining and know where they apply in Business	PO2, PO4	3
CO4	Apply basic concepts, Market basket analysis and algorithm and generating rules	PO4, PO5, PO9, PO10	4
CO5	Estimate Business Intelligence data using data mining methods	PO5, PO7, PO8, PO9	5

#### Syllabus:

Overview and Concepts of Business Intelligence: Why reporting and Analyzing data, Raw data to valuable information. Lifecycle of Data - What is Business Intelligence? BI and DW in today's perspective. What is data warehousing? The building Blocks: Defining Features - Data warehouses and data marts - Overview of the components - Metadata in the data warehouse - Need for data warehousing -Basic elements of data warehousing – trends in data warehousing. The Architecture of BI and DW: BI and DW architectures and its types - Relation between BI and DW Introduction to Data Mining (DM): Motivation for Data Mining - Data Mining-Definition and Functionalities – Classification of DM Systems - DM tasks primitives - Integration of a Data Mining system with a Database or a Data Warehouse - Issues in DM – KDD Process. Data Pre-processing: Why to pre-process data? - Data cleaning: Missing Values, Noisy Data. Data Integration and transformation, Data Reduction: Data cube aggregation, Dimensionality reduction, Data Compression, Data Mining Primitives, and Languages. Concept Description and Association Rule Mining: What is concept description? Data Generalization and summarization-based characterization, Attribute relevance, class comparisons Association Rule Mining: Market basket analysis, basic concepts, finding frequent item sets: A prior algorithm, generating rules, Incremental ARM, Associative Classification – Rule Mining.

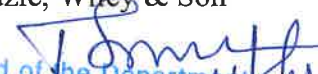
#### Text Books :

1. Business Intelligence : Data mining and optimisation for decision Making : Anil K Maheswari Business Express Press Publications

#### Reference Books :

1. Data Mining Concepts and Techniques, J. Han, M. Kamber

2. Data mining: Concepts, models, methods and algorithms, M. Kantardzic, Wiley & Son

  
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### 21CA32A4: Robotic Process Automation

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

Credits:3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Explain the RPA Foundations and RPA Skills.	PO1	2
CO2	Understand the Process Methodologies and Requirements for RPA Environment Planning.	PO2, PO10	2
CO3	Demonstrate the Process and Methodology of BOT Development.	PO3, PO7	2
CO4	Outline the Deployment, Monitoring and Data Preparation Methodologies.	PO3, PO4, PO5	2
CO5	Implementation of BOT Development Process and Verification using the RPA Tools [UI Path].	PO3, PO4, PO5	5

#### Syllabus:

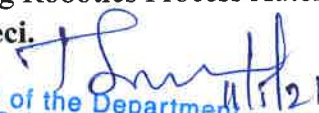
RPA Foundations, RPA Skills: RPA Foundations, What Is RPA, Flavours of RPA, History of RPA, The Benefits of RPA, The Downsides of RPA, RPA Compared to BPO, BPM, and BPA Consumer Willingness for Automation the Workforce of the Future. On-Premise Vs. the Cloud Web Technology Programming Languages and Low Code OCR (Optical Character Recognition), Databases APIs (Application Programming Interfaces), AI (Artificial Intelligence) Cognitive Automation Agile, Scrum, Kanban, and Waterfall, DevOps, Flowcharts. Process Methodologies and Planning: Lean Six Sigma, how to Implement Six Sigma, Six Sigma Roles and Levels Lean Six Sigma, Finding the Right Balance, Applying Lean and Six Sigma to RPA. The Preliminaries, use a Consulting Firm, RPA Consulting: Some Case Studies What to Automate, ROI for RPA, RPA Use Cases the Plan. BOT Development: Preliminaries. Installation of UiPath, Getting Started, Activities, Flowcharts and Sequences, Log Message, Variables, Loops and Conditionals, For Each Loop, Do While Loop and While Loop, IF/THEN/ELSE Conditionals, Switch, Debug, Common UiPath Functions, The UiPath Orchestrator, Best Practices for Bot Development. Deployment and Monitoring, Data Preparation: Testing, Going into Production Monitoring, Security, Scaling and Types of Data, Big Data, The Issues with Big Data, The Data Process, Types of Algorithms, The Perils of the Moonshot, Bias.

#### Text Books :

1. The Robotic Process Automation Hand Book (A Guide to Implementing RPA Systems) by Tom Taulli.
2. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition

#### Reference Books :

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition
2. The Practitioner's Guide to RPA: A Practical Guide for Deploying Robotics Process Automation (Practitioner's Guide) by Jonathon Sireci.

  
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### 21CA32A5: Deep Learning

L-T-P-S: 2-0-2-4

Credits:4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Explain the concepts of Perception, Back Propagation, PCA, Singular Value Decomposition	PO1	2
CO2	Compare Autoencoders, Regularization, Denoising, Convolutional Neural Networks,	PO2	3
CO3	Construct Long Short Term Memory (LSTM) Restricted Boltzmann Machines, Deep Dream, GRU, Neural style transfer,	PO3	3
CO4	Build Markov models, Markov networks, Markov chains, Variational autoencoders, Autoregressive Models, and Generative Adversarial Networks (GANs).	PO2	3


**Syllabus :**History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptron's, Perceptron Learning Algorithm and Convergence, Multilayer Perceptron's (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feedforward Neural Networks, Backpropagation, Gradient Descent (GD), Momentum Based GD, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Principal Component Analysis, Singular Value Decomposition. Autoencoders, Denoising autoencoders, Sparse autoencoders, Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Batch Normalization, Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet Object Detection, RCNN, Fast RCNN, Faster RCNN, YOLO. Long Short Term Memory (LSTM) Restricted Boltzmann Machines, Deep Dream, GRU, Neural style transfer, Deep learning for computer vision, text and sequences. Markov models, Markov networks, Markov chains, Variational autoencoders, Autoregressive Models: NADE, MADE, PixelRNN, Generative Adversarial Networks (GANs), how to train DCGAN, limitations of deep learning

#### Text Books :

1. Deep learning with python – Francois Chollet, Manning publishers, 2018, ISBN-9781617294433
2. Grokking deep learning, Andrew w Trask, 2019, Manning publishers, ISBN-9781617293702

#### Reference Books :

1. Deep Learning with PyTorch: A practical approach to building neural network models using PyTorch by Vishnu bramanian
2. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996 Pattern Recognition and Machine Learning, Christopher Bishop, 2007.

  
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### 21CA21I1: Essentials of IOT

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

Credits:3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
1	Explain the fundamental principles of Internet Of Things with Raspberry PI	PO2	2
2	Summarize knowledge in OSI Network Layers and versions of internet protocols	PO3	3
3	Outline IOT design components	PO3	3
4	Understand IOT technologies and deployment models	PO4, PO5, PO7	2
5	Evaluate and establish communication among IOT devices	PO5, PO6, PO7, PO8, PO9	5

#### Syllabus:

**Introduction to IOT:** Definition, Characteristics, things in IOT, Challenges of IOT based Systems, IOT Device: Building Blocks, Raspberry Pi as an IOT device, Raspberry PI components, Porting LINUX on Raspberry PI, Raspberry PI frequently used commands, Raspberry PI interfaces: Serial, SPI and I2C, Other IOT devices. **IOT Communication model and Protocols:** Link Layer: 802.3 Ethernet, 802.11 WiFi, 802.16 WiMax, 802.15.4 LR-WPAN, 2G/3G/4G Mobile Communication, Network/Internet Layer: IPv4, IPv6, IPv6 Low power, Transport Layer: TCP, UDP, Application Layer: HTTP, CoAP, Web Socket, MQTT, XMPP, DDS, AMQP. **IOT Design Components:** Function Blocks, Communication Models, Communication API. **IOT Enabling Technologies:** Wireless sensor networks, Cloud Computing, Big data Analytics, Embedded Systems, Communication protocols. **IOT Topologies and deployment models:** IOT Deployment components (Devices, resources, controller service, database, web services (stateless/Stateful, Unidirectional / Bi Directional, Request-response/Full duplex, TCP Connections, Header Overhead , Scalability), Analysis Components, Applications, Communication Topologies: Level-1, Level-2, Level-3, Level-4, Level-5, Level-6


#### Text Book:

1. Arshdeep Bahga and Vijay Madisetti,, Internet of Things - A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547

#### Reference Books:

1. Wolfram Donat "Learn Raspberry Pi programming in python", Apress (2014), ISBN - 9781430264255

2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014, ISBN: 9789350239759.

  
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### 21CA22I2: Microprocessor and Microcontroller

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

Credits:3

Prerequisite:

Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
1	Understanding the architecture and instruction set of 8086 microprocessors	PO1	2
2	Identify a detailed software and hardware structure of the microprocessor.	PO3	2
3	Illustrate how the different peripherals are interfaced with microprocessor.	PO2, PO7, PO9	3
4	Analyze merits and demerits of various applications of the microprocessors	PO4, PO7, PO9	3
5	Evaluate applications of microprocessor 8086 instruction set	PO6, PO8, PO9, PO10	5

#### Syllabus:


**Introduction** to 8086 Microprocessor – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation. 8086 signals – Basic configurations – System bus timing – System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors. Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller. : Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.

#### Text Books:

1. Yu-Cheng Liu, Glenn A. Gibson, -Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design, Second Edition, Prentice Hall of India, 2007. (UNIT I-III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, -The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Second Edition, Pearson education, 2011. (UNIT IV-V)

#### Reference Books:

1. Douglas V. Hall, -Microprocessors and Interfacing, Programming and Hardware, TMH, 2012
2. A.K. Ray, K.M. Bhurchandi, Advanced Microprocessors and Peripherals, 3<sup>rd</sup> edition, Tata McGraw Hill, 2012

  
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### 21CA31I3: Electronics and Sensor Technology

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

Credits:3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Understand the role of sensor and actuators in real time aspects and Analog and Digital Actuators.	PO2	2
CO2	Construct the role of signal conditioning circuits and Impedance Matching circuits	PO3	3
CO3	Understand different generation of sensors for the development of IoT based Networks	PO2, PO7	2
CO4	Analyze the role of different Energy management in IoT	PO4, PO9, PO7	3
CO5	Evaluate IoT application with sensors and actuators	PO4	6

#### Syllabus:

Introduction to Sensors and Actuators: Role of sensors and actuators, Sensors and Actuators in Automobile Systems, Sensors, and Actuators in the feedback control system the importance of sensing, Innovative Sensor technologies, Application scenarios, Analog and digital transducers and Actuators Components interconnections and signal conditioning: Component interconnection. Signal modification

conditioning, Importance of Impedance Matching in Component Interconnection, Impedance matching methods Generation of IoT sensors – Description & Characteristics – First Generation – Description & Characteristics – Advanced Generation – Description & Characteristics – Integrated IoT Sensors – Description & Characteristics – Polytronics Systems – Description & Characteristics – Sensors' Swarm – Description & Characteristics – Printed Electronics – Description & Characteristics – IoT Generation Roadmap. Energy sources


and power management Power management: Energy harvesting, solar harvesting, Piezo-mechanical harvesting, RF energy harvesting, Energy storage: Energy and power models, Batteries, Super capacitors, radioactive power sources.

#### Text Books:

1. Sensors and actuators, Engineering System for instrumentation, 2nd Edition, Clarence Wd Selva, CRC Press  
2. Dr. Guillaume Girardin, Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024', Yole Développement

#### Reference Books:

1. Internet of things for architects by Perry Lea, Packt Publishing Ltd., 2018.  
2. Smart Sensors and Systems: Innovations for Medical, Environmental, and IoT Application edited by Chong-Min Kyung, Hiroto Yasuura, Yongpan Liu, Youn-Long Lin Copyrights, 2014

  
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### 21CA32I4: IoT Design and Development

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

Credits:3

Prerequisite: Nil


#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Explain IoT, Enabling Technologies, (IoTWF) Standardized Architecture, Core IoT Functional Stack, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects	PO1,PO2	2
CO2	Illustrating IoT Protocols, Physical and MAC layers, Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer, Application Transport Methods	PO2	2
CO3	Demonstrating IoT Design and Development, Overview of IoT supported Hardware, IoT applications in home, infrastructures, buildings, security, Industries, Home appliances	PO4, PO9, PO7	3
CO4	Solving and Scheduling IoT Data Analytics. IoT Data Analytics Challenges, Organizing in IoT/M2M, Supporting Services-Computing Using a Cloud Platform for IoT/M2M Applications/Services	PO2,PO4, PO5, PO7	3
CO5	Evaluate IOT Applications	PO5, PO6, PO8, PO9	5

**Syllabus:**Internet of Things Evolution (IoT), Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) Standardized Architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. IoT Protocols-IoT Access Technologies, Physical and MAC layers, Topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks,6LoWPAN, Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT IoT Design and Development-Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details, IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT Electronic Equipment's, Industry 4.0 concepts. IoT Data Analytics Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M, Supporting Services-Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud Service Models.

#### Text Books :

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madiseti, Universities Press, 2015

  
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### 21CA32I5: Advance Embedded System

L-T-P-S: 2-0-2- 4

Credits:4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Understanding the key features of embedded systems	PO1	2
CO2	Understanding the Hardware fundamentals of Embedded systems	PO3	2
CO3	Comprehending multithreaded programs on Arduino software package under Linux platform	PO2, PO7, PO9	3
CO4	Applying the peripheral interfacing in embedded system environment	PO4, PO7, PO8, PO9	3
CO5	Evaluate and develop a applications of Embedded systems	PO5, PO7, PO8, PO10	5

#### Syllabus:

**Introduction to Embedded Systems:** Definition, Comparison with Loaded Systems, Challenges of Embedded systems, Application of Embedded Systems. Reading through an Embedded Board, terminology, symbols and notations considering Arduino board. **Hardware fundamentals:** Power and decoupling, open collector out puts, Tristate outputs, Signal loading related issues, Memories type and selection, Processor types and selection. **Introduction to Embedded programming:** Languages that can be used to develop firmware. Differences between C and Embedded C especially related to address mapping, Relevance to Header files included into the embedded C programs in relation to Arduino board. **IDE:** Introduction to IDE, Downloading and installing Arduino IDE, Setting environment for development of applications using Arduino board. Sample program. Testing and Debugging Techniques, Testing and Debugging Tools (Beyond Syllabus). General discussion on Atmega 328, Timers, Counters, watchdog timer, Pulse width Modulation, Interrupts. **Overview on device interfacing with Atmega 328:** LCD, Key Pad Stepper motor, A/D Converters. **Writing on to LCD at function Level:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, Developing sample application to write on to LCD. **Reading analog inputs (Flow) through A/D converters:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, sample application. **Reading analog inputs (Temperature) through A/D converters:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, sample application. **Reading analog inputs (Humidity) through A/D converters:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, sample application. **Reading from Matrix Keyboards:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, sample application. **Pulse with modulation:** The primary concepts Use of pulse width modulators

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**for speed control of stepper Motors:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, sample application, **Use of pulse width modulators for speed control of DC motors:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, sample application **Basic Interfacing:** Interfacing through Ports and PINS, Implementing Memory based and I/O based and BUS based Addressing, Interrupt based I/O, Interrupt latency. **Measuring time through timers:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, Developing sample application using timers. **Using counters:** Block diagrams, Layout, principal of operation, interfacing with a Micro controller, sample application.

### Text Books:

1. An Embedded Software Premier - David E- Simon, PEARSON Education, 2009.
2. Embedded System Design - Frank Vahid / Tony Givargis, WILEY India, 2009.

### Referenc Books:

1. Embedded Systems - Raj – Kamal, Second Edition TMH, 2009.
2. The 8051 Microcontroller and Embedded Systems- Mazidi and Mazidi, 2 Edition

  
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### 21CA1104: Mathematics for Computer Science

L-T-P-S: 3-1-0-0

Credits:4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO1	Understand fundamental concepts to solve problems of matrices	PO2	2
CO2	Demonstrate differential calculus, differentiation rules and identify a method for solving and interpreting the results.	PO2	2
CO3	Develop physical laws and relations mathematically in the form of second/higher order differential equations and identify a method for solving and interpreting the results.	PO2	3
CO4	Apply partial differential equations and identify method for solving PDE's	PO2	3

#### Syllabus:

**Matrices:** A quick review of the fundamental concepts, Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of a Non-Singular Matrix, Canonical form, Normal form. Systems of Linear equations: Homogeneous and Non Homogeneous Equations, Characteristic equation of a matrix. (Relevant sections of Text 1). (proof of all the theorems are to be excluded.)**Differential Calculus:** A quick review of limits of function, rules for finding limits, extensions of limit concepts, derivative of a function, differentiation rules, chain rule, rate of change and simple applications of the rules. Extreme values of a function Rolle's Theorem, Mean Value Theorem.**Ordinary Differential Calculus:** Introduction, Formation of ODE by elimination of arbitrary constants & functions. Solving first order ODE by variable-separable method, linear equation & Bernoulli's equation for non-linear. Solving second and higher order ODE with constant coefficient. Complimentary functions and Particular Integrals like  $e^{ax}$ ,  $\sin ax$ ,  $x^n$ . Solving by the method of Variation of Parameters.**Partial Differential Equations:** Introduction, formulation of Partial Differential Equation by elimination of arbitrary constants and by elimination of arbitrary function. Solution of the first order equations using Lagrange's method.

#### Text Books:

1. Dr. B. S. Grewal – Higher Engineering Mathematics
2. S.K . Stein – Calculus and analytic Geometry , (McGraw Hill )
3. Shanti Narayan - Matrices (S. Chand & Company)

#### Reference Books:

1. Zubair Khan, Shadab Ahmad Khan - Mathematics – 1 and Mathematics – II (Ane Books)
2. N.P.Bali, Dr.N.Ch.Narayana Iyengar-Engineering mathematics – L
3. Matrices, Frank Ayres JR Schaum's Outline Series, TMH Edition
4. Thomas and Finney - Calculus and analytical geometry (Addison-Wesley)

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### 21CA1102: Computer Organization & Architecture

L-T-P-S: 4-0-0-0

Credits:4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	Explain different logic gates and K-maps of variable length	PO1,PO2	2
CO 2	Discuss the functionality of combinational and sequential circuits	PO1,PO2	3
CO 3	Demonstrate the working of registers in computer organization and design	PO1,PO2	3
CO 4	Organize the working of micro programmed control and CPU with memory organization	PO1,PO2	3

#### Syllabus:


**Boolean Algebra** - 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 Map- 2, 3 and 4 Variable K Maps. Minimization Techniques – Min-terms and Max-terms, Sum of Product (SOP), Product of Sum (POS).**Combinational Circuits** - 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 .**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, Instruction Cycle, Memory-Reference Instruction, Input-Output and interrupt, Design of Basic Computer, Design of accumulator Logic, **MICRO Programmed Control:** Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.**Central Processing Unit:** General registers Organization, Stack Organization, 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 by Morris Mano, PHI
2. Computer Organization and Architecture by William Stallings

#### Reference Books:

1. Stephen Brown and Zvonko Vrane "Fundamentals of Digital Logic with Verilog Design" Second Edition, McGraw-Hill.
2. M. Morris Mano, "Digital Logic and Computer Design", Pearson

  
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### 21CA1207: Object Oriented Programming

L-T-P-S: 3-0-2-4

Credits:5

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	Understand the behavior of programs involving the basic programming constructs of Java.	PO1	2
CO 2	Explain the concept of class and objects with access control to represent real world entities.	PO1	2
CO 3	Identify the different predefined classes and methods in packages	PO2 ,PO3	3,4
CO 4	Apply thread concepts to establish develop inter process communication	PO2 ,PO3,PO7	4
CO 5	Develop applications using java concepts.	PO3,PO4,PO5	5

#### Syllabus:

**Introduction to Java** History, Overview of Java, Features and Advantages, Object Oriented Programming, A Simple Program, Using Blocks of Codes, Lexical Issues - White Space, Identifiers, Literals, Comments, Separators, Java Key Words. Data Types, Variables, Type Conversion and Casting, Operators, Operator Precedence. Control Statements: Selection Statements - If, Switch: Iteration Statements - While, Do-While, For Nested Loops, Jump Statements, Using Command Line Arguments.

**Classes and objects** Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Methods, Constructors, "This" Keyword, Finalize ( ) Method, Functions, Over Loading Methods, Using Objects As Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Introducing Final, Understanding Static, Introducing Nested And Inner Classes.**Inheritance**: Inheritance Basics, Using Super, Method Overriding, Dynamic Method Dispatch, Using Final with Inheritance, Polymorphism, Access Modifiers, Interfaces: Definition, Using Abstract Classes , Implementing Interfaces.**Java Packages** : Definition, Access Protection , Creating a Package, the import Keyword, Directory Structure of Packages, Built-in Packages. Exception Handling: Fundamental, Exception Types, Using Try And Catch, Multiple Catch Clauses, Nested Try Statements, Throw, Throws, Finally, Java's Built - In Exception, Using Exceptions. **Multithreaded Programming In Java** The Java Thread Model, The Main Thread, Creating A Thread, Creating Multiple Thread, Isalive() And Join(), Thread - Priorities, Synchronization, Inter Thread Communication, Suspending, Resuming And Stopping Threads, Using Multi Threading. I/O Basics, Reading Control Input, Writing Control Output, Reading And Writing Files.


#### Text Book:

1.Programming with Java, by E. Balagurusamy, McGraw Hill Education

#### Reference Books:

1.The complete reference Java –2: V Edition By Herbert Schildt Pub. TMH.

2. SAMS teach yourself Java – 2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education.

  
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### ANNEXURE-II

#### SYLLABUS FOR MCA:

#### 21UC2103: ESSENTIAL SKILLS FOR EMPLOYABILITY

L-T-P-S :0-0-4-0

Credits: 2

Prerequisites: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.NO	Course Outcome	PO/PSO	BTL
CO1	Developing basic grammar	PO5,PO6	2
CO2	Discovering and practicing functional grammar	PO5,PO6	2
CO3	Developing Intrapersonal skills	PO5,PO6	2
CO4	Developing Speaking and Writing Skills	PO5,PO6	3

#### Syllabus:


Grammar, Prepositions, Tenses, Voice, Speech, Sentence Improvement Functional Grammar, Spotting Errors, Sentence Rearrangements, 300-word list, Cloze Test, SWOC, Self-awareness, Attitude, Self-Confidence, Grooming, Etiquettes, Oral Communication Skills, Speaking from the script through JAM & Extempore, Product & Process Description through JAM & Extempore, Passage completion, Paragraph & Essay writing

#### Textbooks:

1. Objective English for Competitive Examination by Hari Mohan Prasad and Uma Sinha. McGraw Hill Education, 2017.
2. English Language Communication Skills, Cengage, 2014
3. Soft Skills and Professional Communication Skills – Francis Peter S.J. Tata MCGraw Hill Education Private Limited New Delhi 2012
4. Managerial Skills – K. Alex, S.Chand & Company Pvt. Ltd. New Delhi 2013

#### Reference Books:

1. Soft Skills by Dr. Alex S CHAND Publications
2. Objective English by Showarick Thrope, Pearson

  
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### 21CA4101: COMPUTATIONAL THINKING AND DATA STRUCTURES

L-T-P-S: 4-0-2-4

Credits: 6

Prerequisites: NIL

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO. No	Course Outcome	PO/PSO	BTL
CO1	Understand the Fundamentals of C Programming.	PO1	2
CO2	Apply concepts of Arrays, Functions and Strings	PO1, PSO1	3
CO3	Analyze the concepts of pointers, Derived Data Types, and IO	PO2, PO4	4
CO4	Evaluate Data structures - Stacks, arrays, Linked Lists, Trees, Graphs, Searching and Sorting methods	PO1, PO2, PO4, PO6	4
CO5	Create applications using control structures and linear and non-linear data structure	PO4, PSO2	6

#### Syllabus

Introduction to Computers, Algorithm, flowchart, program development steps, Structure of C, program, A Simple C program, identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional, operator, bit-wise operators, assignment operators, expressions, type conversions, conditional, expressions, precedence, and order of evaluation. Control structures such as if, go to, labels, and switch statements. Loops- while, do-while and for statements, break, continue. Derived types-Arrays: Arrays - declaration, definition, accessing elements, storing elements, Strings and string manipulations, 1- D arrays, 2-D arrays – 2-D and character arrays – Multidimensional arrays. Functions: basics, parameter passing, storage classes- scope rules, user defined functions, standard library functions, recursive functions, header files, C pre-processor. Pointers: Concepts, initialization of pointer variables, pointers, and Function arguments, passing by address – dangling memory, Character pointer s and functions, pointer s to pointer s, pointer s and multidimensional arrays, dynamic memory management functions, command line arguments. User Defined types: structures declaration, definition, and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typed of, bitfields, Input and output – concept of a file, text files and binary files, Formatted I/o, file I/o operations. Data Structures: Introduction to Data Structures – Stacks: Definition, Stack implementation one application; Queues: Definition, Queue implementation and types of Queues. Linked Lists: Single Linked List- Definition, implementation; Double Linked List- Definition, implementation. Trees: Binary Trees- representation, traversals. Graphs: Introduction, representation, traversals. Searching: Linear Searching and Binary Searching. Sorting: Bubble Sort, Quick Sort and Merge Sort.

#### Textbooks:

1. Let Us C, Yashwant Kanetkar, BPB Publications, 5th Edition.
2. Computer science, A structured programming approach using C, B.A. Forouzan and R.F.Gilberg, Third edition, Thomson.

#### Reference Books:

1. Fundamentals of Data Structures in C, Horowitz, Sahni, Anderson-Freed, 2nd ed,2008.
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson.

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### 21CA4102: RESEARCH EXPLORATION

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

CREDITS:3

Prerequisites: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

#### Syllabus:


CO.No	Course Outcome	PO/PSO	BTL
CO1	Understand objectives and the steps involved in research process, articulate appropriate research questions, and perform literature review in a scholarly style.	PO3, PSO2	3
CO2	Represent the data in tabular or graphical form	PO3, PSO1, PO2	3
CO3	Perform Statistical Modeling and Analysis and optimize the data, based on various techniques	PO4, PSO1	3
CO4	Use techniques for empathetic research and prepare an appropriate research report	PO3, PO6, PSO1, PSO2	3

Definition and objectives of Research-Types of research, Various Steps in Research process, Mathematical tools for analysis, developing a research question- Choice of a problem, Literature review, Surveying, Synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code. Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables, Relation between frequency distributions and other graphs, preparing data for analysis. Statistical Modeling and Analysis, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Error Analysis. Soft Computing: Computer and its role in research, Use of statistical software SPSS, GRETL in research. Introduction to evolutionary algorithms and their classification, Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems. Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing, Design Thinking for Contextualized Problem-Solving and Empathetic Research. **Textbooks:**

1. C.R. Kothari, Research Methodology. Methods and Techniques, 2nd Edition, Vishwa Prakashan, 2019
2. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 12th Edition, Tata McGRAW-Hill Co. Ltd., 2018.

#### Reference Books:

1. Donald H. McBurney, Research Methods, 9th edition, Thomson Learning, ISBN: 81- 315-0047-0, 2017
2. Fuzzy Logic with Engg Applications, Timothy J. Ross, Wiley Publications, 2nd Edition., 2017
3. R. Panner Selvam, Research Methodology, PHI Learning Pvt. Ltd., 2014
4. Mark Saunders, Research Methods for Business Students, Pearson Education, 2015

  
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### 21CA4103: OPERATING SYSTEMS

L-T-P-S: 4-0-0-0

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):


CO.No	Course Outcome	PO/PSO	BTL
CO1	Understand the concepts of Operating System and Process Management	PO1	2
CO2	Apply Process Synchronization and Deadlocks mechanisms	PO1, PSO1	2
CO3	Analyze the concept of Memory Management, File System Implementation, Mass-storage structure	PO2, PSO2	3
CO4	Analyze Protection and Case Study of LINUX and Windows	PO2, PSO2	3

#### Syllabus:

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 code, Multiprocessor Scheduling Concurrency: Concurrency and Threads code, Thread 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 Devices, Hard Disk Drives, Redundant Disk Arrays (RAID), Files and Directories, File System Implementation, Distributed systems, Data Integrity and Protection.

#### Textbooks:

1. Operating Systems: Three Easy Pieces, Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau, Arpaci-Dusseau Books, May, (2014).
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).
4. Uresh Vahalia ,”Unix Internals-The new Frontiers”,Pearson edition,(2006).
5. Andrew S Tanenbaum ,”Modern Operating Systems-“, Prentice Hall.
6. William Stallings ,”Operating Systems - Operating System: Internals and Design Principles” 4th edition,(2013)

  
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### 21CA4104: DATABASE MANAGEMENT SYSTEM

L-T-P-S: 3-0-2-4

Credits: 5

Prerequisite: Nil


#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.No	Course Outcome	PO/PSO	BTL
CO1	Remembering Database and File System and Applying different kinds of data models with functional components of DBMS	PO1	3
CO2	Applying design, SQL, PL/SQL and correlating appropriate strategies for optimization of queries with Tuple Relational Calculus and Domain Relational Calculus	PSO1, PO2, PO4	4
CO3	Analysing normal forms based on functional dependency and Apply normalization techniques to eliminate redundancy with the ACID properties	PO1, PO4, PSO1	4
CO4	Applying concurrency techniques to demonstrate the organization of Databases with log mechanism and check pointing techniques for system recovery	PO3, PO4	3
CO5	Analysing and apply in Identifying variety of methods for effective processing of given queries	PO4, PO5, PSO1	4

#### Syllabus:

Database Design a Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, view of Data, Database Languages, Data Independence, Structure of a DBMS Database Engine, Database and Application Architecture, Database Users and Administrators. Database Design concepts and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Conceptual Design with the ER Model, Mapping Cardinalities, Primary Key, Removing Redundant Attributes in Entity Sets, Reducing E-R Diagrams to Relational Schemas, Additional Features of the ER Model, Relational Model: Integrity constraint over relations, enforcing integrity constraints,

querying relational data, logical data base design, introduction to views, destroying/altering tables and views. Relational Algebra, Tuple relational Calculus, Domain relational calculus. SQL Data Definition, SQL Data Types and Schemas, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion, Views, Transactions, Triggers, Indexing and Non-Indexing Refinement of Schema: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multivalued dependencies, 4NF, 5NF , Managing Transactions, ACID

  
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properties, Concurrent Executions, Lock based Concurrency, Locking Performance Controlling Concurrency-Serializability, Recoverability, LockBased Protocols, Dealing with Deadlocks, Deadlock Handling, Use of Lock Conversions, Crash Recovery ARIES algorithm, The Write Ahead log Protocol, System Crash Recovery, Storage and indexing- File organization, indexing, Hash based and Tree based Indexing

### Textbooks:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, 3rd Edition, Tata Mc Graw Hill.
2. Database System Concepts, Silberschatz, Korth, 5th edition, Mc Graw Hill.

### Reference Books:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education.
3. Introduction to Database Systems, C.J. Date Pearson Education.
4. Oracle for Professionals, The X Team, S. Shah and V. Shah, SPD.

  
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## 21CA4205: Data Analytics

L-T-P-S: 3-0-2-4

Credits: 5

Prerequisite: Nil

### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.No	Course Outcome	PO/PSO	BTL
CO1	Understand the importance of Data Analytics and Fundamentals of R.	PO1, PSO1	2
CO2	Descriptions of R-datatypes, R-operators and R-functions	PSO1, PO2, PO4	2
CO3	Applications of statistical functions on data frames	PO1, PO4, PSO1	3
CO4	Analyzing imported data through different graphical method	PO2, PO4, PSO1	3
CO5	Evaluate data frames in R	PO4, PO5, PSO1	5

### Syllabus:

Introduction to Data Analytics: What are Data Analytics? – Why Data Analytics?, Data basics: Quantitative data : Nominal data, Ordinal data. What is R? – Why R? – Advantages of R over Other Programming Languages - R Studio: R command Prompt, R script file, comments – Handling Packages in R: Installing a R Package, Important commands to get started: installed. package (), package Description (), help(), find. package (), library () - Input and Output – Entering Data from keyboard – Printing fewer digits or more digits. R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Variables: Variable assignment, Data types of Variable, Finding Variable, Deleting Variables. R- Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators - R Decision Making: if statement, if – else statement, if– else if statement, switch statement – R Loops: repeat loop, while loop, for loop – Loopcontrol statement: break statement, next statement.R-Function: function definition, Built in functions: mean(), paste(), sum(), min(), max(),seq(), user-defined function, calling a function, R-Strings – Manipulating Text in Data: substr(),strsplit(), paste(), grep(), toupper(), tolower(). R Vectors – Sequence vector, rep function, vector access, vector names, vector math, R List -Creating a List, Add/Delete Element to or from a List, Size of List, Merging Lists, Matrix Computations: Addition, subtraction, Multiplication and Division- R Arrays: Accessing Array Elements, Calculation Across Array Elements - R Factors –creating factors, generating factor levels. Basics in Statistics: Descriptive and Inferential, Sample and Population. Data Frames –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge(), Descriptive Statistics: Data Range, Frequencies, Mode, Mean and Median: Mean Applying Trim Option, Applying NA Option, Median - Mode – Summation, Variance, Standard Deviation, Analyzing a sample, The Normal Distribution, Skewness, Central Limit Theorem, Outlier. Correlation and Causation, Spotting Problems in Data with Visualization: visually Checking distributions for a single Variable - R –Pie Charts: Pie Chart title and Colors – Slice Percentages and Chart Legend, 3D Pie Chart – R Histograms – Density Plot - R – BarCharts: Bar Chart Labels, Title and Colors. Loading and handling Data in R: Getting and Setting the Working Directory

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getwd(),setwd(), dir() - R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File –R - Excel File – Reading the Excel file.

### Textbooks:

1. Sandip Rakshit, R Programming for Beginners, McGraw Hill Education (India), 2017, ISBN : 978-93-5260-455-5.
2. Seema Acharya, Data Analytics using R, McGrawHill Education (India), 2018, ISBN: 978-93-5260-524-8.

### References :

1. Tutorials Point (I) simply easy learning, Tutorial Library (2018), R Programming, Retrieved from [https://www.tutorialspoint.com/r/r\\_tutorial.pdf](https://www.tutorialspoint.com/r/r_tutorial.pdf).
2. Andrie de Vries, JorisMeys, R for Dummies A Wiley Brand, 2nd Edition, John Wiley and Sons, Inc, 2015, ISBN: 978-1-119-05580-8, Henry F Korth, S Sudarshan, McGraw-Hill

  
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### 21CA4206: Object Oriented Programming

L-T-P-S: 3-0-2-4

Credits: 5

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.No	Course Outcome	PO/P SO	BTL
CO1	Understand Principles of OOP and Inheritance	PO2,PSO1	2
CO2	Design and Implement interfaces, Packages and Enumeration, Exceptions & Assertions	PO4,PSO1	3
CO3	Analyze Multi-Threading and Applets	PO4,PSO1	4
CO4	Apply Event Handling and Abstract Window Toolkit.	PO3,PSO1	4
CO5	Create user interfaces using awt package classes	PO5,PSO1	5

**Syllabus: Introduction to OOP :** Introduction, Principles of Object Oriented Languages, Applications of OOP, Programming Constructs: Variables, Primitive Data types, Identifiers - Naming Conventions, Keywords, Literals, Operators -Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control - Branching, Conditional, loops. Classes and Objects - classes, Objects, Creating Objects, Methods, constructors - Constructor overloading, cleaning up unused objects -Garbage collector, Class variable and Methods -Static keyword, this keyword, Arrays, Command line arguments.


**Inheritance :** Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class. **Interfaces, Packages and Enumeration:** Interface - Extending interface, Interface Vs Abstract classes, Packages -Creating packages, using Packages, Access protection, java.lang package. **Exceptions & Assertions** – Introduction, Exception handling techniques -try... catch, throw, throws, finally block, user defined exception, Exception Encapsulation and Enrichment, Assertions. **Multi Threading:** java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading - Using isAlive () and join (), Synchronization, suspending and Resuming threads, Communication between Threads Input/Output: reading and writing data, java.io package, **Applets** –Applet class, Applet structure, An Example Applet Program, Applet : Life Cycle, paint(), update() and repaint(). **Event Handling:** Introduction, Event Delegation Model, java.awt.event Description, Sources of Events, Event Listeners, Adapter classes, Inner classes. **Abstract Window Toolkit :**Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar, **Swing :** Introduction, JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box Pluggable Look and Feel.

#### Textbooks:

1. The Complete Reference Java, 8ed, Herbert Schildt, TMH
2. Programming in JAVA, Sachin Malhotra, Saurabhchoudhary, Oxford.

#### References:

1. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
2. Introduction to Java programming, 7th ed

  
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### 21CA4207: Software Engineering

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

Credits: 3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.No	Course Outcome	PO/PSO	BTL
CO1	Understand Fundamentals Object Oriented Software Engineering	PO1,PSO1	2
CO2	Design UML diagrams for Echo Systems	PO4, PSO1,	3
CO3	Design and apply software architectures	PO3,PSO1	3
CO4	Analyze software testing and software process models	PO3,PSO1	3

#### Syllabus


Software and Software Engineering, Nature of software, software application domains, unique nature of web applications, software engineering, software process, software engineering practice, SDLC, software myths. Process Models: Generic process model, prescriptive process models, specialized process models, unified process, personal and team process models, product and process. Reverse Engineering, Agile Development, Agile manifesto and principles, Extreme programming, Scrum, Feature Driven Development (FDD), Lean Software Development (LSD), Requirements Engineering, Requirements classification, Requirements modeling approaches, SRS and User Stories, Analysis to Design, Coupling and Cohesion, Refactoring. Design Concepts, Design Principles, Software architecture, architectural styles, Use cases, Classes, Relationships, common Mechanisms and their diagrams. Interfaces, Modeling techniques for Class & Object Diagrams. Behavioral Modeling :Interaction diagrams. Activity Diagrams. Software testing & reliability, A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Testing methods, The Human and The Computer, Golden Rules, user interface analysis and design, interface analysis, interface design steps. Software Process Improvement, Software Quality Assurance : Six Sigma & The CMMI.

#### Textbook:

1. Object Oriented Software Engineering: Practical Software Development using UML and Java. Timothy C Lethbridge & Robert, Langaneire, Mc Graw Hill

#### Reference Books:

1. The Unified Modeling Language User Guide. Grady Booch, James Rumbaugh and Ivar Jacobson. Addison-Wesley.
2. Software Engineering; A Practitioner's Approach. Roger SPressman.
3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education

  
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### 21CA4208: Computer Networks

L-T-P-S: 4-0-0-0

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.NO	Course Outcome	PO/PSO	BTL
CO1	Understand the fundamentals of computer networks and data communication	PO2	2
CO2	Understand Data Link Layer, IEEE Standards, design issues in networks	PO2	2
CO3	Analyze Internet Transport Protocols and different types of protocols	PO1	4
CO4	Analyze various types of Network Devices and different types of Networks	PO4	4

#### Syllabus

Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models, Data Communication Services & Network Examples, Internet Based Applications. Data Communications: Transmission Media, Wireless Transmission, Multiplexing, Switching, Transmission in ISDN, Broad Band ISDN, ATM Networks. Data Link Control, Error Detection & Correction, Sliding Window Protocols, LANs & MANs: IEEE Standards for LANs & MANs-IEEE Standards 802.2, 802.3, 802.4, 802.5, 802.6, High Speed LANs. Design Issues in Networks: Routing Algorithms, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking. Internet Transport Protocols: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues. Overview of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, Worldwide Web, Firewalls. Network Devices: Overview of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, routers, Hubs, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies. Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks

#### Textbooks:

1. Computer Networks, Andrews S Tanenbaum, Edition 5, PHI, ISBN: -81-203- 1165-5
2. Data Communications and Networking, Behrouz A Forouzan, Tata McGraw- Hill Co Ltd, Second Edition

#### Reference Books:

1. *Computer Networks*, Mayank Dave, Cengage.
2. *Computer Networks, A System Approach*, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier.
3. *An Engineering Approach to Computer Networks*-S.Keshav, 2nd Edition, Pearson Education.
4. *Understanding Communications and Networks*, 3rd Edition, W.A. Shay Thomson.

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### 21CA4209: IoT Technology and Applications

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

Credits: 3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.No	Course Outcome	PO/PSO	BTL
CO1	Understand the IoT technologies and vision of IoT from a global context. Understand the application of IoT.	PO2, PSO1	2
CO2	Apply the Market perspective of IoT	PO4, PSO1	3
CO3	Analyze state of the art architecture in IoT	PO1, PSO1	4
CO4	Evaluate Opinions on IoT Application and Value for Industry	PO3, PSO1	4

#### Syllabus


Internet of Things Evolution (IoT), Enabling Technologies, M2M Communication, IoT World Forum (IoTWF) Standardized Architecture, Simplified IoT Architecture, Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects. IoT Protocols-IoT Access Technologies, Physical and MAC layers, Topology and Security of IEEE 802.15.4, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, 6LoWPAN, Application Transport Methods: SCADA, Application Layer Protocols: CoAP and MQTT.. IoT Design and Development-Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, Arduino Board details, IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT Electronic Equipment's, Industry 4.0 concepts. IoT Data Analytics Introduction, Structured Versus Unstructured Data, Data in Motion versus Data at Rest, IoT Data Analytics Challenges, Data Acquiring, Organizing in IoT/M2M, Supporting Services-Computing Using a Cloud Platform for IoT/M2M Applications/Services, Everything as a service and Cloud Service Models.

#### Textbook:

1. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014

#### References Books:

1. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
2. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1

  
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### 21CA5110: WEB TECHNOLOGIES

L-T-P-S: 3-0-2-4

Credits: 5

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.No	Course Outcome	PO/PSO	BTL
CO 1	Illustrate the basic concepts of HTML and CSS & apply those concepts to design static web pages	PO1, PSO1	2
CO 2	Identify and understand various concepts related to dynamic web pages and validate them using JavaScript	PO1, PSO1	2
CO 3	Outline the concepts of Extensible markup language	PO2, PSO1	3
CO 4	Develop web Applications using Scripting Languages & Frameworks	PO1, PSO1	3
CO 5	Create and deploy secure, usable database driven web applications using PHP and RUBY	PO5, PSO1	6

#### Syllabus:

**Introduction to Web Technology :** HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, Iframes Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML. **CSS:** Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution, CSS3. **Introduction to JavaScript:** Objects, Primitives Operations and Expressions, Control Statements, Arrays, Functions, Constructors, Pattern Matching using Regular Expressions, Fundamentals of Angular JS and NODE JS. **Introduction to XML:** Syntax of XML, Document Structure, Document type definition, Namespaces, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX. **Introduction to PHP:** Overview of PHP, general server characteristics, Creating PHP Pages, Form handling , Data Base access with PHP & MySql. **Web Servers-** IIS (XAMPP, LAMP) and Tomcat Servers. Java Web Technologies-Introduction to Servlet, Life cycle of Servlet, Servlet methods, Java Server Pages. **Database connectivity** – Servlets, JSP, PHP, Practice of SQL Queries. Web development frameworks – Introduction to Ruby, Ruby Scripting, Ruby on rails – Design, Implementation and Maintenance aspects.

#### Textbooks:

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
2. Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.
3. Pro Mean Stack Development, 1st Edition, ELad Elrom, Apress O'Reilly, 2016
4. Java Script & jQuery the missing manual, 2nd Edition, David sawyer mcfarland, O'Reilly, 2011.
5. Web Hosting for Dummies, 1st Edition, Peter Pollock, John Wiley & Sons, 2013.
6. RESTful web services, 1st Edition, Leonard Richardson, Ruby, O'Reilly, 2007.

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### Reference books:

1. Ruby on Rails Up and Running, Lightning fast Web development, 1st Edition, Bruce Tate, Curt Hibbs, Oreilly, 2006.
2. Programming Perl, 4th Edition, Tom Christiansen, Jonathan Orwant, O'Reilly, 2012.
3. Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1st Edition, Dream Tech, 2009.
4. An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning, 2003

  
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### 21CA5111: AUTOMATION AND INTELLIGENCE

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


Credits: 3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.No	Course Outcome	PO/PSO	BTL
CO 1	Explain different concepts in Automation and Intelligence, shall be capable of understanding and analyzing, Basic Automation technologies used across various applications.	PO1, PSO1	2
CO 2	Discuss about different types of dynamic control and Industrial, field/service using Automation and Intelligence.	PO1, PSO1	2
CO 3	Demonstrate the work of Sensing, perception, planning, and control applied to Automation and Intelligence.	PO2, PSO1	3
CO 4	Identify the working of different Applications using Artificial Intelligence in Automation and Intelligence.	PO1, PSO1	3
CO 5	Develop different types of Design Automation and Intelligence systems for new applications	PO2, PSO1	3

**Overview of Automation and Intelligence:** Introduction, What Process Automation, Historic Evaluation of PA, Using of PA, Test automation v/s RPA, Pros & Cons of Process Automation, Myths about Automation and Intelligence. **Process automation working principles** of RPA, Implementation process of RPA, Different Tools for implementation of RPA, Selecting principals of a specific Tool, Examples of Real time Applications using RPA. **Fundamentals and basics of UIPATH:** Introduction and discussion about UiPath, Advantages of UiPath and Different Products of UiPath. installation of uipath: Minimum Requirements for Installing and Starting, UiPath Studio, Important Concepts in UiPath Studio, Different Components and User Interfaces, **Advanced techniques of Uipath** Shortcuts and Customization: File Management, Recording, Workflow Execution, Selecting Activities with Examples. **Automation of Projects and Their Debugging:** Working with Automation Projects in UiPath Studio Working Design of UiPath Layout Diagrams, Type of Decisions, Switch Activity, Flow Decision, Flow Switch Naming Conventions. Managing Variables in UiPath Studio, The Variable Panel, Types of Variables, How to Create Variables, How to Remove Variables, Managing arguments and Argument Panel, How to Use an Argument. **Additional features:** Recording using UiPath Studio, Types of Recording, Automatic Recording, Example of Basic Automatic Recording, Example of Desktop Automatic Recording, Example of Web Automatic Recording, and Manual Recording. **Data Scraping and Screen Scraping:** Introduction of Data Scraping, Steps for using Data Scraping Wizard with Example, details about Screen Scraping, Screen Scraping Methods, Steps for using Screen Scraping Wizard with Example. **Detailed examples:** Excel Automation, Email Automation, PDF Data Extraction and Automation.

  
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### Text Book:

1. Learning Robotic Process Automation, Authord by Alok Mani Tripathi Published with ISBN 978-1-78847-094-0, Packt Publishing Ltd.
2. The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems 1st ed. Edition by Tom Taul, ISBN-13: 978-1484257289
3. <https://www.ibm.com/cloud/learn/intelligent-automation#toc-intelligen-E3BkaLP8>

### Reference Books:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition.
2. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition

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### 21CA5213: INTELLECTUAL PROPERTY RIGHTS

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

Credits: 3

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO.No	Course Outcome	PO/PSO	BTL
CO 1	Explain PRINCIPLES OF IPR	PO3,PSO1	2
CO 2	Discuss about PATENT LAW AND PRACTICES	PO5,PSO1	2
CO 3	Demonstrate COPYRIGHT LAW AND PRACTICES	PO6,PSO1	2
CO 4	Identify TRADEMARK LAW AND PRACTICES	PO6,PSO1	3

#### Syllabus:

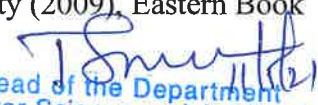
**PRINCIPLES OF IPR:** Introduction to Intellectual Property Rights ,Concept and Theories ,Kinds of Intellectual Property Rights ,Economic analysis of Intellectual Property Rights ,Need for Private Rights versus Public Interests,Advantages and Disadvantages of IPR,Criticisms of Intellectual Property Rights Politics of Intellectual Property Rights. **COPYRIGHT LAW AND PRACTICES:** Research exemption Introduction to Patents, Overview, Historical development, Concepts, Novelty, Utility, Inventiveness/Non-obviousness. Patent Act 1970 – amendments of 1999, 2000, 2002 and 2005, Patent able subject matter, Patent ability criteria, non-patent able inventions, Pharmaceutical products and process and patent protection Software Patents ,Patenting of Micro-organism. **COPYRIGHT LAW AND PRACTICES:** Copyright and Neighbouring Rights ,Concept and Principles Historical background and Development of Copyright Law ,Leading International Instruments, Berne Convention, Universal Copyright Convention, International Copyright under Copyright Act WIPO Phonograms and Performances treaty,Copyright Act, 1957 ,Terms of Copyright conditions for grant of copyright, extent of rights exception to copyright protection, fair use provision, assignment and licensing, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematography Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers. **TRADEMARK LAW AND PRACTICES:** Historical development of the concept of trademark and trademark law-National and International ,Introduction to Trademarks ,Need for Protection. Kinds of trademarks ,Concept of Well known trademark,Registration of trademark,Grounds of refusal of registration ,Absolute ground ,Relative ground ,Procedure of registration of trademark ,opposition and its grounds

#### Text Book:

1. D.P. Mittal (Taxman Publication), Indian Patents Law and Procedure
2. P. Narayanan (Eastern Law House), Intellectual Property Law
3. Dr. B.L. Wadhwa, Law Relating to Patent, Trademarks, Copyright & Designs

#### Reference Books:

- 1.N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book
- 2.W. Cornish (Universal Publication), Intellectual Property Law

  
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### 21CA5115: Machine Learning

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

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO#	Course Outcome	PO/PSO	BTL
CO1	To understand the basic concepts of statistical learning methods and models	PO 1, PSO 1	1
CO2	To understand the importance of supervised learning in classifying class labels for prediction	PO 3, PSO 1	2
CO3	To understand the different algorithms related to classification techniques	PO 5, PSO 1	3
CO4	To understand the assumptions in estimating regression coefficients using OLS method	PO 4, PO 8, PSO 1	3
CO5	Evaluate applications using classification techniques	PO 5, PSO 1	3

#### Syllabus:

**Introduction to Machine Learning Algorithms:** Introduction to Machine learning – Statistical Learning – types of Machine Learning – learning models: geometric, probabilistic and logistic models, introduction to supervised, unsupervised and reinforcement learning – model evaluation – model implementation – model accuracy indicators. **Supervised Learning – Simple Linear Regression Analysis :** Introduction to parametric machine learning method, assumptions of parametric machine learning methods, linear model and its assumptions, simple linear regression, scatter diagram, Simple linear Regression parameter estimation, properties of regression parameters, testing the significance of regression parameters using ANOVA and t test, estimation of  $\sigma^2$ , Interval Estimation of the Mean Response, R Square, Adjusted R Square, Normality of response variable, prediction of new observations, Confidence interval for  $\beta_0$ ,  $\beta_1$  and  $\sigma^2$ . **Supervised Learning – Multiple Linear Regression Analysis I** Multiple linear regression model, assumptions of Multiple linear regression variables – multicollinearity, homoscedasticity, autocorrelation, effects of multicollinearity, effect of homoscedasticity and auto autocorrelation in parameter estimation, Least - Squares Estimation of the Regression Coefficients, Geometrical Interpretation of Least Squares, Properties of the Least - Squares Estimators, Estimation of  $\sigma^2$ , Inadequacy of Scatter Diagrams in Multiple Regression. **Supervised Learning – Multiple Linear Regression Analysis II** testing the general linear hypothesis, Test for Significance of Regression, Tests on Individual Regression Coefficients and Subsets of Coefficients, Special Case of Orthogonal Columns in X, Confidence Intervals on the Regression Coefficients, CI Estimation of the Mean Response, Simultaneous Confidence Intervals on Regression Coefficients, predicting new observations, residual analysis,

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model adequacy and validation. **Supervised Learning – Non Linear Regression Analysis**  
Introduction to non-linear regression models, non-linear least square method to estimating the regression parameters, transformation of non-linear model to linear model, linearization, other parameter estimation methods, starting values, statistical inference in non-linear regression models

### Textbooks

1. Introduction to Linear Regression Analysis, Fifth Edition - DOUGLAS C. MONTGOMERY, ELIZABETH A. PECK, G. GEOFFREY VINING, A JOHN WILEY & SONS, INC., PUBLICATION
2. Introduction to Machine Learning - Ethem Alpaydm, The MIT Press

### Reference Books

1. Python Machine Learning - Sebastian Raschka, PACKT Publishing
2. Using Multivariate Statistics - Barbara G. Tabachnick, Linda S. Fidell, Pearson Education Inc

  
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### 21CA5123: CLOUD COMPUTING

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

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO No	Course Outcomes	PO	BTL
CO 1	Relate Scalable Computing and System models for Distributed and Cloud Environment	PO1	3
CO 2	Apply Implementation levels of Virtualization mechanisms	PO1	3
CO 3	Estimate Service models and Architectural Design for Resource management	PO1	3
CO 4	Extrapolate Ubiquitous in Cloud environment and Cloud Software Environments	PO1	3
CO 5	Formulate and design the workload balancing and Virtualization using Distributed Cloud Environment	PO5	5

#### Syllabus:

**Distributed System Models and Enabling Technologies** Scalable Computing over the Internet, Technologies for Network-Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security, and Energy Efficiency. **Virtual Machines and Virtualization of Clusters and Data Centers** Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation

**Cloud Platform Architecture over Virtualized Data Centers** Cloud Computing and Service Models, Data-Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS, and Azure, Inter-cloud Resource Management, Cloud Security and Trust Management. **Ubiquitous Clouds** Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems, and the Cloud, Social and Professional Networking. Cloud Programming and Software Environments-Features of Cloud and Grid Platforms, Parallel and Distributed Programming Paradigms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments

#### Textbooks:

1. Rafaels, Ray J. *Cloud Computing: From Beginning to End*. CreateSpace Independent Publishing Platform, 2015.
2. Thomas, Erl, Mahmood Zaigham, and Puttini Ricardo. "Cloud Computing Concepts, Technology & Architecture." (2013).
3. Hwang, Kai, Jack Dongarra, and Geoffrey C. Fox. *Distributed and cloud computing: from parallel processing to the internet of things*. Morgan kaufmann, 2013.

#### Reference Book:

1. Weinman, Joe. *Clouconomics: The business value of cloud computing*. John Wiley & Sons, 2012.

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### 21CA2116: SOFT COMPUTING

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

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO..	Course Outcome	PO/PSO	BTL
CO 1	Interpret fuzzy logic system	PO2,PSO1	2
CO 2	Analyze Artificial Neural Network Models	PO1,PSO1	4
CO 3	Demonstrate Swarm and Evolutionary Algorithms	PO1, PSO1	3
CO 4	Illustrate Hybrid Fuzzy-Neural- Evolutionary- Swarm Models	PO3, PSO1	3
CO5	Demonstration of neuro, fuzzy, evolutionary, and swarm algorithms using open source tools	PO4, PSO1	5

#### Syllabus:

Introduction to Computing, Distinguish Hard Computing versus Soft Computing. Characteristics of Soft Computing. Fuzzy Logic and Control System: Crisp Vs Fuzzy Sets Operations, Fuzzification methods, Defuzzification Methods, Extension Principle and Fuzzy Relations, Fuzzy Inference Systems. Fundamentals of Artificial neural networks: Fundamentals of connectionist modeling Major classes of neural networks: The multi-layer perceptrons, radial basis function networks, Kohonen's self-organizing network, The Hopfield network, industrial and commercial application of ANN. Evolutionary computing: Overview of Evolutionary Computing, Genetic algorithms and optimization, Genetic Algorithm operators and algorithms, Particle Swarm Optimization. Hybrid Systems: Developing fusion of methods of Fuzzy-Neuro-Evolutionary- Swarm models

#### Textbooks:

1. Fakhreddine O. Karry, Clarence De Silva, "Soft Computing and Intelligent systems Design Theory, Tools and Applications", Pearson, (2009).
2. S. N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", John Wiley & Sons, 2007.
3. Goldberg DE (1989) Genetic algorithms for search, optimization, and machine learning. Addison-Wesley, Reading

#### Reference Books:

1. J S R Jang, C T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education, (2015).
2. S N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Second Edition, Wiley India (2011).
3. Laurene Fausett, "Fundamentals of Neural Networks", Pearson, (2004).
4. Timothy J Ross "Fuzzy Logic with Engineering Applications", 3rd Edition, Wiley, (2010).
5. Bart Kosko, "Neural Networks and Fuzzy Systems", PHI, (2004).
6. Randy I.Haupt, "Practical Genetic Algorithms", Wiley Interscience (2004)

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### 21CA5120: BIG DATA ANALYTICS

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

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO#	Course Outcome	PO/PSO	BTL
CO1	To understand the basic concept of BigData, different types of Data	PO 1, PSO1	1
CO2	To understand architecture of Hadoop and YARN	PO 3, PSO 1	2
CO3	To understand about Processing and Storage Layer of Hadoop, internal concept of MapReduce	PO 5, PSO 1	3
CO4	You will understand the concept of Master and Slave Architecture	PO 5, PO 7, PSO 1	3
CO5	You will learn about cluster management using YARN	PO 5, PSO 1	3

#### Syllabus:

**Understanding BigData:** Defining Data, Types of Data, Structured Data, Semi Structured Data, Unstructured Data, How data being Generated, Different source of Data Generation, Rate at which Data is being generated, Different V's, Volume, Variety, Velocity, Veracity, Value, How single person is contributing towards BigData, Significance for BigData, Reason for BigData, Understanding RDBMS and why it is failing to store BigData. Future of BigData, BigData use cases for major IT Industries. **Introduction to Hadoop** : What is Hadoop, Apache Community, Cluster, Node, Commodity Hardware, Rack Awareness, History of Hadoop, Need for Hadoop, How is Hadoop Important, Apache Hadoop Ecosystem, Different Hadoop offering , Hadoop 1.x Architecture, Apache Hadoop Framework, Master- Slave Architecture, Advantages of Hadoop. **Storage Unit:** Hadoop Distributed File System, Design of HDFS, HDFS Concept, How files are stored in HDFS, Hadoop File system, Replication factor, Name Node, Secondary Name Node, Job Tracker, Task tracker, Data Node, FS Image, Edit-logs, Check-pointing Concept, HDFS federation, HDFS High availability. Architectural description for Hadoop Cluster, When to use or not to use HDFS, Block Allocation in Hadoop Cluster, Read operation in HDFS, Write operation in HDFS, Hadoop Archives, Data Integrity in HDFS, Compression & Input Splits. **Processing Unit** : What is MapReduce, History of MapReduce, How does MapReduce works, Input files, Input Format types Output Format Types, Text Input Format, Key Value Input Format, Sequence File Input Format, Input split, Record Reader, MapReduce overview, Mapper Phase, Reducer Phase, Sort and Shuffle Phase, Importance of MapReduce.Data Flow, Counters, Combiner Function, Partition Function, Joins, Map Side Join, Reduce Side Join, MapReduce Web UI, Job Scheduling, Task Scheduling,

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Fault Tolerance, Writing MapReduce Application, Driver Class, Mapper Class, Reducer Class, Serialization, File Based Data Structure, Writing a simple MapReduce program to Count Number of words, MapReduce Work Flows. **YARN & Hadoop Cluster:** YARN, YARN Architecture, YARN Components, Resource Manager, Node Manager, Application Master, Concept of Container, Difference between Hadoop 1.x and 2.x Architecture, Execution of Job in Yarn Cluster, Comparing and Contrasting Hadoop with Relational Databases Cluster Specification, Cluster Setup and Installation, Creating Hadoop user, Installing Hadoop, SSH Configuration, Hadoop Configuration, Hadoop daemon properties, Different modes of Hadoop, Standalone Mode, Pseudo Distributed Mode, Fully Distributed Modes,

### Text Book:

1. Hadoop: The Definitive Guide, By: Tom White, O'REILLY

### Reference Books:

1. Hadoop for Dummies, By: Dirk deRoos, Paul C. Zikopoulos, Bruce Brown, Rafael Coss, and Roman B. Melnyk, A Wiley brand
2. Hadoop in Action, Writer: Chuck Lam Published By: Manning Publications

  
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### 21CA5124: CLOUD INFORMATION SECURITY

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

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):


CO. No	Course Outcome	Mapped PO	BTL
CO 1	Explain importance of Information Security in the Cloud Context	PO2, PSO1	2
CO 2	Discuss various concepts of cloud security	PO6, PSO1	2
CO 3	Develop the cloud vulnerabilities and threats	PO7, PSO1	3
CO 4	Identify how cloud and Security works in a seamless model	PO8, PSO1	3
CO 5	Evaluate Applications on Cloud Security	PO4, PSO1	5

#### Syllabus:

**Introduction to Virtualization & Cloud :** Virtualization and Cloud computing concepts, Private cloud Vs Public cloud, IAAS, PAAS & SAAS concepts, Virtualization security concerns, Hypervisor Security, Host/Platform Security, Security communications, Security between Guest instances, Security between Hosts and Guests **Cloud Controls Matrix & Top Cloud Threats :** Introduction to Cloud Controls Matrix & Top Cloud Threats, Cloud Controls Matrix, Trusted Cloud Initiative architecture and reference model, requirements of Security as a Service (SecaaS) model and Top Security threats to the cloud model. **Cloud Security :** Cloud Security vulnerabilities and mitigating controls, Cloud Trust Protocol, Cloud Controls Matrix. Complete Certificate of Cloud Security Knowledge (CCSK) **Cloud Trust Protocol & Transparency :** Introduction to Cloud Trust Protocol & Transparency, Cloud Trust Protocol and Transparency, Transparency as a Service, Concepts, Security, Privacy & Compliance aspects of cloud

#### Text Book:

1. Cloud Security – A comprehensive Guide to Secure Cloud Computing by Ronald L. Krutz and Russel Dean Vines
2. **Reference Books:**
  1. Visible Ops Private Cloud – Andi Mann, Kurt Miline and Jeanne Morain, IT Process Institute, Inc.; first edition (April 8, 2011)
  2. Cloud Computing Explained – John Rhoton 2009

  
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### 21CA5217: PATTERN RECOGNITION

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

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO#	Course Outcome	PO/PSO	BTL
CO1	To understand the concept of pattern recognition	PSO1,PO1,PO2	1
CO2	To explore Statistical pattern recognition	PSO1,PO1,PO2	2
CO3	To classify Syntactic pattern recognition	PO 5, PSO 1	3
CO4	To apply pattern recognition techniques in real time scenario	PO 4,PO 8, PSO 1	3

#### Syllabus:

Introduction and general pattern recognition: Pattern Recognition (PR), Pattern Recognition Approaches, Examples of PR Applications, Pattern Recognition Extensions. What is Pattern Recognition (PR). Pattern Recognition Approaches, Examples of PR Applications, Pattern Recognition Extensions. Statistical pattern recognition: Introduction, Supervised, Parametric Approaches, Unsupervised Approaches. Statistical pattern recognition: Introduction, Supervised, Parametric Approaches, Unsupervised Approaches. Bayes Classifier: Bayes Theorem, Minimum Error Rate Classifier, Estimation of Probabilities Comparison with the NNC, Naive Bayes Classifier. Hidden Markov Models: Markov Models for Classification, Hidden Markov Models, HMM Parameters, Learning HMMs, Classification Using HMMs, Classification of Test Patterns. Syntactic (structural) pattern recognition & NN Classifiers: Introduction, Structural Analysis Using Constraint Satisfaction and Structural Matching, The Formal Language-based Approach, Learning/Training in the Language-based Approach. Nearest Neighbour Based Classifiers: Nearest Neighbour Algorithm, Variants of the NN Algorithm, Use of the Nearest Neighbour Algorithm for Transaction Databases, Minimal Distance Classifier (MDC). Applications of Pattern Recognition: Finger printing, cursive characteristic recognition, Biometrics, Rice inspection, Food quality analysis, etc.


#### Textbooks:

1 R. O. Duda, P. E. Hart, and D. G. Stork, Pattern Classification, 2nd edition, Wiley-Inter science. ISBN 0-471-05669-3 .

2 Pattern Recognition, An Algorithmic Approach, M. Narasimha Murty , V. Susheela Devi, 2011, Universities Press (India) Pvt. Ltd, Co-Published by Springer.

#### Reference Books :

1 Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning," Springer

  
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## 21CA5221: DATA VISUALIZATION

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

Credits: 4

Prerequisite: Nil

Mapping of Course outcomes (CO) with program outcomes (PO):

O#	Course Outcome	PO/PSO	BTL
CO1	Understand the need of visualization techniques	PO1, PSO1	2
CO2	To explain Static Graphical Techniques	PO2, PSO1	2
CO3	To apply Multivariate Graphical Techniques	PO4, PSO1	3
CO4	To explain the concept of Graphical Validation and customization	PO2, PSO1	3

### Syllabus:


**Introduction to Data Visualization** Brief history of data visualization, scientific design choices in data visualization- choice of graphical form, grammar of graphical techniques of large amount of data, crucial need of visualization techniques, challenges in visualization techniques, classification of visualization techniques for qualitative and quantitative data, power of visualization techniques, introduction to different visualization techniques. **Static Graphical Techniques – 1 Introduction** to bar graph, basic understanding of making basic bar graph, grouping bars together, bar graphs on counts, customization of bar graphs by changing colour, size, title, axis units, changing width and spacing of the bar chart, adding labels to bar graph, application of bar graph in business. **Multivariate Graphical Techniques** Introduction to correlation matrix, application of correlation matrix in the multivariate analysis, network graph, basics of heat map, difference between heat map and tree map, introduction to higher dimensional scatter plot, axis adjustment in the higher dimensional scatter plot, addition of prediction surface of higher dimensional scatter plot. **Graphical Validation:** Basics of multivariate statistical visual representations and its results, dendrogram, importance of dendrogram in grouping (cluster analysis), Scree Plot, importance of Scree Plot, application of Scree Plot in determining number of clusters and factors, QQ plot, importance of QQ plot in distribution of data for the further quantitative analysis, PP plot, applications and usage of PP Plot for distribution detection. **Customization** : Introduction to annotations – adding : text, mathematical expression , lines, arrows, shaded shapes, highlighting the texts and items, adding error bars, introduction to axis, swapping x and y axis, changing the scaling ration in the axis, positioning of axis and arranging tick marks and labels, changing the appearance of axis labels, circular graphs, using themes, changing the appearance of theme elements, creating the own themes, legends : removing the legends, position of legends, legend title, labels in legends.

### Textbooks:

1. Munzner, Visualization Analysis and Design, 2014, ISBN 1466508914
2. Ware, Information Visualization: Perception for Design, 3rd ed. Morgan Kaufmann, 2012, ISBN 0123814642 (available electronically through the Clemson University libraries)

### Reference Books:

1. Visualizing Data. O'Reilly' Media, 2008, ISBN 0596514557

  
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### 21CA5225: CLOUD ARCHITECTURE

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

Credits: 4

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO..	Course Outcome	PO/PSO	BTL
CO 1	Understand the main concepts, key technologies, strengths, and limitations of cloud computing.	PO2, PSO1	2
CO 2	Understanding the Cloud Architecture and infrastructure of cloud computing	PO1, PSO1	2
CO 3	Understanding the cloud services.	PO1, PSO1	2
CO 4	To understand and define the multi-tenant cloud architecture, its advantage and requirements.	PO3, PSO1	2

#### Syllabus:

**Overview of Cloud Computing** - Brief history and Evolution of Cloud Computing, Traditional vs. Cloud Computing, Importance of Cloud Computing, Benefits and Challenges of Cloud Computing, **Cloud Computing Architecture:** Cloud computing stack Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services 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, Community cloud. **Infrastructure as a Service (IaaS):** Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM) **Platform as a Service(PaaS):** Introduction to PaaS What is PaaS, Service Oriented Architecture (SOA) Cloud Platform and Management Computation Storage.


**Software as a Service (SaaS:)** Introduction to SaaS, Web services, Web 2.0, Web OS. **Overview of Multi-Cloud Management Systems** - Explain concept of multi- cloud management, Challenges in managing heterogeneous clouds, benefits of multi-cloud management systems. **Overview of Cloud Security** - Security concerns in Traditional IT, Challenges in Cloud Computing in terms of Application, Server, and Network Security. **Service Management in Cloud Computing:** Service Level Agreements (SLAs).

#### Textbooks:

1. Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski (2011), Cloud Computing: Principles and paradigms.

#### Reference Book:

1. Krutz, Ronald L.; Vines, Russell Dean, Cloud Security, A comprehensive Guide to Secure Cloud Computing.
2. Barrie Sosinsky (2011), Cloud Computing Bible, Wiley.

  
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### 21CA5218: DEEP LEARNING

L-T-P-S: 3-0-2-4

Credits: 5

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO#	Course Outcome	PO/PSO	BTL
CO1	Able to understand and remember the concepts of Perception, Back Propagation, PCA, Singular Value Decomposition	PSO1,PO1,PO2	2
CO2	Able to understand auto encoders- and apply Regularization, Denoising, Sparse, Contractive, Vectoral Representations of words Convolutional Neural Networks, LeNet, AlexNet	PSO1,PO1,PO2	3
CO3	Apply Long Short-Term Memory (LSTM) Restricted Boltzmann Machines, Deep Dream, GRU, Neural style transfer, Deep learning for computer vision, text and sequences.	PO 5, PSO 1	3
CO4	Build Markov models, Markov networks, Markov chains, Variational autoencoders, Autoregressive Models: NADE, MADE, PixelRNN, Generative Adversarial Networks (GANs), how to train DCGAN, limitations of deep learning	PO 4, PO 8, PSO 1	3
CO5	Implement basic Neural Networks, optimization algorithms, engine vector decomposition, various types of auto encoders, batch normalization, convolutional neural networks	PO3,PO5,PSO2	5

#### Syllabus:

Syllabus: History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptron's, Perceptron Learning Algorithm and Convergence, Multilayer Perceptron's (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feedforward Neural Networks, Backpropagation, Gradient Descent (GD), Momentum Based GD, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Principal Component Analysis, Singular Value Decomposition. Autoencoders, Denoising autoencoders, Sparse autoencoders, Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Batch Normalization, Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet Object Detection Long Short-Term Memory (LSTM) Restricted Boltzmann Machines, Deep Dream, GRU, Neural style transfer, Deep learning for computer vision, text and sequences. Markov models, Markov networks, Markov chains, Variational autoencoders, Autoregressive Models: NADE, MADE, Generative Adversarial Networks (GANs), how to train DCGAN, limitations of deep learning.

#### Textbooks:

1. Deep learning with python – Francois Chollet, Manning publishers, 2018, ISBN9781617294433
2. Grokking deep learning, Andrew w Trask, 2019, Manning publishers, ISBN9781617293702
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville (2016) Deep Learning Book.

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### **Reference Books:**

1. Deep Learning with PyTorch: A practical approach to building neural network models using PyTorch by Vishnu bramanian
2. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996 Pattern Recognition and Machine Learning, Christopher Bishop, 2007

  
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### 21CA5222: COGNITIVE COMPUTING

L-T-P-S: 3-0-2-4

Credits: 5

Prerequisite: Nil

#### Mapping of Course outcomes (CO) with program outcomes (PO):

CO#	Course Outcome	PO/PSO	BTL
CO1	Understand and discuss what cognitive computing is, and how it differs from traditional approaches	PO1, PO2	2
CO2	Applying the primary tools associated with cognitive computing	PO1, PO2	3
CO3	Develop a project that leverages cognitive computing	PO 5	3
CO4	Understand and discuss the business implications of cognitive computing	PO 4, PO 8,	3
CO5	Evaluate Applications using cognitive computing methods	PO3, PO5	5

#### Syllabus:


The Foundation of Cognitive Computing: Uses, Artificial Intelligence as the Foundation of Cognitive Computing, Understanding Cognition, The Elements of a Cognitive System, Cognitive Applications. Design Principles for Cognitive Systems: Building the Corpus, Bringing Data into the Cognitive System, Machine Learning, Hypotheses Generation and Scoring, Presentation and Visualization Services. Natural Language Processing in Support of a Cognitive System: The Role of NLP in a Cognitive System Understanding Linguistics, Applying Natural Language Technologies to Business Problems Representing Knowledge in Taxonomies and Ontologies: Developing a Cognitive System, Models for Knowledge Representation, Other Methods of Knowledge Representation. The Relationship Between Big Data and Cognitive Computing: The Architectural Foundation for Big Data, Hadoop, Integration of Big Data with Traditional Data. Applying Advanced Analytics to Cognitive Computing : Key Capabilities in Advanced Analytics, Using Machine Learning in the Analytics Process, Predictive Analytics Text Analytics, Image Analytics, Speech Analytics Using Advanced Analytics to Create Value Business Implications: Advantages of New Disruptive Models, The Difference with a Cognitive Systems Approach, IBM's Watson : DeepQA Architecture, UIMA – Unstructured Information Management Architecture, Structured Knowledge Building Cognitive Applications: Defining the Objective, Defining the Domain, Defining Questions and Exploring Insights, Building a Cognitive Healthcare Application, Smarter Cities: Cognitive Computing in Government.

#### Textbooks :

1. Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.
2. Jarafsky, D., and Martin, J.H. (2008). Speech and Language Processing, Prentice Hall Series in Artificial Intelligence.

#### Reference Books :

1. David Kriesel: A Brief Introduction to Neural Networks
2. Richard S. Sutton and Andrew G. Barto: Reinforcement Learning: An Introduction

  
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### 21CA5226: CLOUD WEB SERVICES

L-T-P-S: 3-0-2-4

Credits: 5

Prerequisite: Nil

Mapping of Course outcomes (CO) with program outcomes (PO):


CO. No	Course Outcome	Mapped PO	BTL
CO 1	Understand the model of Cloud Computing As A Service	PO4, PSO1	2
CO 2	Understand the Networking Basics required for cloud services	PO8, PSO1	2
CO 3	Demonstrate the Control of workflow in cloud services	PO4, PSO1	2
CO 4	Explain the method of fault tolerance in cloud	PO8, PSO1	2
CO 5	Experiment with the cloud	PO8, PSO1	3

#### Syllabus:

**Cloud Web concepts:** Search engine, Apache Hadoop, Grid Computing, Amazon Web Services, REST APIs, SOAP API, Query API, User Authentication, Connecting to the Cloud, Open SSH Keys, Tunneling / Port Forwarding, Image (glance), Object Storage (swift), ACL, Logging, Signed URI, Compute (nova), Cloud value proportion, Cloud economics, cloud architecture and design principles, AWS Cloud basic services. **Networking & Storage :** Overview, Key pairs, Network Types, LAN, Gateways and Router, IP Classes and Subnets, CIDR, Utilities, Instances Management, Image Management, direct connect, hybrid deployments, VPN, Security groups, Block Storage (cinder), Ubuntu in the Cloud, Installation, Utilities, File system, basic concepts of storage and databases, various storage services, storage solutions, database services **Global Infrastructure and Security:** Methods of deploying and operating cloud, global infrastructure, availability zone, benefits of CloudFront and Edge locations. AWS Corer services, resources for technology support, methods for provisioning services, Benefits of shared responsibility model, layers of security, Multi Factor Authentication, Identity Access Management Security levels, security policies, benefits of compliance, security services. **Monitoring & Pricing:** Approaches for monitoring, benefits of Cloud watch, CloudTrail, Trust Advisor, Pricing and support model, free tire, benefits of organization and consolidated billing, Budgets, Explorer, AWS pricing calculator, various AWS support plans, AWS market place.

#### Textbooks:

1. Cloud Computing: Principles and Paradigms, Editors: RajkumarBuyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
2. OpenStack Essentials by Dan Radez (Author)

  
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### Reference Books:

1. OpenStack Cloud Computing Cookbook - Third Edition by Egle Sigler, Cody Bunch, Kevin Jackson
2. Cloud Computing Explained: Implementation Handbook for Enterprises, John Roton, Recursive Press (November 2, 2009).

  
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### Department of Computer Science & Applications Minutes of the DAC meeting held on 07-04-2021.


#### Agenda Items

1. To discuss any proposals for modifications to the existing curriculums of the department.
2. To formulate the eligibility criteria for admissions into BCA & MCA with Specializations.
3. To introduce a two year Post Graduate Program MCA with Specialization from this year onwards.
4. To Analyze the feedback towards curriculum improvement.

This meeting is chaired by Dr. K. Bhagavan, HOD, Department of Computer Applications.

#### Members Attended

S.No.	Name of the Member	Designation
1.	Dr. K. Bhagavan	HOD
2.	Dr.V.S.Bhagavan	Professor
3.	Dr.K.Kiran Kumar	Professor
4.	Dr.C.M.Sheela Rani	Professor
5.	Dr.Nitin Tyagi	Professor
6.	Dr.M.N.V. Kiran Babu	Associate Professor
7.	Dr.B.Mouleswara Rao	Associate Professor
8.	Mr.N.Venkata Ramana	Assistant Professor
9.	Mrs.B.Aruna	Assistant Professor
10.	Mr.K. Rohit Kumar	Assistant Professor
11.	Ms.V Nandini	Assistant Professor
12.	Mr.G.Venkateswarlu	Assistant Professor
13.	Ms.Papiya Mukharjee	Assistant Professor
14.	Dr. T. Thiru Venkadam	Assistant Professor
15.	Dr.A.Sabena Banu	Assistant Professor
16.	Dr.V.S.Narayana	Professor
17.	Mr.S.Parabrahma Chari	Assistant Professor
18.	Ms.M.Radha	Assistant Professor

  
Head of the Department  
Computer Science and Applications  
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### Minutes of Meeting:

1. It is recommended to set the eligibility criteria for admission into all the four programs of BCA as “minimum 50% marks in core subjects of intermediate or equivalent study”.
2. It is recommended to allow students who studied intermediate or equivalent without mathematics subjects. However, for such students a strong bridge course is proposed before the commencement of graduation program.
3. Dr. S. Lavanya & Dr. G. Siva Nageswara Rao Suggested to rename the following course names for Y21 BCA.
  - a. “DLD & CO” course reorganized into Computer Organization and Architectures.
  - b. “Fundamentals of Mathematics” in to “Mathematics for Computer Science”.
  - c. “Programming in C” to be renamed as “Problem Solving through Programming”.
  - d. “Object Oriented Programming through Java” to be focused on concepts only, hence, to be renamed as “Object Oriented Programming”.
  - e. Data Science specialization Electives title “Probability and Statistics” to be restructured as Statistics for Data Science
  - f. Professional Communication Skills course may be replaced with “Essential Skills for Employment”.
4. As per the recommendation of Industry person Mr. Sai Satish, Web & Social Media and Mobile Application Development courses are introduced in 2<sup>nd</sup> semester for Y21 BCA admitted students.
5. As per recommendation of Academic Peer Dr. M. Babu Reddy, a new course Essentials of Information Technology is introduced in 1<sup>st</sup> semester for Y21 BCA admitted students.
6. As per recommendation of Academic peers and Industry Feedback a two-year MCA program was introduced from academic year 2021-22
7. Industry Person Ms. Siva Leela, Team Leader, Hexaware suggest introducing “Cloud Architecture” for designing solutions that align with business objectives while considering factors like performance, security, cost, and compliance.
8. Faculty Member Ms. Sabeena Banu Suggested to introduce the course “Essentials of IoT” to have a basic understanding of the devices, sensor, layers, and communication.
9. Industry Person Ms. Sravani suggested introducing the course “Java Full Stack Development” to gain knowledge on front end and backend languages used for web development.

  
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10. Faculty Member Dr. G. Siva Nageswara Rao, suggested to introduce the course “Object Oriented Analysis and Design” for generating the diagrams which give a brief information about the project.
11. Academic Peer Dr. R. Kiran Kumar, Krishna University suggested to introduce the course “Statistics for Data Science”, which gives fundamental statistical concepts and techniques that are essential for working with data, conducting data analysis, and making data-driven decisions.
12. Alumni Mr. M. Sumanth Kumar suggested to introduce “Business Intelligence” refers to the processes, technologies, tools, and practices.
13. Faculty Member Dr. T. Thiruvankadam suggested introducing “Microprocessor and Micro Controller” with high processing capabilities, extensive memory, and support for advanced communication protocols.
14. Faculty Member Dr. C. M. Sheela Rani suggested “Electronics and Sensor Technology” with electronic components and sensors to measure, monitor, control, and process various physical phenomena.
15. Industry Person Mr. K. Srinivas suggested introducing the course “Robotics Process Automation” to automate repetitive, rule-based tasks.
16. Academic Peer Dr. P. Suresh Varma, suggested introducing the course “IoT Design & Development” involve creating interconnected devices in various domains, including smart homes, industrial automation, healthcare, agriculture.
17. Academic Peer Dr. E. Babu Reddy, Suggested to Introduce the course “Deep Learning” focuses on the development and training of artificial neural networks, particularly deep neural networks, to solve complex problems.
18. Alumni Swetha Shireen, suggested to introduce the course “Advance Embedded Systems” involve complex hardware and software configurations applications, including aerospace, automotive, medical devices, industrial automation, and consumer electronics for the IoT specialization students.
19. As per the recommendations from Academic Peer Dr. Anil Kumar, Term Paper is introduced to the Y21 BCA students to understand the standards of the problems in Research papers.
20. As per the recommendations from Industry person Mr. M. Tarun, “Essentials Skills for Employability is introduced to the Y21 BCA students to get aware of the skills required to acquire a job in IT Industry.

  
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