

KONGU ENGINEERING COLLEGE, PERUNDURAI - 638 060

MINUTES OF THE MEETING OF BOARD OF STUDIES IN B.Sc Board

MEETING No. 23

DATE : 12-02-2022

TIME : 10.00 AM (Online/ Offline)

Google Meet Id: meet.google.com/tyn-kqfs-xw

The following members were present for the meeting:

1.	Name, Designation and Affiliation Dr.P.Natesan Professor & Head Department of Computer Technology – UG Kongu Engineering College.	Chairman
2.	Dr.S.Suriya Associate Professor Department of Computer Science and Engineering, PSG College of Technology, Peelamedu, Coimbatore.	University Nominee
3.	Dr. N.Radhika Professor Department of Computer Science, School of Engineering, Amrita Vishwa Vidyapeetham, Coimbatore.	Academic Council Nominee
4.	Dr. V.S.Shankar Shriram Associate Dean, School of Computing SASTRA University	Academic Council Nominee
5.	Mr. M.Nandakumar Software Architect Development Specialist, SAP	Alumni Representative
6.	Mr.S. Balasubramanian Digital Architect, Microsoft Corporation India Pvt Ltd, Domlur, Bangalore.	Industry Representative
7.	Dr.S.Kalaiselvi Assistant Professor (SLG) Kongu Engineering College	Internal Member
8.	Dr.S.Karunakaran Associate Professor Kongu Engineering College	Internal Member
9.	Dr.S.Kavitha Bharathi Associate Professor Kongu Engineering College	Internal Member
10.	Dr.S.Gandhimathi Associate Professor Kongu Engineering College	Internal Member
11.	Dr.N.T.Renukadevi Assistant Professor (SRG) Kongu Engineering College	Internal Member
12.	Dr.K.Saraswathi Assistant Professor (SRG) Kongu Engineering College	Internal Member
13.	Dr.C.N.Vanitha Assistant Professor (SRG) Kongu Engineering College	Internal Member
14.	Ms.S.S.Saranya Assistant Professor Kongu Engineering College	Internal Member

15.	Dr.Sakthi Radha Assistant Professor (SRG) Kongu Engineering College	Internal Member
16.	Mr.A.Kalyanasaravanan Assistant Professor (SRG) Kongu Engineering College	Internal Member
17.	V.Gowri Shankar Assistant Professor (SRG) Kongu Engineering College	Internal Member
18.	Mr.B.Ravishankar Assistant Professor (SRG) Kongu Engineering College	Internal Member
19.	Ms.K.Sathya Assistant Professor Kongu Engineering College	Internal Member
20.	Ms.S.Poorani Assistant Professor (SRG) Kongu Engineering College	Internal Member
21.	Ms.P.Gokila Brindha (SRG) Assistant Professor Kongu Engineering College	Internal Member
22.	Ms.S.Malathy Assistant Professor Kongu Engineering College	Internal Member
23.	Dr.C.Menaka Assistant Professor Kongu Engineering College	Internal Member
24.	Ms.M.N.Kavitha Assistant Professor Kongu Engineering College	Internal Member

The following members have requested for leave of absence:

1. Ms. S.Nandhini Devi
Assistant Professor
Kongu Engineering College

Meeting of the B.Sc Board:

Chairman/BoS welcomed the members and briefed on curriculum, syllabi of courses to be added and syllabi of courses to be modified under Regulation 2020 for B.Sc (Computer Systems and Design, Information Systems and Software Systems).

The board discussed and approved the following points as per the agenda:

Item No. 23.1: Ratification of the following items under R2018 & R2020 as given in Annexure-I.

a. Course and Syllabi for PhD Course work -NA

b. One / Two credit courses

One credit courses – The following courses are offered to students as two credit course.

18VAC27-Natural Language Processing with Python

18VAC62-Introduction to GitHub

20VC016-Introduction to MATLAB Programming

20VC017-Programming with Golang

20VC018-Introduction to augmented reality using UNITY game engine

c. On line courses

noc-22 cs-28 – Data Science for Engineers

noc-22 cs-14 – Compiler Design

noc-22 cs-30 – Social Networks

noc-22 hs-59 – Intellectual Property

noc-22 cs-42 – An Introduction to Programming through C++

noc-22 cs-37 – Online Privacy

d. Curriculum and Syllabi amendments under R2018 & R2020 for UG / PG courses NA

e. Introduction of new electives under R2018 & R2020 for UG / PG courses NA

f. Credit transfer from Foreign Universities, Change of Regulations for readmitted students, Transferred candidates NA

g. Other items if any - Nil

It is resolved to ratify the above items a, b, c, d, e, f and g as given in Annexure – I.

Item No. 23.2. Approval of the curriculum, syllabi of courses to be added newly and syllabi of courses to be modified from 5th semester to 6th semester for B.SC (Computer Systems and Design, Information Systems and Software Systems) under R2020 as given in Annexure-II.

The members discussed the curriculum, syllabi of courses to be added newly and syllabi of courses to be modified from 5th semester to 6th semester for B.Sc (Computer Systems and Design, Information Systems and Software Systems) as given in Annexure-II and approved the same.

Item No. 23.3. Approval of the syllabi of courses to be studied for honours degree under R2020 as given in Annexure-III. NA

Item No. 23.4. Approval for Value Added Courses (one / two credit courses), on-line courses with syllabi to be offered from first semester onwards, Transfer of credits from UGC & AICTE approved institutions and Credit transfer from foreign universities under R2018 & R2020 as given in Annexure-IV.

The members discussed the value added courses (one/ two credit courses), on-line courses with syllabi to be offered from first semester onwards,, Transfer of credits from UGC and AICTE approved institutions including NPTEL, SWAYAM, etc., and Credit transfer from foreign universities under R2018 & R2020 (from the year 2021-22 onwards) as given in Annexure – IV and approved the same.

Item No. 23.5. Approval of Syllabus for PhD courses under R2020 as given in Annexure-V.

NA

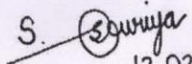
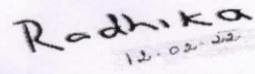
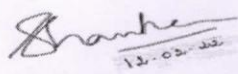
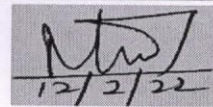
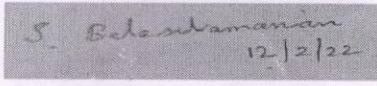
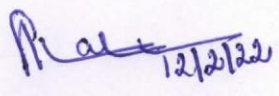
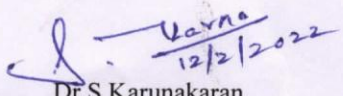
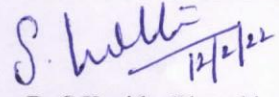
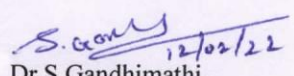
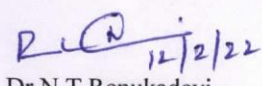
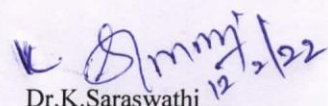
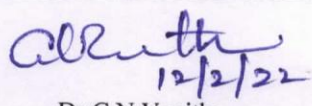
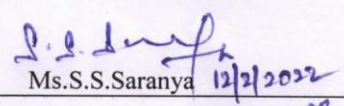
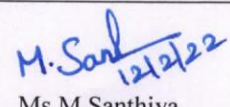
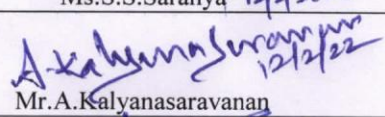
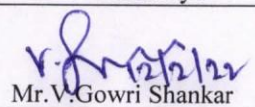
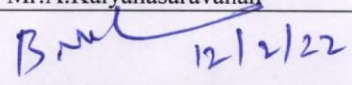
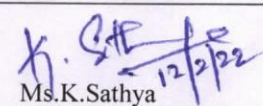
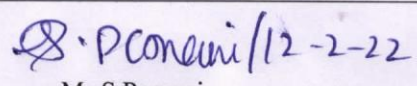
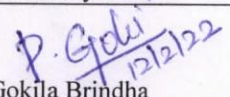
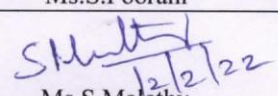
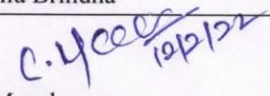
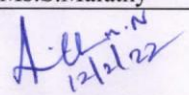
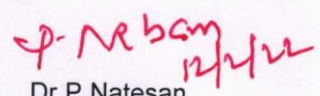
Reporting Item No. 23.6. Proctored online/ conventional examination system being followed for the November / December 2021 end semester / trimester examinations as given in Annexure-VI.

The members appreciated the proctored online/ conventional examination system being followed for the November / December 2021 end semester / trimester examinations as given in Annexure-VI.

The following suggestions were made by the members:

- In Deep learning syllabus fundamental concepts of statistics can be ensured.
- Analysis of algorithms part can be included in Data Structures syllabus
- Latest version of Android studio can be ensured and real time application project can be given as a case study.
- Certifications with AWS, GOOGLE... etc may be encouraged and the content to be added in the appropriate course.
- Edge computing topic may be added in Internet of Things syllabus.
- Distributed computing course can be merged with cloud computing.
- Demonstration is required for Block chain concepts.
- Devops can be included in Cloud Computing.
- In Multicore Architecture GPU services can be included.
- Hands on sessions may be given for Cyber Forensics and Security Management course.
- Privacy and social engineering related concepts can be included in Social Web Mining Syllabus.
- OWASP can be included and certification may be encouraged for Ethical Hacking course.
- Computational Thinking with Lab components may be added in the curriculum.

The meeting was concluded with a vote of thanks to the members.

 12.02.2022 Dr. S. Suriya	 12.02.2022 Dr. N. Radhika
 12.02.2022 Dr. V.S. Shankar Shriram	 12/2/22 Mr. M. Nandakumar
 12/2/22 Mr. S. Balasubramanian	 12/2/22 Dr. S. Kalaiselvi
 12/2/2022 Dr. S. Karunakaran	 12/2/22 Dr. S. Kavitha Bharathi
 12/02/22 Dr. S. Gandhimathi	 12/2/22 Dr. N.T. Renukadevi
 12/2/22 Dr. K. Saraswathi	 12/2/22 Dr. C.N. Vanitha
 12/2/2022 Ms. S.S. Saranya	 12/2/22 Ms. M. Santhiya
 12/2/22 Mr. A. Kalyanasaravanan	 12/2/22 Mr. V. Gowri Shankar
 12/2/22 Mr. B. Ravisankar	 12/2/22 Ms. K. Sathya
 12-2-22 Ms. S. Poorani	 12/2/22 Ms. P. Gokila Brindha
 12/2/22 Ms. S. Malathy	 12/2/22 Dr. C. Menaka
 12/2/22 Ms. M.N. Kavitha	
	 12/2/22 Dr. P. Natesan (Chairman/BoS)

Annexure – I

Ratification items under R2018 & R2020 implemented during the academic year 2021-22 and/or previous years.

a. Course and Syllabi for PhD Course work- NA

b. One credit courses

18VAC27-Natural Language Processing with Python

18VAC62-Introduction to GitHub

20VC016-Introduction to MATLAB Programming

20VC017-Programming with Golang

20VC018-Introduction to augmented reality using UNITY game engine

c. On line courses

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noc-22 cs-37 – Online Privacy

d. Curriculum and Syllabi amendments under R2018 & R2020 - NA

e. Introduction of new electives under R2018 & R2020 - NA

f. Credit transfer from Foreign Universities, Change of Regulations for readmitted students, Transferred candidates - NA

g. Other items if any -NIL

Annexure - II

(i) Curriculum, syllabi of courses to be added newly and syllabi of courses to be modified from 2nd semester to final semester for B.Sc (Computer Systems and Design / Information Systems/ Software Systems) under R2020

(a) List of courses newly added:

S.No.	Course Name	Semester	Regulation
1.	Ethical Hacking	VI	R2020

(b) List of courses modified the syllabus content:

S.No.	Course Code & Course Name	Semester	Regulation
1.	Open Source Programming	IV	R2020
2.	Cloud Computing	V	R2020
3.	Mobile Application Development	V	R2020

(c) List of courses removed:

S.No.	Course Code & Course Name	Semester	Regulation
1.	Software Architecture	VI	R2020

(d) List of courses swapped:

S.No.	Course Code(s) & Course Name(s)	Existing Semester	Swapped Semester	Regulation
NIL				

Curriculum from 2nd semester to final semester B.Sc under R2020

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 060

(Autonomous)

B.Sc. DEGREE IN COMPUTER SYSTEMS AND DESIGN, INFORMATION SYSTEMS, SOFTWARE SYSTEMS

CURRICULUM UNDER REGULATIONS 2020

(For the candidates admitted from academic year 2020-21 onwards)

Semester I								
Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCC11	Communicative English I	3	0	2	4	50	50	100
20BCT11	Mathematics I	3	1	0	4	50	50	100
20BCT12	Digital Principles and Logic Design	3	0	0	3	50	50	100
20BCT13	C Programming	3	0	0	3	50	50	100
20BCT14	Web Programming	3	0	0	3	50	50	100
20MNT21	Student Induction Program	-	-	-	-	100	-	100
Practical / Employability Enhancement								
20BCL11	Digital Principles and Logic Design Laboratory	0	0	4	2	50	50	100
20BCL12	C Programming Laboratory	0	0	4	2	50	50	100
20BCL13	Web Programming Laboratory	0	0	4	2	50	50	100
Total Credits to be earned					23			

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(For the candidates admitted from academic year 2020-21 onwards)

Semester II								
Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCC21	Communicative English II	3	0	2	4	50	50	100
20BCT21	Mathematics II	3	1	0	4	50	50	100
20BCT22	Basics of Electrical and Electronics Engineering	3	0	0	3	50	50	100
20BCT23	Python Programming	3	0	0	3	50	50	100
20BCT24	Data Structures	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCL21	Electrical and Electronics Engineering Laboratory	0	0	4	2	50	50	100
20BCL22	Python Programming Laboratory	0	0	4	2	50	50	100
20BCL23	Data Structures Laboratory	0	0	4	2	50	50	100
Total Credits to be earned					23			

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B.Sc. DEGREE IN COMPUTER SYSTEMS AND DESIGN, INFORMATION SYSTEMS, SOFTWARE SYSTEMS

CURRICULUM

(For the candidates admitted from academic year 2020-21 onwards)

Semester III								
Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCT31	Java Programming	3	0	0	3	50	50	100
20BCT32	Operating Systems	3	0	0	3	50	50	100
20BCT33	Database Management Systems	3	0	0	3	50	50	100
20BCT34	Computer Organization	3	1	0	4	50	50	100
20BCT35	Software Engineering	3	1	0	4	50	50	100
20GEL31	Professional Skills Training I	2	0	2	2	100	-	100
Practical / Employability Enhancement								
20BCL31	Java Programming Laboratory	0	0	4	2	50	50	100
20BCL32	Operating Systems Laboratory	0	0	4	2	50	50	100
20BCL33	Database Management Systems Laboratory	0	0	4	2	50	50	100
Total Credits to be earned					25			

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CURRICULUM

(For the candidates admitted from academic year 2020-21 onwards)

Semester IV								
Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCT41	Open Source Programming	3	0	0	3	50	50	100
20BCT42	Computer Networks	3	1	0	4	50	50	100
20BCT43	Graphics and Multimedia	3	0	0	3	50	50	100
20BCT44	Data Warehousing and Data Mining	3	1	0	4	50	50	100
20BCT45	Object Oriented Analysis and Design	3	0	0	3	50	50	100
20GEL41	Professional Skills Training II	2	0	2	2	100	-	100
Practical / Employability Enhancement								
20BCL41	Open Source Programming Laboratory	0	0	4	2	50	50	100
20BCL42	Graphics and Multimedia Laboratory	0	0	4	2	50	50	100
20BCL43	Object Oriented Analysis and Design Laboratory	0	0	4	2	50	50	100
Total Credits to be earned					25			

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CURRICULUM

(For the candidates admitted from academic year 2020-21 onwards)

Semester V								
Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCT51	Artificial Intelligence and Machine Learning	3	0	0	3	50	50	100
20BCT52	Mobile Application Development	3	0	0	3	50	50	100
	Elective I	3	0	0	3	50	50	100
	Elective II	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCL51	Machine Learning Laboratory	0	0	4	2	50	50	100
20BCL52	Mobile Application Development Laboratory	0	0	4	2	50	50	100
20BCP51	Project Work I	0	0	12	6	50	50	100
Total Credits to be earned					22			

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B.Sc. DEGREE IN COMPUTER SYSTEMS AND DESIGN
CURRICULUM

(For the candidates admitted from academic year 2020-21 onwards)

Semester VI								
Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
	Elective III	3	0	0	3	50	50	100
	Elective IV	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCP61	Internship / Project Work II	0	0	12	6	50	50	100
Total Credits to be earned					12			

Total Credits: 130

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(For the candidates admitted from academic year 2020-21 onwards)

LIST OF PROFESSIONAL ELECTIVE COURSES

Course Code	Course Title	Hours/Week			Credit
		L	T	P	
	SEMESTER 5				
	Elective I				
20BCE01	Cloud Computing	3	0	0	3
20BCE02	Information Security	3	0	0	3
20BCE03	Microprocessor and Interfacing	3	0	0	3
	SEMESTER 5				
	Elective II				
20BCE04	Internet of Things	3	0	0	3
20BCE05	Distributed Computing	3	0	0	3
20BCE06	User Interface Technologies	3	0	0	3
	SEMESTER 6				
	Elective III				
20BCE07	Deep Learning	3	0	0	3
20BCE08	Unix and Shell Programming	3	0	0	3
20BCE09	Blockchain Technologies	3	0	0	3
	SEMESTER 6				
	Elective IV				
20BCE10	Big Data Analytics	3	0	0	3
20BCE11	Multicore Architecture	3	0	0	3
20BCE12	Software Project Management	3	0	0	3

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Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCT41	Open Source Programming	3	0	0	3	50	50	100
20BCT42	Computer Networks	3	1	0	4	50	50	100
20BIT41	Cryptography and Network security	3	0	0	3	50	50	100
20BCT44	Data Warehousing and Data Mining	3	1	0	4	50	50	100
20BCT45	Object Oriented Analysis and Design	3	0	0	3	50	50	100
20GEL41	Professional Skills Training II	2	0	2	2	100	-	100
Practical / Employability Enhancement								
20BCL41	Open Source Programming Laboratory	0	0	4	2	50	50	100
20BIL41	Network Security Laboratory	0	0	4	2	50	50	100
20BCL43	Object Oriented Analysis and Design Laboratory	0	0	4	2	50	50	100
Total Credits to be earned					25			

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 060**(Autonomous)****B.Sc. DEGREE IN INFORMATION SYSTEMS****CURRICULUM****(For the candidates admitted from academic year 2020-21 onwards)**

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCT51	Artificial Intelligence and Machine Learning	3	0	0	3	50	50	100
20BCT52	Mobile Application Development	3	0	0	3	50	50	100
	Elective I	3	0	0	3	50	50	100
	Elective II	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCL51	Machine Learning Laboratory	0	0	4	2	50	50	100
20BCL52	Mobile Application Development Laboratory	0	0	4	2	50	50	100
20BIP51	Project Work I	0	0	12	6	50	50	100
Total Credits to be earned					22			

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B.Sc. DEGREE IN INFORMATION SYSTEMS
CURRICULUM

(For the candidates admitted from academic year 2020-21 onwards)

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
	Elective III	3	0	0	3	50	50	100
	Elective IV	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BIP61	Internship / Project Work II	0	0	12	6	50	50	100
Total Credits to be earned					12			

Total Credits: 130

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 060
(Autonomous)
B.Sc. DEGREE IN INFORMATION SYSTEMS
CURRICULUM

(For the candidates admitted from academic year 2020-21 onwards)

LIST OF PROFESSIONAL ELECTIVE COURSES

Course Code	Course Title	Hours/Week			Credit
		L	T	P	
	SEMESTER 5				
	Elective I				
20BCE01	Cloud Computing	3	0	0	3
20BIE01	Cyber Forensics and Security Management	3	0	0	3
20BIE02	Mobile communication	3	0	0	3
	SEMESTER 5				
	Elective II				
20BCE04	Internet of Things	3	0	0	3
20BIE03	Social Web Mining	3	0	0	3
20BIE04	Storage Infrastructure Management	3	0	0	3
	SEMESTER 6				
	Elective III				
20BCE07	Deep Learning	3	0	0	3
20BIE05	Information Technology Ethics	3	0	0	3
20BCE09	Blockchain Technologies	3	0	0	3
	SEMESTER 6				
	Elective IV				
20BCE10	Big Data Analytics	3	0	0	3
20BIE06	E-commerce	3	0	0	3
20BCE12	Software Project Management	3	0	0	3

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 060
(Autonomous)
B.Sc. DEGREE IN SOFTWARE SYSTEMS
CURRICULUM

(For the candidates admitted from academic year 2020-21 onwards)

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCT41	Open Source Programming	3	0	0	3	50	50	100
20BCT42	Computer Networks	3	1	0	4	50	50	100
20BST41	Software Testing	3	0	0	3	50	50	100
20BCT44	Data Warehousing and Data Mining	3	1	0	4	50	50	100
20BCT45	Object Oriented Analysis and Design	3	0	0	3	50	50	100
20GEL41	Professional Skills Training II	2	0	2	2	100	-	100
Practical / Employability Enhancement								
20BCL41	Open Source Programming Laboratory	0	0	4	2	50	50	100
20BSL41	Software Testing Laboratory	0	0	4	2	50	50	100
20BCL43	Object Oriented Analysis and Design Laboratory	0	0	4	2	50	50	100
Total Credits to be earned					25			

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 060**(Autonomous)****B.Sc. DEGREE IN SOFTWARE SYSTEMS****CURRICULUM****(For the candidates admitted from academic year 2020-21 onwards)**

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
20BCT51	Artificial Intelligence and Machine Learning	3	0	0	3	50	50	100
20BCT52	Mobile Application Development	3	0	0	3	50	50	100
	Elective I	3	0	0	3	50	50	100
	Elective II	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BCL51	Machine Learning Laboratory	0	0	4	2	50	50	100
20BCL52	Mobile Application Development Laboratory	0	0	4	2	50	50	100
20BSP51	Project Work I	0	0	12	6	50	50	100
Total Credits to be earned					22			

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 060**(Autonomous)****B.Sc. DEGREE IN SOFTWARE SYSTEMS****CURRICULUM****(For the candidates admitted from academic year 2020-21 onwards)**

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
Theory/Theory with Practical								
	Elective III	3	0	0	3	50	50	100
	Elective IV	3	0	0	3	50	50	100
Practical / Employability Enhancement								
20BSP61	Internship / Project Work II	0	0	12	6	50	50	100
Total Credits to be earned					12			

Total Credits: 130

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 060
(Autonomous)
B.Sc. DEGREE IN SOFTWARE SYSTEMS
CURRICULUM

(For the candidates admitted from academic year 2020-21 onwards)

LIST OF PROFESSIONAL ELECTIVE COURSES

Course Code	Course Title	Hours/Week			Credit
		L	T	P	
	SEMESTER 5				
	Elective I				
20BCE01	Cloud Computing	3	0	0	3
20BSE01	Software Quality Assurance	3	0	0	3
20BSE02	User Interface Design	3	0	0	3
	SEMESTER 5				
	Elective II				
20BCE04	Internet of Things	3	0	0	3
20BSE03	Enterprise Resource Planning	3	0	0	3
20BSE04	Software Metrics	3	0	0	3
	SEMESTER 6				
	Elective III				
20BCE07	Deep Learning	3	0	0	3
20BSE05	Ethical Hacking	3	0	0	3
20BCE09	Blockchain Technologies	3	0	0	3
	SEMESTER 6				
	Elective IV				
20BCE10	Big Data Analytics	3	0	0	3
20BSE06	Agile Software Development	3	0	0	3
20BCE12	Software Project Management	3	0	0	3

Syllabi for the courses mentioned in above items (a) and (b) under R2020

(a) List of courses newly added:

20BSE05 - ETHICAL HACKING

Programme& Branch	B.Sc – Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	VI	PE	3	0	0	3

Preamble	To impart the security fundamentals, networking concepts and technical foundation related to ethical hacking. The course discloses all the methodology and issues related to hacking and threats	
Unit - I	Introduction to Ethical Hacking:	9
Security Fundamentals : Goals → Risk, Assets, Threats, and Vulnerabilities – Backing Up Data – Exploit – Risk Assessment Security Testing : Black Box, White Box, Gray Box – Types- Hacker and Cracker Descriptions- Ethical Hackers : Required Skills – Modes of Ethical Hacking		
Unit - II	Technical Foundations of Hacking:	9
The Attacker's Process : Performing Reconnaissance and Footprinting – Scanning and Enumeration – Gaining Access – Escalation of Privilege – Maintaining Access- Covering Tracks and Planting Backdoors – Ethical Hacker's Process – Security and the Stack : OSI Model – Anatomy of TCP/IP Protocols		
Unit - III	Footprinting and Scanning:	9
Information Gathering: Documentation – Organization's Website – Job Boards – Employee and People Searches – EDGAR Database – Google Hacking – Usenet – Registrar Query – DNS Enumeration – Determining the Network Range – Identifying Active Machines – Finding Open Prot and Access Points.		
Unit - IV	Fingerprinting and System Hacking:	9
OS Fingerprinting – Fingerprinting Services– Mapping the Network Attack Surface – System Hacking: Password Attacks – Guessing – Sniffing –key logging- Owning the Box – Windows and Linux Authentication Types – Cracking Passwords – Rootkits -File Hiding and Covering Tracks		
Unit - V	Malware Threats::	9
Viruses and Worms –Types – Payloads – well-known viruses –Tools – Trojans- Types - Goals – Infection Mechanisms- Tools– Convert Communication – Keystroke Logging and Spyware- Hardware – Software- Malware Countermeasures- Detecting Malware – Antivirus - Analyzing Malware		

Total:45

TEXT BOOK:

1.	Michael Gregg, "Certified Ethical Hacker (CEH) Version 9 Cert Guide", 2 Edition, Pearson Publication, 2018.
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REFERENCE:

1.	Dr. Allen Harper, Stephen Sims, Micheal Baucom, "Gray Hat Hacking The Ethical Hacker's Handbook", 5 Edition, 2018.
2.	Patrick Engebretson, "The Basics of Hacking and Penetration Testing", 2 Edition, Elsevier Syngress Publications, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the security fundamentals and testing	Understanding (K2)
CO2	examine hacking using technical foundations	Understanding (K2)
CO3	discriminate the foot printing and scanning	Applying (K3)
CO4	investigate finger printing and scanning	Applying (K3)
CO5	categorize malware threats like viruses and worms	Analyzing (K4)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											1	2
CO2	2	1											1	2
CO3	2	1											1	2
CO4	3	2	1	1									2	3
CO5	3	3	2	2	1								3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	50					100
CAT2	30	50	20				100
CAT3	15	25	40	20			100
ESE	15	40	30	15			100

(b) List of courses modified the syllabus content:

20BCT41 - OPEN SOURCE PROGRAMMING

Programme & Branch	B.Sc - Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Web Programming	4	PC	3	0	0	3

Preamble	To deal with the programming concepts in open source languages like PHP with MySQL and to develop database driven web applications.	
UNIT - I	Introduction to PHP Programming:	9
Basic HTML and PHP Syntax - Sending Data to The Web Browser - Adding Comments - Variables: Types of Variables – Quotation Marks - HTML Forms: Creating Simple HTML Forms – Receiving Form Data in PHP - Displaying errors.		
UNIT - II	Strings, Control Structures and Arrays:	9
Strings - Concatenating Strings – Encoding and Decoding Strings – Substrings - Control Structures: If conditional – types – Switch – For Loop – Array: Creating an Array – Adding items to an array – Multidimensional arrays – Sorting – Creating array from a form – Regular Expression.		
UNIT- III	Creating Web Applications and User-defined Functions:	9
Creating Templates – Using External Files – Constants – Date and Time – Sticky forms – Sending Emails – Understanding HTTP Headers - Functions: Creating and Using simple functions – Function call with arguments – Default arguments – Function with return values.		
UNIT- IV	Introduction to Database:	9
Introduction to SQL – Connecting to MySQL – Error Handling – Creating Table – Inserting Data to database – Securing Query data – Retrieving data – Deleting data – updating data in a database.		
UNIT- V	Cookies, Sessions and File Handling:	9
Creating Cookies – Manipulating Cookies – Creating a Session – Manipulating sessions - Files and Directories: File Permissions – Lock Files – File Uploads – Navigating Directories – Reading Files incrementally.		

Total:45

TEXT BOOK:

1.	Larry Ullman, "PHP for the Web", 5th Edition, Pearson Education, 2016.
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REFERENCES:

1.	David Powers, "PHP Solutions: Dynamic Web Design Made Easy", 3rd Edition, Apress Publications, 2014.
2.	Luke Welling and Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Addison Wesley, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the programming constructs of PHP	Understanding (K2)
CO2	create HTML forms using control structures and arrays	Applying (K3)
CO3	design web pages with user-defined functions	Applying (K3)
CO4	develop web applications with database connectivity	Applying (K3)
CO5	Implement various session handling techniques and file manipulations	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											3	2
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1									2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	30	30	40				100
CAT3	30	30	40				100
ESE	20	30	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

20BCE01 - CLOUD COMPUTING

Programme & Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Operating Systems & Computer Networks	5	PE	3	0	0	3

Preamble	This course covers comprehensive and fundamental concepts of distributed computing and virtualization. It imparts the foundations and technologies related to the applications and services of cloud computing.	
Unit - I	Distributed System Models:	9
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		
Unit - II	Virtualization:	9
Implementation levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU, Memory, I/O devices – Virtual Clusters and Resource Management – Virtualization for Data-Center Automation- Debops demonstration.		
Unit - III	Cloud Platform Architecture over Virtualized Data Centers:	9
Cloud computing and Service models – Data-Center Design and Interconnection Networks – Architectural Design of Compute and Storage Clouds – Public Cloud Platforms - Google App Engine – AWS – Microsoft Windows Azure – Inter-cloud Resource Management.		
Unit - IV	Cloud Programming and Software Environments:	9
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: Open Stack.		
Unit - V	Ubiquitous Clouds and the Internet of Things:	9
Cloud Trends in supporting Ubiquitous Computing – Performance of Distributed Systems and the Cloud – Enabling technologies for the Internet of Things – Innovative Applications of the Internet of Things.		

Total:45

TEXT BOOK:

1	Kai Hwang, Geoffrey C Fox & Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", 1st Edition, Morgan Kauffmann, 2017.
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REFERENCES:

1	Daniel Kirsch, Judith Hurwitz, "Cloud Computing", 2nd Edition, Wiley, 2020.
2	Marinescu, "Cloud Computing : Theory And Practice" , 2nd Edition, Elsevier India, 2020

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the concepts, characteristics and benefits of Distributed System Models	Understanding (K2)
CO2	summarize the different virtualization technologies	Understanding (K2)
CO3	discuss the various cloud computing service models	Understanding (K2)
CO4	demonstrate the use of cloud platforms and software environments	Applying (K3)
CO5	explain the cloud trends that supports ubiquitous clouds and Internet of Things	Understanding (K2)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											3	2
CO2	2	1											3	2
CO3	2	1											3	2
CO4	3	2	1	1									2	3
CO5	2	1											3	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	25	45	30				100
ESE	25	60	15				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

20BCT52 – MOBILE APPLICATION DEVELOPMENT

Programme& Branch	B.Sc – Computer Systems and Design, Information Systems and Software Systems	Sem.	Categor y	L	T	P	Credit
Prerequisites	Java Programming	5	PC	3	0	0	3

Preamble	To explore the fundamental knowledge and to create mobile applications using Android programming.	
Unit - I	Introduction:	9
Getting Started with Android Programming: Android- Android versions - Features of Android - Architecture of Android - Android Devices - Android Market - Android Studio - Android SDK - Creating AVDs - Launching the First Android Application - Using Android Studio for Android Development: Exploring the IDE- Using code completion - Debugging the application - Publishing the Application.		
Unit - II	Activities, Fragments and Intent:	9
Understanding Activities - Applying Styles and Themes to an Activity - Hiding the Activity Title - Dialog Window - Progress Dialog - Linking Activities using Intents - Returning Results from an Intent - Passing Data using Intent Object – Fragments - Adding Fragments Dynamically - Life Cycle of a Fragment - Interactions between fragments - Understanding the Intent Object - Using Intent Filters - Displaying Notifications.		
Unit - III	Android User Interface:	9
Understanding the Components of a Screen - Views and ViewGroups - FrameLayout - LinearLayout – TableLayout - RelativeLayout-FrameLayout – ScrollView - Utilizing the Action Bar - Adding Action Items to the Action Bar – Designing User Interface with Views: Using Basic Views - Picker Views - List Views.		
Unit - IV	Pictures, Menus and Content Providers:	9
Using Images to Display Pictures - ImageView view - ImageSwitcher - GridView- Using Menus with Views - Creating the Helper Methods - Options Menu - Context Menu - Using WebView - WebView - Content Providers: Sharing Data in Android - Using a Content Provider - Creating and Using Content Provider.		
Unit - V	Data Persistence:	9
Saving and Loading User Preferences - Accessing Preferences using an Activity - Programmatically Retrieving and Modifying the Preferences Values - Persisting Data to Files - Saving to Internal Storage - Saving to External Storage - Choosing the Best Storage Option - Creating and Using Databases- Creating the DBAdapter Helper class - Using the Database Programmatically.		

Total:45

TEXT BOOK:

1	J.F. DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, John Wiley & sons Inc., 2018.
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REFERENCES:

1	Murat Yener, Onur Dunder, "Expert Android Studio", John Wiley & son's Inc., 2017
2	John Horton, "Android Programming for Beginners", 2nd Edition, Packt Publishing Ltd, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explore the android studio environment and run the application using emulator.	Understanding (K2)
CO2	apply the activities, fragments and Intents in android applications.	Applying (K3)
CO3	design the application using views and view groups.	Applying (K3)
CO4	demonstrate the apps that handles images and menus.	Applying (K3)
CO5	implement the different data storage mechanisms.	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											1	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1									2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	30	40				100
CAT2	20	40	40				100
CAT3	30	30	40				100
ESE	20	30	50				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

(c) List of courses removed:

20BSE05 - SOFTWARE ARCHITECTURE

Programme& Branch	B.Sc – Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	20BCT35 – Software Engineering	VI	PE	3	0	0	3

Preamble	This course introduces the basics of software architecture and its importance. It focuses on architecture requirements, design, documenting , testing, implementation and governance	
Unit - I	Introduction:	9
Software Architecture-Structures and Views- Patterns-Good Architecture- Software Architecture Importance: Inhibiting System's Quality Attributes- Reasoning About and Managing Change- Predicting System Qualities- Enhancing Communication - Carrying Early Design Decisions- Defining Constraints - Influencing the Organizational Structure- Enabling Evolutionary Prototyping- Improving the Estimates- Supplying a Transferable, Reusable Model- Allowing Incorporation of Independent Components- Restricting the Vocabulary of Design Alternatives- Providing a Basis for Training		
Unit - II	Quality attributes:	9
Understanding Quality Attributes: Architecture and Requirements- Functionality- Quality Attribute Considerations- Specifying Quality Attribute Requirements- Achieving Quality Attributes through Tactics- Guiding Quality Design Decisions- Availability: Availability General Scenario- Tactics- Interoperability: Interoperability General Scenario- Tactics – Modifiability: Modifiability General Scenario-Tactics		
Unit - III	Architecture Requirements, Designing, Documenting:	9
Architecture and Requirements:Gathering ASRs from Requirements Documents-Gathering ASRs by Interviewing Stakeholders-Gathering ASRs by Understanding the Business Goals-Capturing ASRs in a Utility Tree-Tying the Methods Together-Designing an Architecture:Design Strategy- The Attribute-Driven Design Method- The Steps of ADD- Documenting Software Architectures: Uses and Audiences for Architecture Documentation- Notations- Views- Choosing the Views- Combining Views- Building the Documentation Package- Documenting Behavior- Architecture Documentation and Quality Attributes- Documenting Architectures-Documenting Architectures in an Agile development project		
Unit - IV	Architecture Implementation and Testing, Reconstruction and Conformance:	9
Architecture, Implementation, and Testing: Architecture and Implementation- Architecture and Testing- Architecture Reconstruction and Conformance: Architecture Reconstruction Process- Raw View Extraction- Database Construction- View Fusion- Architecture Analysis: Finding Violations- Guidelines		
Unit - V	Architecture Evaluation, Management and Governance:	9
Architecture Evaluation: Evaluation Factors- The Architecture Tradeoff Analysis method- Lightweight Architecture Evaluation- Management and Governance: Planning- Organizing-Implementing-Measuring- Governance		

Total:45

- | | |
|----|--|
| 1. | Bass Len, Clements Paul and Kazman Rick, "Software Architecture in Practice ", 3rd Edition, Pearson Education, 2012. |
|----|--|

TEXT BOOK:

REFERENCES:

- | | |
|----|--|
| 1. | Ian Sommerville, "Software Engineering", 10th Edition, Pearson Education, 2016. |
| 2. | Mark Richards, Neal Ford, "Fundamentals of Software Architecture An Engineering Approach", 1st Edition, O'Reilly Media, 2020 |

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	illustrate the basics of software architecture	Understanding (K2)
CO2	build the technical foundation to design an architecture and achieve particular quality attributes	Applying (K3)
CO3	construct systems using software architecture	Applying (K3)
CO4	solve two critical areas in system-building	Applying (K3)
CO5	explain the importance of architectural management and governance	Understanding (K2)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											1	2
CO2	2	3	1	1									1	2
CO3	3	2	1	1									2	3
CO4	3	2	1	1									2	3
CO5	3	2	1	1							1		2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom"s Taxonomy														

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	30	40	30				100
CAT3	30	50	20				100
ESE	20	50	30				100

* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

Annexure – IV

List of One / Two credit courses, on-line courses and syllabi, Transfer of credits from UGC and AICTE approved institutions and Credit transfer from foreign universities under R2020 (from the year 2021-22 onwards)

On-line courses and syllabi

noc22-cs28 **Data Science for Engineers**

By Prof. Ragnathan Rengasamy, Prof. Shankar Narasimhan | IIT Madras

Duration :	8 weeks
Start Date :	24 Jan 2022
End Date :	18 Mar 2022
Category :	<ul style="list-style-type: none">• Computer Science and Engineering• Data Science• Programming
Credit Points :	2
Level :	Undergraduate/Postgraduate

Learning Objectives :

1. Introduce R as a programming language
2. Introduce the mathematical foundations required for data science
3. Introduce the first level data science algorithms
4. Introduce a data analytics problem solving framework
5. Introduce a practical capstone case study

Learning Outcomes:

1. Describe a flow process for data science problems (Remembering)
2. Classify data science problems into standard typology (Comprehension)
3. Develop R codes for data science solutions (Application)
4. Correlate results to the solution approach followed (Analysis)
5. Assess the solution approach (Evaluation)
6. Construct use cases to validate approach and identify modifications required (Creating)

Course layout

Week 1: Course philosophy and introduction to R

Week 2: Linear algebra for data science

1. Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse)
2. Geometric view - vectors, distance, projections, eigenvalue decomposition

Week 3: Statistics (descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates)

Week 4: Optimization

Week 5: 1. Optimization

2. Typology of data science problems and a solution framework

Week 6: 1. Simple linear regression and verifying assumptions used in linear regression

2. Multivariate linear regression, model assessment, assessing importance of different variables, subset selection

Week 7: Classification using logistic regression

Week 8: Classification using kNN and k-means clustering

Books and references:

- INTRODUCTION TO LINEAR ALGEBRA - BY GILBERT STRANG
- APPLIED STATISTICS AND PROBABILITY FOR ENGINEERS – BY DOUGLAS MONTGOMERY

Course Link: https://onlinecourses.nptel.ac.in/noc22_cs28/preview

noc22-cs14
Compiler Design

By Prof. Santanu Chattopadhyay | IIT Kharagpur

Duration :	12 weeks
Start Date :	24 Jan 2022
End Date :	15 Apr 2022
Category :	<ul style="list-style-type: none">• Computer Science and Engineering• Systems
Credit Points :	3
Level :	Undergraduate

Compilers have become part and parcel of today's computer systems. They are responsible for making the user's computing requirements, specified as a piece of program, understandable to the underlying machine. These tools work as interface between the entities of two different domains – the human being and the machine. The actual process involved in this transformation is quite complex. Automata Theory provides the base of the course on which several automated tools can be designed to be used at various phases of a compiler. Advances in computer architecture, memory management and operating systems provide the compiler designer large number of options to try out for efficient code generation. This course on compiler design is to address all these issues, starting from the theoretical foundations to the architectural issues to automated tools. Being primarily targeted to a one-semester course for the undergraduate students, the course will follow the current GATE syllabus, enabling the students to prepare well for the same. It can also help all other participants looking for an introduction to the domain of compiler designs and code translators.

Course layout

Week 1 : Introduction

Week 2 : Lexical Analysis

Week 3 : Parsing – Part I

Week 4 : Parsing – Part II

Week 5 : Parsing – Part III

Week 6 : Syntax Directed Translation

Week 7 : Type Checking and Symbol Tables

Week 8 : Runtime Environment Management – Part I

Week 9 : Runtime Environment Management – Part II

Week 10 : Intermediate Code Generation – Part I

Week 11 : Intermediate Code Generation – Part II

Week 12 : Intermediate Code Generation – Part III

Books and references

1. Santanu Chattopadhyay, "Compiler Design", PHI Learning Pvt. Ltd., 2015.
2. A.V. Aho, R. Sethi, J.D. Ullman, "Compilers Principles, Techniques and Tools", Addison-Wesley, 1986.

Course Link: https://onlinecourses.nptel.ac.in/noc22_cs14/preview

noc22-cs30
Social Networks

By Prof. Sudarshan Iyengar, Prof. Yayati Gupta | IIT Ropar, Mahindra University, Hyderabad

Duration :	12 weeks
Start Date :	24 Jan 2022
End Date :	15 Apr 2022
Category :	<ul style="list-style-type: none">• Computer Science and Engineering
Credit Points :	3
Level :	Undergraduate

The world has become highly interconnected and hence more complex than ever before. We are surrounded by a multitude of networks in our daily life, for example, friendship networks, online social networks, world wide web, road networks etc. All these networks are today available online in the form of graphs which hold a whole lot of hidden information. They encompass surprising secrets which have been time and again revealed with the help of tools like graph theory, sociology, game theory etc. The study of these graphs and revelation of their properties with these tools have been termed as Social Network Analysis.

Course layout

Week 1: Introduction

Week 2: Handling Real-world Network Datasets

Week 3: Strength of Weak Ties

Week 4: Strong and Weak Relationships (Continued) & Homophily

Week 5: Homophily Continued and +Ve / -Ve Relationships

Week 6: Link Analysis

Week 7: Cascading Behaviour in Networks

Week 8: Link Analysis (Continued)

Week 9: Power Laws and Rich-Get-Richer Phenomena

Week 10: Power law (contd..) and Epidemics

Week 11: Small World Phenomenon

Week 12: Pseudocore (How to go viral on web)

Books and references

1. Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010 (available for free download).
2. Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.

Course Link: https://onlinecourses.nptel.ac.in/noc22_cs30/preview

noc22-hs59
Intellectual Property
By Prof. Feroz Ali | IIT Madras

Duration :	12 weeks
Start Date :	24 Jan 2022
End Date :	15 Apr 2022
Category :	<ul style="list-style-type: none">• Humanities and Social Sciences• Law• Faculty Domain - Advanced
Credit Points :	3
Level :	Undergraduate/Postgraduate

This is a substantive course on Intellectual Property. The course shall give a brief overview of the IP landscape in India. It shall also dwell into the role of IP in the modern intangible economy. The course can be offered as a generic elective subject under the Choice Based Credit System in universities and affiliated colleges as suggested by UGC.

Course layout

Week 1 : Basics of Intellectual Property
Week 2 : The Intangible Economy
Week 3 : Patents—From ball pens to biologics
Week 4 : Trade Marks—What does red soles and barbie girl mean?
Week 5 : Copyright—Is it right to copy?
Week 6 : Unconventional IP—The expanding scope
Week 7 : Enforcement of IP—Protecting your rights
Week 8 : IP for Business—A profit making asset class
Week 9 : IP, Research, and Universities
Week 10 : IP for the Creative and Entertainment Industries
Week 11 : Governments Role in Fostering IP
Week 12 : Teaching IP—Let everyone learn IP

Books and references

Lionel Bently & Brad Sherman, Intellectual Property Law (2014)

Course link: https://onlinecourses.nptel.ac.in/noc22_hs59/preview

noc22-cs42
An Introduction to Programming Through C++
By Prof. Abhiram G. Ranade | IIT Bombay

Duration :	12 weeks
Start Date :	24 Jan 2022
End Date :	15 Apr 2022
Category :	• Computer Science and Engineering, Programming
Credit Points :	3
Level :	Undergraduate

This course provides an introduction to problem solving and programming using the C++ programming language.

Course layout

Week 1: Introduction to computers using graphics. Notions of program organization, control flow. Introduction to a repeat macro statement and its use for drawing interesting pictures. Basics of computer hardware and how numbers and other information are represented and processed on computers.

Week 2: Basic data types. Variables. Assignment statement. Introduction to program design using examples such as summing infinite series. Introduction to coordinate based graphics and elementary animation. The repeat macro is used for looping.

Week 3-4: Statements of C++ for conditional execution and looping. Applications such as computing mathematical functions, root finding.

Week 5: Functions. Parameter passing. Pointers and references. Recursion basics.

Week 6: Recursive algorithms and recursive drawings. Breaking larger programs into functions. Passing functions as arguments to other functions.

Week 7: Arrays. Basic array processing strategies including passing arrays to functions. Pointers. Applications illustrating use of arrays to store sets and sequences. Iterating over pairs of objects from an array. Selection sort.

Week 8: Use of arrays to represent textual data. Multidimensional arrays. Command line arguments. Binary search. Mergesort.

Week 9: Structures. Pointers with structures. Structure examples. Basics of classes: member functions, constructors, operator overloading and access control.

Week 10: Dynamic memory allocation. Basic mechanisms and pitfalls. Design of a "String" class that has automated memory management. Copy constructors and destructors. Introduction to the standard library.

Week 11-12: Use of the standard library in designing programs. Design of medium size programs. A miniature program for marks and ranks display. A program for gravitational simulation. A program for designing and solving resistive circuits with a graphical user interface.

Text Book: Abhiram G. Ranade. 2018. An Introduction to Programming through C++ (1st ed.). McGraw Hill Education (India) Private Limited.

Course link: https://onlinecourses.nptel.ac.in/noc22_cs42/preview

Duration :	12 weeks
Start Date :	24 Jan 2022
End Date :	15 Apr 2022
Category :	<ul style="list-style-type: none"> Computer Science and Engineering
Credit Points :	3
Level :	Undergraduate/Postgraduate

With increase in the usage of the Internet, there has been an exponential increase in the use of online platforms. These platforms have changed our way of living, and information that we share with or consume from these platforms. However, widely used, there is a lack of understanding of privacy on these online platforms. It is critical to understand the threats and defend privacy through real-time and scalable systems. Since there are no logical boundaries for the online space, it is important to study the problem from an international perspective too.

Course layout

Week 1: Introduction; Various Privacy breaches, and its effects; Why Online privacy has become an important topic?; Privacy cases / litigations, and outcomes

Week 2: Definition & forms of Privacy; Difference between data security & data privacy; Trade-off between privacy and freedom of speech; Trade-off between privacy and utility; Contextual integrity theory and applications

Week 3: Privacy Attitudes & Awareness

Week 4: Social Media Privacy

Week 5: Social Media Privacy

Week 6: Data anonymity: K-anonymity, L-diversity, T-closeness, Differential privacy

Week 7: Image & Location privacy; Ethics about studying online privacy: Institutional Review Board / Ethics Committee; Conducting {User, Lab, and Online} Studies; Privacy from 3rd party trackers & advertisers

Week 8: Image & Location privacy; Ethics about studying online privacy: Institutional Review Board / Ethics Committee; Conducting {User, Lab, and Online} Studies; Privacy from 3rd party trackers & advertisers

Week 9: User behaviour & Usable privacy; Privacy in National projects like Aadhaar, NATGRID; Differential privacy in US census, Apple; PDP Bill / Srikrishna commission report / GDPR: Implications

Week 10: User behaviour & Usable privacy; Privacy in National projects like Aadhaar, NATGRID; Differential privacy in US census, Apple; PDP Bill / Srikrishna commission report / GDPR: Implications

Week 11: Privacy policies: Length, readability, legality, cost of reading privacy policies; Nutrition labels of Privacy policies: How to make the policies simple and user friendly

Week 12: Privacy policies: Length, readability, legality, cost of reading privacy policies; Nutrition labels of Privacy policies: How to make the policies simple and user friendly

Course link: https://onlinecourses.nptel.ac.in/noc22_cs37/preview

Integral and Vector Calculus

By Prof. Hari Shankar Mahato | IIT Kharagpur

Duration :	12 weeks
Start Date :	24 Jan 2022
End Date :	15 Apr 2022
Category :	<ul style="list-style-type: none"> Mathematics
Credit Points :	3
Level :	Undergraduate

This course will offer a detailed introduction to integral and vector calculus.

Course layout

Week 1 : Partition, concept of Riemann integral, properties of Riemann integrable functions, anti-derivatives, Fundamental theorem of Integral calculus, mean value theorems.

Week 2 : Reduction formula and derivation of different types of formula, improper integrals and their convergence, tests of convergence.

Week 3 : Beta and Gamma function, their properties, differentiation under the integral sign, Leibnitz rule.

Week 4 : Double integrals. change of order of integration, Jacobian transformations, triple integrals.

Week 5 : Area of plane regions, rectification, surface integrals.

Week 6 : Volume integrals, center of gravity and moment of Inertia.

Week 7 : Collection of vector algebra results, scalar and vector fields, level surfaces, limit, continuity, differentiability of vector functions

Week 8 : Curves, Arc-length, partial derivative of vector function, directional derivative gradient, divergence and curl.

Week 9 : Irrotational, conservative and Solenoidal fields, tangent, normal, binormal, Serret-Frenet formula.

Week 10 : Application of vector calculus in mechanics, lines, surface and volume integrals. line integrals independent of path.

Week 11 : The divergence theorem of Gauss, Stokes theorem, and Green's theorem.

Week 12 : Integral definition of gradient, divergence and curl. revision of problems from Integral and Vector calculus.

Books and references

Differential and Integral Calculus by N. Piskunov.2. Integral Calculus by Shanti Narayan and P.K. Mittal.3. Principles of Mathematical Analysis by W. Rudin4. Real Analysis by S.K. Mapa5. Advanced Engineering Mathematics, 9th edition by E. Kreyszig6. Vector Analysis by Ghosh and Maity7. An Introduction to Vector Analysis: For Physicists and Engineers by B. Hague8. Vector Analysis by H.E.Newell, Jr.

Course link: https://onlinecourses.nptel.ac.in/noc22_ma03/preview

noc22-mg50
International Marketing
By Prof. Dr Biswarup Ghosh | IIT Kharagpur

Duration :	8 weeks
Start Date :	21 Feb 2022
End Date :	15 Apr 2022
Exam Date :	24 Apr 2022 IST
Enrollment Ends :	21 Feb 2022
Category :	<ul style="list-style-type: none">• Management Studies• Marketing
Credit Points :	2
Level :	Postgraduate

International Marketing course for practicing Managers working in International Markets, MBA Students. This course will provide basic theories of Internal Business, various types of entry strategies to International Market, understanding risk associated with expansion & risk mitigation plans, understanding cultural differences while strategizing International expansion , import export procedures, various modes of payment mechanisms.

Course layout

Week 1: Introduction to International Business, EPRG Framework, Driving forces of International Marketing, Restraining forces of International Marketing, Challenges, Factors encouraging standardization, Adaption, Relevant macroeconomic terms (GDP, GNP, BoP, BoT, etc.), Foreign exchange rates, exchange rate determination, and exchange rate regimes.

Week 2: Export Marketing (Indirect & Direct Exports), Theories of International Trade, Internationalization Theories for Entry Modes.

Week 3: Cultural Dimensions -Tools & Techniques, Cross-cultural sales negotiations, Implications of Hofstede's Work.

Week 4: Concepts of Import & Export Processes, Methods of payments Bill of Exchange, Letter of Credits, INCO Terms, Trade Barriers, Customs House agents, Bill of Entry.

Week 5: Designing a global marketing programme - Concept of Marketing Mix , Product Mix, Standardization & Adaption of the International Marketing Mix, Product Classifications, Customer Value Hierarchy, Pricing decisions Distribution Decisions, Communication Decisions

Week 6: International Business Case analysis & probable solutions – Study of two different case studies –Direct Entry Strategy , Make or Buy decision.

Week 7: Session 1 & Session 2: Live interaction with Practicing Managers dealing with large International Markets. Learning from their vast experience of International Business Expansion across the globe

Week 8: Session 3 Live interaction with Practicing Manager dealing with large International Markets. & Conclusion session

Books and references

Cateora, P. R., Meyer, R. B. M. F., Gilly, M. C., & Graham, J. L. (2015). International marketing. McGraw-Hill Education.

Course link: https://onlinecourses.nptel.ac.in/noc22_mg50/preview

Introduction to augmented reality using UNITY game engine

L	T	P	Credit
2	0	2	1

Preamble	To impart the basic knowledge of augmented reality and implement using unity.		
Unit - I	Introduction to Augmented Reality:		6
Introduction - Augmented reality – How it differs from Virtual Reality - Types of Augmented Reality - Applications in various Industries - Latency Issues in Augmented Reality Displays - Displays - Augmented Reality: Marker vs. Marker less - User Interfaces in Augmented Reality Systems.			
Unit - II	Basics of Unity Game Engine:		6
Importing packages inside Unity - Samples - Capturing an Image – AR Image tracking and uploading Image Targets – How user experience changes with device – Cross platform experience - Testing the output on an Android smartphone – Career opportunities in Unity.			

List of Exercises / Experiments:

1.	Basics of Unity -Understanding different panels in Unity
2.	Moving, rotating & scaling Gameobjects in Unity
3.	Game Panel in Unity - Physics in Unity
4.	Increasing the light intensity
5.	Adding colors to Gameobject
6.	Adding textures to Gameobject
7.	Parent and child Gameobjects in Unity
8.	Local/Global and Pivot/Center tools in Unity
9.	Prefabs in Unity.
10.	Script for rotating and revolving the spheres

Lecture:12, Practical:18, Total: 30

REFERENCES:

1.	Jon Peddie, “Augmented Reality”, 1 st Edition, Springer International Publishing, Switzerland,2017
2.	Jesse Glover, Pablo Farias Navarro, Tim Bonzon , “Unity for human beings”, 1 st Edition , Zenva Pty Ltd ,Australia,2021
3.	https://www.udemy.com/course/develop-augmented-reality-book-ar-business-card-with-unity/

COURSE OUTCOMES:

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	outline user interface, hardware and software components for augmented reality	Understanding (K2)
CO2	demonstrate basics of unity game engine, importing 3D models and textures.	Applying (K3)
CO3	develop an application using unity game engine	Applying (K3) Manipulation(S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1	3						2		2	3
CO3	3	2	1	1	3						2		2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

ASSESSMENT PATTERN

Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
Assessment1 (60 marks)*	30	60	10				100
Assessment2 (40 marks)*			70			30	100

* As per the approval

INTRODUCTION TO GITHUB

		L	T	P	Cred it
		2	0	2	1
Preamble	Git provides distributed software project management and access control mechanism. GitHub enables static web hosting services which provides public repository for learning community.				
Unit - I	Introduction to Version Control and Git				5
DevOps and Git - Installation -The Git Command Line – Creating an Initial Repository – Adding a file to your repository – Configuring the commit author – Making another commit – Viewing your commits – Viewing commit differences – Removing and renaming files in your repository – Making a copy of your repository – Configuration Files – Create remote repository – Push to remote repository. Gits graph model – Git IDs – Git References – Branches – Merging – Resolving merge conflicts – Merge strategies -Tracking branches					
Unit - II	Git and GitHub				5
Fetch, Pull and Push –Rebasing – Rewriting history - Diff's -Pull request – Git workflows – Publishing repositories – Repository structure – Living with distributed development – Knowing your Place – Working with multiple Repositories – Patches – Hooks – Using Git with Subversion Repositories – Git and GitHub					

List of Exercises / Experiments:

1.	Experiment on basic Git Commands
2.	Creating Git local repository and adding files to it
3.	Creating remote repository - GitHub
4.	Synchronization of local repository and remote repository
5.	Experiment on creating branches and merging branches
6.	Experiment on merge conflicts and resolution
7.	Experiment on Fetch, Pull, Clone and rebasing on repositories
8.	Working with multiple repositories and configuration files
9.	Working with Patches and Hooks
10.	Experiment on Git graph models and version tracking
11.	Subversion
12.	Combining projects

Lecture:10, Practical:20, Total: 30

REFERENCES:

1	Jon Loeliger and Matthew McCullough, “Version control with Git”, 2nd Edition, O’Reilly USA, 2012.
2	Alex Magana and Joseph Muli, “Version control with Git and GitHub”, 1st Edition, Packt Publishing, 2018.

COURSE OUTCOMES:

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	Outline the need for Git repository	Understanding (K2)
CO2	Create personalized Git repository for their applications	Applying (K3)
CO3	Implement version controlling using Git	Applying (K3)

Mapping of COs with POs and PSOs

COs/POs	P01	P02	P03	P04	P05	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	3	2	1	1	2				1	1	1	1		
CO3	3	2	1	1	2				1	1	1	1		

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom’s Taxonomy

ASSESSMENT PATTERN

Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
Assessment 1 (MCQ -50)	20	40	40				100

marks)							
Assessment 2 (Miniproject - 50 marks)		40	60				100

PROGRAMMING WITH GOLANG

L	T	P	Credit
2	0	2	1

Preamble	This course provides an introduction to Go language basic data types, functions, arrays, pointers, maps, strings and implements concurrency model to demonstrate parallel execution.		
Unit - I	Fundamentals of Golang:		8
Overview of Golang - Environment Setup- Variables- Constants - Data Types - Operators - Decision Making - Loops – Arrays – Slices - Sorting – Functions - Recursion			
Unit - II	Strings and Packages:		7
Strings - Structures - Pointers- Go Rune - Go Reflect - Maps - Interfaces - Packages - Go Time - Go Error – Go defer, panic and recover – Concurrency - Go routines, Go Race, Go Mutex			

List of Exercises / Experiments:

1.	Create a Hello World application using Go Programming.
2.	Write a Go program to check whether the given number is odd or even.
3.	Create a simple calculator application using operators.
4.	Write a program to check whether a given number is palindrome or not in Golang.
5.	Write a program to check whether a given number is Armstrong number or not in Golang.
6.	Create a simple application to find the factorial of a given number.
7.	Write a program to shift all zeros to the end of array in Golang.
8.	Write a program to perform swapping of two numbers using call by reference.
9.	Write a program to generate Fibonacci series in go using recursive function.
10.	Write a program to sort the given numbers in ascending order using slices in Golang.
11.	Write a Go program to demonstrate various string methods.
12.	Write a Go program to demonstrate the map functions.
13.	Create area calculation of different shapes application using Interfaces.
14.	Write a Go program to demonstrate the built-in functions in Time package.
15.	Illustration of the Dining Philosophers problem in Golang.

Lecture:15, Practical:15, Total: 30

REFERENCES:

1.	Caleb Doxsey, "Introducing Go", 1 st Edition, O'Reilly Publication, New York, 2016.
2.	Alan A. A. Donovan, Brian W. Kemighan, "The Go Programming Language", 1 st Edition, Pearson Education, Indiana, 2015.
3.	William Kennedy, Brian Ketelsen, Erik Saint Martin, "Go in Action", 1 st Edition, Manning Publications, USA, 2015.

COURSE OUTCOMES:

On completion of the course, the students will be able to

		BT Mapped (Highest Level)
CO1	demonstrate data types, control structures, arrays and functions with simple application	Applying (K3)
CO2	implement basic applications using strings, structures, packages and interfaces	Applying (K3)
CO3	apply Reflect, Rune, Map and Concurrency for a real world application	Applying (K3), Manipulation (S2)

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1					2	3	3	2	1	1
CO2	3	2	1	1					2	3	3	2	1	1
CO3	3	2	1	1					2	3	3	2	1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
MCQ – 30 marks	20	30	50				100
Programming Test - 50 marks	20	30	50				100
Assignment – 20 marks	20	30	50				100

INTRODUCTION TO MATLAB PROGRAMMING

L	T	P	Credit
2	0	2	1

Preamble	This course provides an introduction to MATLAB commands, arrays, matrices and functions. It also explains the basic commands and functions in MATLAB suitable for the applications like Image Processing, Machine Learning and Deep Learning.		
Unit - I	Fundamentals of MATLAB:		8
Overview of the MATLAB - Commands - Data types and operators - Loops and Conditional Statements - Vectors and Matrices - Indexing into and Modifying Arrays - Array Calculations - Calling Functions - Importing Data from table - Plotting Data - Data organization - Data Pre-processing - Common data analysis techniques - MATLAB documentation - Troubleshooting the code.			
Unit - II	Applications of MATLAB:		7
Image Processing: Introduction – Working with Images in MATLAB – Segmenting an Image – Pre and Post Processing techniques – Classification and Batch Processing. Machine Learning: Overview – Classification Workflow – Importing and pre-processing Data – Engineering features – Classification models.			

List of Exercises / Experiments:

1.	Demonstration of MATLAB environment.
2.	Experiment with basic MATLAB commands in Live Editor for the following constructs a) Operators b) Datatypes c) Conditional and Loops
3.	Demonstrate the various vector operations.
4.	Construct a MATLAB code to implement following operations on matrix a) Create b) Concatenate c) Expand
5.	Write a MATLAB code to remove a row and column in a matrix.
6.	Perform the following operations on given array: a) Indexing b) Reshaping c) Transposing and Flipping d) Shifting and Rotating e) Sorting
7.	Illustration of calling functions in MATLAB
8.	Construct a sample data and create 2D and 3D plot for the same data.
9.	Perform the following operations in an image: a) Reading the image b) Displaying the image c) Conversion between image types
10.	Implementation of Edge detection techniques in MATLAB.
11.	Build a simple model to perform classification task using MATLAB.
12.	Train and use machine learning models to make predictions using MATLAB.

Lecture: 15, Practical: 15, Total: 30

REFERENCES:

1.	Holly Moore, "MATLAB for Engineers", Third Edition, Pearson Publications, 2012.
2.	Stephen J. Chapman, "MATLAB Programming for Engineers", Fourth Edition, Thomson learning, 2008.
3.	https://in.mathworks.com/help/releases/R2021a/matlab/index.html

COURSE OUTCOMES:

On completion of the course, the students will be able to

	BT Mapped (Highest Level)
CO1 demonstrate the basic commands and functions in MATLAB	Applying (K3)
CO2 implement basic applications in Image processing	Applying (K3)
CO3 apply MATLAB functions to implement Machine learning techniques.	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1					2	3	3	2	1	1
CO2	3	2	1	1					2	3	3	2	1	1
CO3	3	2	1	1					2	3	3	2	1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

ASSESSMENT PATTERN							
Test / Bloom's Category	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
MCQ – 30 marks	20	30	50				100
Programming Test - 50 marks	20	30	50				100
Assignment – 20 marks	20	30	50				100

Natural Language Processing with Python

L	T	P	Credit
2	0	2	1

Preamble	This course introduces the essentials of Natural Language Processing. It also demonstrates the classification of texts using Machine Learning algorithms.		
Unit - I	Introduction to Natural Language Processing and Pre-processing of Text:		5
Natural Language Processing (NLP) in Text Mining - Reading, Writing to text and word files - Setting the NLTK Environment- Accessing the NLTK Corpora - Tokenization - Frequency Distribution - Different Types of Tokenizers - Bigrams, Trigrams and Ngrams – Stemming – Lemmatization – Stopwords - POS Tagging.			
Unit - II	Analyzing Sentence Structure:		4
Syntax Trees – Chunking – Chinking - Named Entity Recognition - Context Free Grammars - Automating Text Paraphrasing.			
Unit - III	Text Classification:		6
Bag of Words - Count Vectorizer - Term Frequency (TF) - Inverse Document Frequency (IDF) - Converting text to features and labels - Multinomial Naive Bayes Classifier - Leveraging Confusion Matrix.			

List of Exercises / Experiments:

1.	Implement Tokenization of Text using Regex and create Bigram, Trigram & N – gram models
2.	Implementation of Stopword Removal and POS Tagging.
3.	Implementation of Chunking, Chinking and Named Entity Recognition (NER)
4.	Demonstrate Bag of Words Approach
5.	Implement the working of CountVectorizer() function
6.	Demonstrate Term Frequency – Inverse Document Frequency (TF-IDF)
7.	Demonstrate converting text to features and labels
8.	Demonstrate text classification using Multinomial NaiveBayes Classifier

Lecture:15, Practical:15, Total: 30

REFERENCES:

1.	Dipanjan Sarkar, "Text Analytics with Python: A Practitioner's Guide to Natural Language", Apress; 2nd edition, 2019.
2.	Steven Bird, "Natural Language Processing with Python", O'Reilly Media, 1st edition, 2009.

COURSE OUTCOMES:		BT Mapped (Highest Level)
On completion of the course, the students will be able to		
CO1	apply the ways of text extraction and cleaning using NLTK.	Applying (K3)
CO2	experiment with a sentence structure using a group of words to create phrases and sentences using NLP and the rules of English grammar	Applying (K3)
CO3	apply a Machine Learning classifier for text classification	Applying (K3)

Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									2	3
CO2	3	2	1	1									2	3
CO3	3	2	1	1									3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy														

ASSESSMENT PATTERN							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
Assessment1 (50 marks)*	20	40	40				100
Assessment2 (50 marks)*	20	40	40				100

* As per the approval