External BoS Members:

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APPROVED BY	DATE
BOS	10.07.2024
Academic Council	18.07.2024
Board of Management	07.08.2024
Governing Body	25.11.2024

GNSU Handbook

of

BCA with Specialization in Data Science and Artificial Intelligence in collaboration with IBM

3-Years Programme

AY-2024-25

August-2024

Prof.(Dr.) Nabendu Chaki Prof.(Dr.) T.V. Rajnikanth Dr.K.L. Ambashtha Dr.Ajay Kumar Dr.Rajkumar Mandal Prof.(Dr.)Arunava De
Chairman (BoS)

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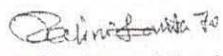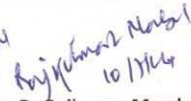
1.1	**Program Educational Objectives:** PEO1: To facilitate in development of strong basic fundamentals of Computer Applications towards beginning a professional career in industry PEO2: To develop programming skills in learners by using fundamental knowledge of computer science PEO3: To apply new designs and solutions to complex real-life problems using existing and/or novel technologies. PEO4: Be effective and inspiring leader for fellow professionals and face the challenges of the rapidly changing multi-dimensional, contemporary world
1.2	**Program Outcomes-** PO 1. **Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. PO 2. **Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology. PO 3. **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings. PO 4. **Effective Citizenship**: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering. PO 5. **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them. PO 6. **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development. PO 7. **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes PO 8. **Innovation and Entrepreneurship**: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.
1.3	**Program Specific Outcomes-** PSO 1. **Knowledge of Computing Systems:** An ability to understand the principles and working of computer systems. PSO 2. **Project Development Skills:** An ability to understand the structure and development methodologies of software systems. PSO 3. **Software Development Skills:** Familiarity and practical competence with a broad range of programming language and open-source platforms. PSO 4. **Mathematical Skills:** An ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable algorithm.
1.4	**Teaching and Learning Process:** The whole process/system for Teaching and Learning Quality Improvement is shown below. The Academic Calendar of the Faculty of Information Technology is based on Syllabus prescribed by the University. The calendar of events of the academic calendar incorporates various industrial visits, guest lectures, technical competitions and short-term courses. The calendar of events is incorporated in framing the Timetable.

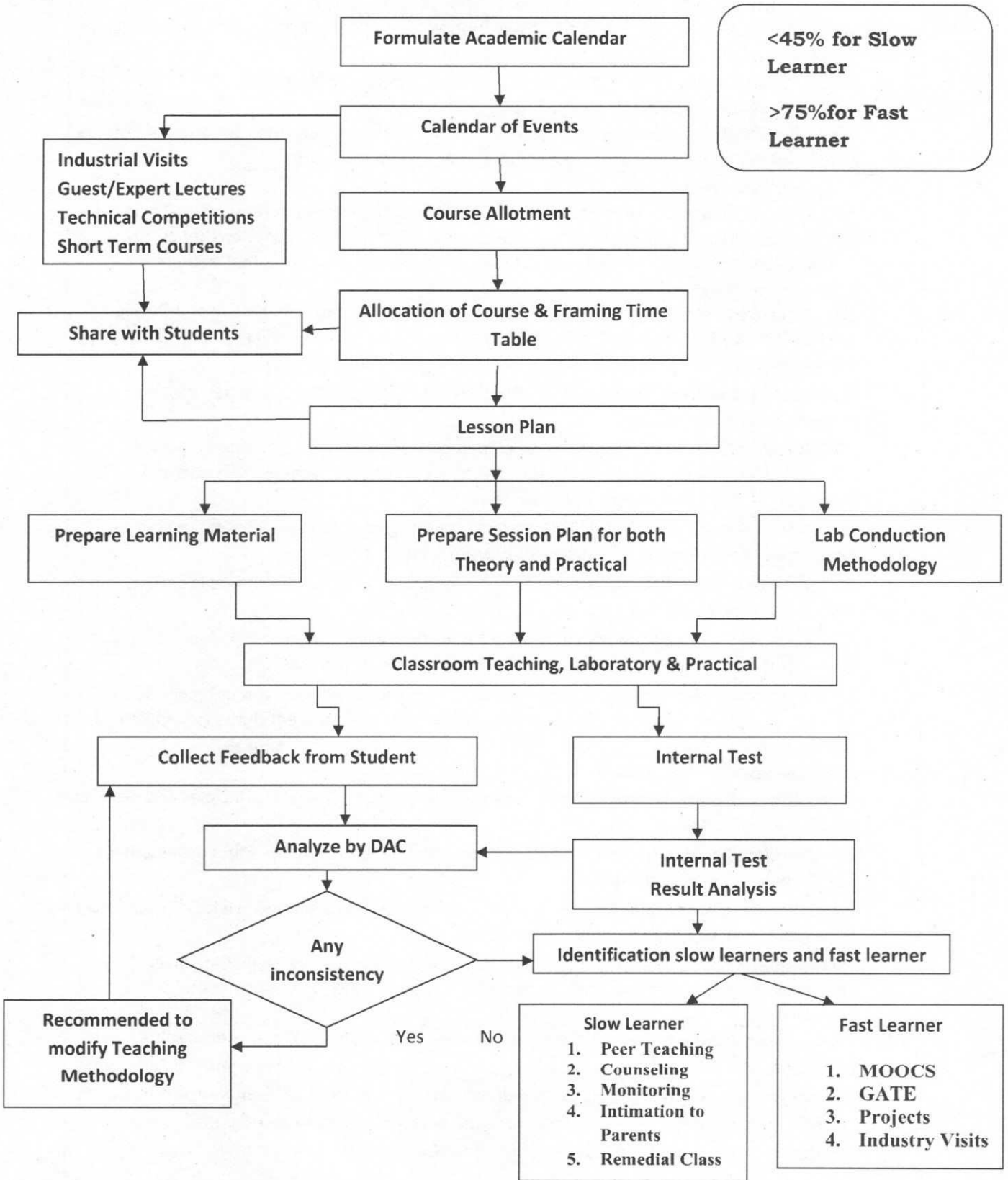Prof.(Dr.) Nabendu Chaki   Prof.(Dr.) T.V. Rajnikanth   Dr.K.L. Ambashtha   Dr.Ajay Kumar   Dr.Rajkumar Mandal   Prof.(Dr.)Arunava De
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1.5	Teaching Learning Process- Flowchart

Formulate Academic Calendar

<45% for Slow Learner

>75%for Fast Learner

Calendar of Events

Industrial Visits
Guest/Expert Lectures
Technical Competitions
Short Term Courses

Course Allotment

Allocation of Course & Framing Time Table

Share with Students

Lesson Plan

Prepare Learning Material

Prepare Session Plan for both Theory and Practical

Lab Conduction Methodology

Classroom Teaching, Laboratory & Practical

Collect Feedback from Student

Internal Test

Analyze by DAC

Internal Test Result Analysis

Any inconsistency

Identification slow learners and fast learner

Recommended to modify Teaching Methodology

Yes   No

Slow Learner
1. Peer Teaching
2. Counseling
3. Monitoring
4. Intimation to Parents
5. Remedial Class

Fast Learner
1. MOOCS
2. GATE
3. Projects
4. Industry Visits

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The academic calendar events and time table are shared with the students. The faculty prepares the lesson plan for the allotted subject. For better delivery of teaching learning process, the faculty prepares the course plan and learning methodology for the allotted subject.

The faculty conducts the classes as per the lecture and course plan. Online feedback from the students are collected and analysed by the Departmental Academic committee (DAC). If any inconsistencies are found by DAC in the teaching learning process, the concerned faculty are advised to modify the teaching methodology and also attend Faculty development programmes.

Two internal assessments are conducted for a particular subject per semester. The attainment of COs are analysed for taking remedial actions. **Remedial actions** include identification of **slow, and fast learners.**

For the **slow learners (≤45% marks in class test)** the following methods of improvement are adopted- Peer teaching, Counselling, mentoring, intimation to parents and conducting extra classes.

Fast learners (>75% marks in class test) are motivated to continue the achieve excellency and they are encouraged to participate in co-curricular and extra-curricular activities.

2	**Admission Guidelines.** **Eligibility Criteria** A candidate shall be eligible for appearing in the Entrance Test leading to admission to BCA(Bachelor of Computer Applications) Semester I, if he/she has passed the following:

Admission to 3-Year programme **BCA with Specialization in Data Science and Artificial Intelligence in collaboration with IBM**	45% marks or equivalent grade in "10+2" examination (any discipline) from any recognized board preferably Mathematics/ any subject in Computer Science. OR A pass in diploma in Commercial Practice or equivalent (The University will offer suitable bridge courses such as Mathematics etc., forthe students coming from diverse backgrounds to prepare Level playing field and desired learning outcomes of the programme

3	**BCA - with Specialization in Data Science and Artificial Intelligence in collaboration with IBM (3 Years-6 Semester) guidelines:**

    a. Admission in BCA(DS & AI), I-Semester programme of study shall be made on merit in **the Entrance** Test.

    b. The Faculty shall have an Admission Committee for BCA undergraduate admission, constituted under the provisions of Ordinances and consisting of the Dean or his nominee and two senior-most members of the teaching staff of the Faculty. Admission shall be made in accordance with these ordinances and the rules made there under.

    c. Admission cannot, however, be claimed by any candidate as a matter of right. The admission or re-admission of a candidate shall be entirely at the discretion of the Admission Committee

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which may refuse to admit any student without assigning anyreason there for.

d. On his/her selection for admission to the BCA(DS&AI) Semester I programme, the candidate shall, within the time fixed by the Dean, Faculty of Information Technology and Engineering deposit the fees prescribed for the programme. If the candidate fails to deposit fees within the stipulated time, his/her selection shall automatically stand cancelled.

e. Reservation in admission will be made as Govt. of Bihar rules

Intake

Course	Intake
BCA(DS & AI) **(3-years,6 Semesters)**	60

Documents Required
- Scanned copies of academic details.
- Scanned passport size photograph of the candidate in JPG/JPEG format
- Scanned clear signature of the candidate in JPG/JPEG format
- A valid e-mail ID.
- Scanned copies of Category certificate, PwD certificate, if applicable.
- Migration certificate
- Transfer certificate
- Character certificate
- **Other documents if any

Academic Calendar - Each academic session is divided into two semesters of approximately an Odd semester (July- December) and Even semester (January-June).

4.

MOOCS & MAR (Mandatory Additional Requirements) guidelines-

Mandatory Additional Requirement (MAR) for earning BCA-DS&AI degree will be incorporated which would be effective from the upcoming semester (ODD-2024-25). 1st Year starting from the academic year-2024-25 onwards BCA(DS & AI), minimum points to be earned for earning Degree will be 75. Each academic year 25 points have to be earned.

- MAR points for MOOCs courses already part of syllabus will also not be applicable.
- Any MOOCS already done or registered before the introduction of MAR system is not to be considered again for awarding activity points for MAR. Those courses should not be taken into consideration with retrospective effect.
- A student can also select MOOCs from the MOOCs basket/repository as designed by the Faculty of IT and Engineering for earning activity points for MAR. There should not be any overlapping of MOOCs with regard to MAR.
- If any student is unable to get certificate from MOOCs platform after auditing the course, the Faculty of IT and Engineering will extend facility for awarding point after evaluation in consultation with the University.
- In addition to SWAYAM/NPTEL/Coursera the names of all available MOOCs can be included. At present, SWAYAM/NPTEL/Coursera have only been mentioned.
- MOOCs Basket and Online Certification portals will be notified by the Faculty of IT & Engineering at the start of the semester/Academic Year.
- Every student has to compulsorily attain minimum qualifying MAR marks and submit the MAR certificates/ documents to their concerned Mentors.
- Mentors have to advise the Mentee students regarding the MAR rules, regulations and guidelines as applicable from time to time and motivate the students accordingly.

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- Mentors (Faculty) will have to collect the MAR Document (against each MAR activity) of each student in scanned Soft and Hard copy and submit it to the Examination cell before the completion of the even semester (i.e. end of Academic Year).
- Reasoning and Aptitude classes will be conducted in the Faculty of IT and Engineering in 3rd ,4th ,5th Semesters of BCA(DS & AI)
- All the 5th Semester students are expected to appear for TCS-NQT.
- **For students of pre-final year (Even Sem) BCA**(DS & AI), for Reasoning and Aptitude marks (Compulsory in nature) are to be earned via - *Online certifications namely Coursera/any other (*as notified by the Faculty of IT at the start of the semester*)*. Completion certificates have to be produced as a valid proof for giving MAR points. If any student is unable to get certificate from online platform, the Faculty of IT and Engineering will extend facility for awarding points after evaluation in consultation with the University. Regular Reasoning & Aptitude classes will be conducted in the department for training the students in pre-final and final year of BCA(DS&AI).
- For final year students of (ODD Sem) BCA(DS & AI), Online certification(TCS NQT test will be preferable). TCS-NQT score will be valid and will earn points for MAR Grades.
- Minimum MAR points have to be compulsorily earned for completion of the Degree. If MAR documents are not submitted then the result of the even semester will be withheld.
- Digital versions of all certificates regarding MAR should be uploaded in the Examination portal. A provision for it may be created in online Examination portal.
- MAR points will be displayed in the marksheet of the Even Semester (only) i.e. Academic Year once. e.g. Minimum Marks-25, Maximum Marks Scored-XXX
- Once a student attains the Maximum score in a particular activity, the activity gets blocked, i.e. no further score is allowed in that particular activity in further semesters.
- The mentors are required to maintain a list of activities completed with scores for each student under them.
- The Faculty of IT and Engineering is also pleased to introduce new activities as part of MAR, which would encourage entrepreneurship ability of the students.
- **MAR activities listed in Annexure-1.**

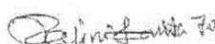| 5.	**General Course Structure & Theme-**

5.1 Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

5.2. Range of Credits: Credit Requirements: The candidates shall complete courses equivalent to a minimum of

➢ **142 credits** to become eligible for the **Bachelor in Computer Applications**(DS & AI) **Degree**(3-Years,6 semesters) co-branded with **IBM**

5.3 Course level coding scheme: Three-digit number (odd numbers are for the odd semester courses and even numbers are for even semester courses) used as suffix withthe Course Code for identifying the
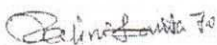
level of the course. Digit at hundred's place signifiesthe year in which course is offered.

e.g. 101, 102 ... etc. for first year. 201, 202 .... etc. for second year.301, 302 ... for third year.

Sessional (Project, Seminar, etc) e.g. BC24-SEC-681..i.e 6-Sixth Sem, 8-Project/Sessional, 1- sequence.

Laboratory- BC24-AEC-192..i.e 6-Sixth Sem,9-Laboratory, 1- sequence

Total credit for BCA(DS&AI) (3 Years) to be awarded- 142

5.4 Mandatory Induction Program: The Essence and Details of Induction program can also be understood from the 'Detailed Guide on Student Induction program', as available on AICTE Portal, (Link: https://www.aicteindia.org/sites/default/files/Detailed%20Guide%20on%20Student

%20Induction%20program.pdf).

Induction program(mandatory)	Three-week duration
Induction program for students to be offered right at the start of the first year.	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch &Innovations

5.5 Credit Distribution:

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
CC	Core Courses
AEC	Ability Enhancement Courses
MDE	Multi-Disciplinary Elective course
VAC	Value added Courses
SEC	Skill Enhancement courses
DSE	Discipline Specific Elective
OE	Open Elective

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Semester	Core Courses	Ability Enhancement Courses	Multi-Disciplinary Elective course	Value added Courses	Skill Enhancement courses	Discipline Specific Elec-tive	Total
I	6	14	-	-	-	-	20
II	6	22	-	-	-	-	28
III	20	4	-	-	-	-	24
IV	12	-	-	4	6	-	22
V	22	-	-	-	-	4	26
VI	4	-	4	4	6	4	22
Credits	70	40	4	8	12	8	Total-142

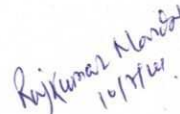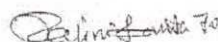Prof.(Dr.) Nabendu Chaki   Prof.(Dr.) T.V. Rajnikanth   Dr.K.L. Ambashtha   Dr.Ajay Kumar   Dr.Rajkumar Mandal   Prof.(Dr.)Arunava De
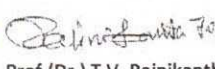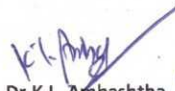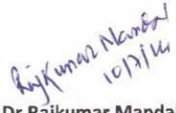Chairman (BoS)

6 | **Semester-wise subject structure of B.C.A** (DS & AI) **(3 years-6 semesters)**

		1st Semester-Theory					Credit
1	BC24-AEC-101	Digital Electronics	3	1	0	4	
2	BC24-AEC-102	Software Foundation and Programming (with C)	3	1	0	4	
3	BC24-AEC-103	Mathematics for Data-Science	3	1	0	4	
4	BC24-CC-101	Data Visualization	3	1	0	4	20
		1st Semester-Laboratory					
5	BC24-AEC-192	Software Foundation and Programming (with C) Lab	0	0	4	2	
6	BC24-CC-191	Data Visualization laboratory	0	0	4	2	
		2nd Semester-Theory					
1	BC24-AEC-201	Computer Architecture & Organization	3	1	0	4	
2	BC24-CC-201	Data Structures using C	3	1	0	4	
3	BC24-AEC-202	English Language and Communication	3	1	0	4	
4	BC24-AEC-203	Front End Development	3	1	0	4	28
5	BC24-AEC-204	Programming with Java	3	1	0	4	
		2nd Semester-Laboratory					
6	BC24-CC-291	Data Structures using C Laboratory	0	0	4	2	
7	BC24-AEC-292	Business Presentation and Language Laboratory	0	0	4	2	
8	BC24-AEC-293	Front End Development laboratory	0	0	4	2	
9	BC24-AEC-294	Programming with Java Laboratory	0	0	4	2	
		3rd Semester Theory					
1	BC24-CC-301	Software Engineering	3	1	0	4	
2	BC24-CC-302	Operating Systems	3	1	0	4	
3	BC24-AEC-301	Management and Accounting,	3	1	0	4	
4	BC24-CC-303	Predictive Analytics Modeler	3	1	0	4	24
5	BC24-CC-304	Programming with Python	3	1	0	4	
		3rd Semester Laboratory					
6	BC24-CC-393	Predictive Analytics Modeler Laboratory	0	0	4	2	
7	BC24-CC-394	Programming with Python Laboratory	0	0	4	2	
		4th Semester Theory					
1	BC24-CC-401	Database Management Systems	3	1	0	4	
2	BC24-VAC-401	Values and Ethics in Profession	3	1	0	4	
3	BC24-SEC-401	Spark and Scala	3	1	0	4	
4	BC24-CC-402	Cloud Fundamentals	3	1	0	4	22
		4th Semester Laboratory					
5	BC24-CC-491	Database Management Systems laboratory	0	0	4	2	
6	BC24-SEC-491	Spark and Scala Laboratory	0	0	4	2	
7	BC24-CC-492	Cloud Fundamentals Laboratory	0	0	4	2	
		5th Semester Theory					
1	BC24-CC-501	Computer Networks	3	1	0	4	
2	BC24-CC-502	Design and Analysis of Algorithms	3	1	0	4	
3	BC24-CC-503	Data Science	3	1	0	4	
4	BC24-CC-504	Artificial Intelligence	3	1	0	4	26
5	BC24-DSE-501A/B/C	Elective-1	3	1	0	4	

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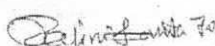
		5th Semester Laboratory				
6	BC24-CC-591	Computer Networks laboratory	0	0	4	2
7	BC24-CC-593	Data Science Laboratory	0	0	4	2
8	BC24-CC-594	Artificial Intelligence Laboratory	0	0	4	2
		6th Semester Theory				
1	BC24-VAC-601	Environment and Ecology	3	1	0	4	
2	BC24-CC-601	Deep Learning (Application Building using AI)	3	1	0	4	
3	BC24-DSE-601 A/B/C	MOOCs-Electives preferably be opted from the NPTEL/SWAYAM Platform*.	3	1	0	4	
4	BC24-MDE-601A/B/C	MOOCs- Electives preferably be opted from the NPTEL/SWAYAM Platform*.	3	1	0	4	22
		6th Semester Laboratory					
5	BC24-SEC-681	Project- Deep Learning (Application Building using AI)	0	0	12	6	
		List of Electives in the 5th and 6th Sem BCA				
	BC24-DSE-501A	Image Processing	3	1	0	4
	BC24-DSE-501B	Pattern Recognition	3	1	0	4
	BC24-DSE-501C	Compiler Design	3	1	0	4
	BC24-DSE-601A/B/C	MOOCs basket will be declared at the start of the semester e.g. Cryptography and Network Security, Web and Social Media Analytics, Data Mining	3	1	0	4
	BC24-MDE-601A/B/C	MOOCs basket will be declared at the start of the semester e.g. E-Commerce and ERP, Introduction to Digital Marketing, Business Communication & Value Science	3	1	0	4
		Total credit for BCA 3 years to be awarded= 142				

7. Mandatory Course-Non Credit

1	MC-VAC-401	Environmental Sciences	2	0	0	Non-Credit
1	MC-VAC-501	Constitution of India/ Essence of Indian Knowledge & Tradition	1	0	0	Non-Credit

*MOOCs Regarding: MOOCs basket will be declared at the beginning of the semester by Dean Faculty of Information Technology and Engineering based on emerging technologies. The courses has to be chosen from the basket.

[1] While opting for a course for pursuing the Open Elective, a student needs to ensure that:

i) The duration of the course must minimum of 12-Weeks.

ii) The course must not be covered in previous semesters of the program.

iii) Date of Exam and publication of result should be within the tenure of the BCA(DS&AI) 6th Semester i.e. January to June of every Year.

[2] The student should register and submit the details of the course at the time of enrolment of 6th Sem.

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8.	Evaluation Scheme:

Since assessment rubrics are not generic in nature and depend on courses, topics, assessment strategies of individual faculties etc., it is suggested that Faculty of Information Technology & Engineering will follow the following rubrics for Theory, Laboratory and Sessional evaluation.

a. Rubrics for Theory Courses:
The internal assessment will be of 30 marks and end semester examinations will be of 70 marks. For passing the subject the students should obtain at least 40 marks out of 100 (Internal assessment and end semester assessment).

Suggestive rubrics for Internal Assessment: Calculation of Internal assessment number will be Average of Best of three CA plus 5 marks of Attendance.

Continuous Assessment	Activities
CA1	Quiz/ Assignment
CA2	Internal test (Pen and paper)
CA3	PPT presentation/ Group Discussion
CA4	Internal test(Pen and paper)

b. Rubrics for Practical Courses:
The internal assessment will be of 40 marks and end semester laboratory examinations will be of 60 marks. For passing the subject the students should obtain at least 50 marks out of 100 (Internal assessment and end semester assessment).

Sessional Exams- (Project, Seminar, Group Discussion, Internship, Training etc.) end semester examinations will be held for 100 marks. For passing the subject the students should obtain at least 50 marks out of 100 . Evaluation will be based on work done, quality of report, performance in viva-voice, presentation etc. for which rubrics may be designed based on course outcomes. The Project Viva and practical examinations will preferably have external examiners as per rules of the University.

c. Mapping of Marks to Grades
Each course (Theory/Practical) is to be assigned 100 marks, irrespective of the number of credits, and the mapping of marks to grades may be done as per the following table:

Classification	Letter Grade	Score on 100 percentage point	Points
Outstanding	O	100 to 90	10
Excellent	E	89 to 80	9
Very Good	A	79 to 70	8
Good	B	69 to 60	7
Fair	C	59 to 50	6
Below Average	D	49 to 40	5
Failed	F	Below 40	2
Incomplete	I	------	2

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d. Promotional Policy: Candidates will be eligible for promotion to the next semester without clearing all end semester theory courses of earlier semesters if,

    a. Candidate has minimum attendance percentage of 75% in the previous semester
    b. Candidates must have appeared for all internal examinations and has secured marks in Continuous Assessments, Sessional Examinations, Practical Examinations
    c. Candidates must have applied for appearing in the end semester examinations and have valid admit card in previous semester

Candidates failed to achieve the minimum benchmarks as mentioned in (a), (b), (c) for promotion will not be eligible for promotion to the next higher semester.

Candidates will appear in the end semester theory examinations as back log candidate in corresponding semester, of subsequent academic year. Marks scored in Continuous Assessments, Sessional Examinations, Practical Examinations during attending regular semester with minimum qualifying attendance would be carried all through. Backlog candidates would be allowed to appear in the end semester examinations. **For 5th and 6thSemester backlog students, backlog examinations will be conducted after two months from the date of result publication.**

If any candidate fails to secure minimum qualifying marks (pass marks) in sessional or practical examinations would suffer year lag and they have to continue the semester concerned afresh in the next academic year. In the internal examination of 30 marks -Cumulative Assessment 25 plus 5 marks for attendance.

The marks of a backlog paper will be determined from the marks obtained in theory examination and marks of the continuous evaluation of the regular semester. No up-gradation of internal/continuous assessment marks would be allowed.

If any candidates fail to achieve any of the three conditions above (a, b & c) in any semester (say, 1st semester), they would not be allowed to continue their study in the next semester (i.e., 2nd semester) and they have to fulfill the academic regulations by enrolling them in the next academic year from the discontinued semester (i.e. 1st semester) and so on.

However, there would not be any limit of number of back papers to continue their study in subsequent semester as regular candidate.

e. Calculation of DGPA, CGPA for one, two, three and four year programmes.

- Result Status: X=Not eligible for Semester Promotion/Degree; XP=Eligible for Promotion with Backlogs; P=Passed and Promoted.
- The method of calculation of Grade Point Average is as follows
- **SGPA (Semester Grade Point Average)** $= \dfrac{Credit\ Index}{\sum Credits}$

- **YGPA (Yearly Grade Point Average)** $= \dfrac{Credit\ Index\ Odd\ Semester + Credit\ Index\ Even\ Semester}{\sum Credits\ Odd\ Semester + \sum Credits\ Even\ Semester}$
- For final **Degree Grade Point Average (DGPA)** the calculation is as under

    DGPA $= \dfrac{YGPA\ 1 + YGPA2 + 1.5 * YGPA3 + 1.5 * YGPA4}{5}$

(For 4 Year Course)

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$$DGPA = \frac{YGPA2 + 1.5 * YGPA3 + 1.5 * YGPA4}{4}$$

(For Lateral Entry Students)

$$DGPA = \frac{YGPA\,1 + YGPA2 + YGPA3}{3}$$

(For 3 Year Course)

$$DGPA = \frac{YGPA\,1 + YGPA2}{2}$$

(For 2 Year Course)

$$DGPA = YGPA1$$

(For 1 Year Course)

CUMULATIVE GRADE POINT AVARAGE (CGPA)

$$CGPA = \frac{\sum_{K=1}^{K=n} Credit\ Index\ of\ k^{th}\ semester}{\sum_{k=1}^{k=n} Credit\ of\ k^{th}\ Semester}$$

Where

n = 4 for 2 years programme

n=6 for 3 years programme

n = 8 for 4 years programme

n = 10 for 5 years programme

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9.

Student Roll No............................   Student Name: ....

Academic year: 2023-24
Internal Examinations-I
B.C.A ,2023 Batch
1ˢᵗ Semester

Subject Code: | **Subject Name**

Time: 1 hours   **Max. Marks: 25**

This template is recommended for courses with 4 COs and two In-Sem Tests. Can also be followed for courses with five COs. The COs can be altered in the template depending on the test being conducted.

(Assume any missing data suitably and design adequate hypothesis, if required)

Part-A	(3X 1M=3M)
Answer Any Three Questions	
Q. No. 1, 2 from CO1 Preferred to be at lower BTL than the Max BTL of CO1	
Q. No 3, 4 from CO2 Preferred to be at lower BTL than the Max BTL of CO2	

1.	
2.	
3.	
4.	

Part-B	(2 X 4M=8M)
Answer Any Two Questions	
Q. No. 5, 6 from CO1 Preferred to be at lower BTL than the Max BTL of CO1	
Q. No 7, 8 from CO2 Preferred to be at lower BTL than the Max BTL of CO2	

5.	
6.	
7.	
8.	

Part-C	(2 X 7M=14M)
Answer ALL Questions	
Q. No. 9,10 from CO1 and have a internal choice between Q.No.9 and Q.No.10	
Q. No. 11,12 from CO2 and have a internal choice between Q.No.11 and Q.No.12	

9.	Q. No. 9 from CO1 Preferred to be at lower BTL than the Max BTL of CO1, At least one sub question must be of Max. BTL of the CO1; max 2 sub questions.
	(Or)
10.	Q. No.10 from CO1 Preferred to be at lower BTL than the Max BTL of CO1, At least one sub question must be of Max. BTL of the CO1, max 2 sub questions.
11.	Q. No.11 from CO2 Preferred to be at lower BTL than the Max BTL of CO2, At least one sub question must be of Max. BTL of the CO1, max 2 sub questions.
	(Or)
12.	Q. No.12 from CO2 Preferred to be at lower BTL than the Max BTL of CO2, At least one sub question must be of Max. BTL of the CO1, max 2 sub questions.

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Student Roll No............................ Student Name................................

Subject Code: | **Subject Name**

Time: 1 hours | **Max. Marks: 25**

This template is recommended for courses with 4 COs and two In-Sem Tests. Can also be followed for courses with five COs. The COs can be altered in the template depending on the test being conducted.

(Assume any missing data suitably and design adequate hypothesis, if required)

Part-A	(3X 1M=3M)

Answer Any Three Questions
Q. No. 1, 2 from CO3 Preferred to be at lower BTL than the Max BTL of CO3
Q. No 3, 4 from CO4 Preferred to be at lower BTL than the Max BTL of CO4

1.	
2.	
3.	
4.	

Part-B	(2 X 4M=8M)

Answer Any Two Questions
Q. No. 5, 6 from CO3 Preferred to be at lower BTL than the Max BTL of CO3
Q. No 7, 8 from CO4 Preferred to be at lower BTL than the Max BTL of CO4

5.	
6.	
7.	
8.	

Part-C	(2 X 7M=14M)

Answer ALL Questions
Q. No. 9,10 from CO3 and have a internal choice between Q.No.9 and Q.No.10
Q. No. 11,12 from CO4 and have a internal choice between Q.No.11 and Q.No.12

9.	Q. No. 9 from CO3 Preferred to be at lower BTL than the Max BTL of CO3, At least one sub question must be of Max. BTL of the CO3, max 2 sub questions.
	(Or)
10.	Q. No.10 from CO3 Preferred to be at lower BTL than the Max BTL of CO3, At least one sub question must be of Max. BTL of the CO3, max 2 sub questions.
11.	Q. No.11 from CO4 Preferred to be at lower BTL than the Max BTL of CO4, At least one sub question must be of Max. BTL of the CO4, max 2 sub questions.
	(Or)
12.	Q. No.12 from CO4 Preferred to be at lower BTL than the Max BTL of CO4, At least one sub question must be of Max. BTL of the CO4, max 2 sub questions.

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Student Roll No......................

Student Name:.........................

Subject Code:

Name of the Course:

Time: 3 hours

Max. Marks: 70

(Assume any missing data suitably and design adequate hypothesis, if required)

Part-A	(8 X 4M=32M)
Answer ALL Questions	
Q. No.1.a to 1.h Preferred to be at lower BTL than the Max BTL, No sub questions	
1 a.	Q. No. 1.a from CO1 with Lower BTL Level
1 b.	Q. No. 1.b from CO1 with Lower BTL Level
1 c.	Q. No. 1.c from CO2 with Lower BTL Level
1 d.	Q. No. 1.d from CO2 with Lower BTL Level
1 e.	Q. No. 1.e from CO3 with Lower BTL Level
1 f.	Q. No. 1.f from CO3 with Lower BTL Level
1 g.	Q. No. 1.g from CO4 with Lower BTL Level
1 h.	Q. No. 1.h from CO4 with Lower BTL Level

Part-B	(4 X 7M=28M)
Answer ALL Questions	
Q. No. 2 to 4 Preferred to be at lower BTL than the Max BTL, No sub questions and have a internal choice	
2.a	Q. No. 2.a from CO1 with BTL Level
	[OR]
2.b	Q. No. 2.b from CO1 with BTL Level
3.a	Q. No. 3.a from CO2 with BTL Level
	[OR]
3.b	Q. No. 3.b from CO2 with BTL Level
4.a	Q. No. 4.a from CO3 with BTL Level
	[OR]
4.b	Q. No. 4.b from CO3 with BTL Level
5.a	Q. No. 5.a from CO4 with BTL Level
	[OR]
5.b	Q. No. 5.b from CO4 with BTL Level

Part-C	(1 X 10M=10M)
Answer ANY ONE Question	
Q. No.6 and 7 preferably be Max BTL and maximum four sub questions with equal marks and may have a link between those questions.	
(Question must be based on comprehensive knowledge of course and interconnection of courses)	
6	Combination of all CO's
7	Combination of all CO's

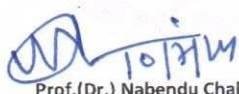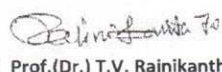Prof.(Dr) Nabendu Chaki   Prof.(Dr.) T.V. Rajnikanth   Dr.K.L. Ambashtha   Dr.Ajay Kumar   Dr.Rajkumar Mandal   Prof.(Dr.)Arunava De
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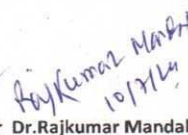| 10 S.N	Annexure-1 -Name of the MAR Activity	Points	Maximum Points Allowed
1(a).	Reasoning and Aptitude tests via online platform/others **Mandatory for 4th Sem BCA(DS & AI)	10 (per course)	20
1(b)	**Mandatory-Online certifications/TCS-NQT **preferable for 5th Sem BCA(DS & AI)	20	20
2.	Tech Fest/Fest/Teachers' Day/Fresher's Welcome		
	a) Organizer	5	10
	b) Participant	3	6
3.	Tree Plantation and up keeping (per tree)	1	10
4.	Participation in Relief Camps		
	a) Collection of funds/materials for the Relief Camp	5	20
	b) To be a part of the Relief Work team	10	
5.	Participation in Debate/Group Discussion/Tech Quiz/Quiz	10	20
6.	Publication of Wall Magazine in institutional level (magazine/article/internet)	10	20
7.	Publication in Newspaper, Magazine and Blogs	10	20
8.	Research Publication (per publication)	15	30
9.	Innovative Projects (other than course curriculum)	30	60
10.	Blood donation	8	16
	Blood donation camp organization	10	20
11.	Participation in Sports/Games		
	a) College level	5	10
	b) University level	10	20
	c) District level	12	24
	d) State level	15	30
	e) National/International Level	20	20
12.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
13.	Member of Professional Society	10	20
14.	Student Chapter	10	20
15.	Relevant Industry Visit & Report	10	20
16.	Activities in different Clubs (Photography Club, Cine Club)	5	10
17.	Participation in Yoga Camp (Certificate to be submitted)	5	10
18.	Community Service & Allied Activities	10	20
19.	**Self-Entrepreneurship Programme**		
	a) To Organize Entrepreneurship Workshop and Programmes	10	20
	b) To take part in Entrepreneurship Workshop and get certificate	5	10
	c) Video Film-Making on Entrepreneurship	10	20
	d) Submit Business Plan on any Project	10	20
	e) To work for start-up/as entrepreneur	20	40

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11	Annexure 2: Detailed Syllabus Semester –I to Semester VI

Course Title: Digital Electronics
Course code: BC24-AEC-101
LTP: 3-1-0
Credit : 4

Unit 1. Data and number systems; Binary, Octal and Hexadecimal representation and their conversions; BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic.
Venn diagram, Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method

Unit 2. Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator. [5]
Memory Systems: RAM, ROM, EPROM, EEROM, Design of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs)

Unit 3. Sequential Circuits- Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology.

Unit 4. Different types of A/D and D/A conversion techniques. Logic families-TTL, ECL, MOS and CMOS, their operation and specifications.

Course title: Mathematics for Data Science
Course code: BC24-AEC-103
LTP: 3-1-0
Credit: 4

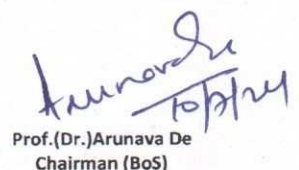| Module No.	Description of Topic
I	Set Theory - Number system, Sets and their operations, Relations and functions – Relations and their types, Functions and their types.
II	Basic Probability: Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient
III	Probability Function and Distributions: Continuous random variables and their properties, Probability density and distribution functions, Moments, Normal distributions and Exponential distributions

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IV	Basic Statistics:
	Measures of Central tendency and dispersion, Moments, Skewness and Kurtosis, Pearson Correlation and Rank correlation. Univariate ,bivariate and multivariate data analysis. Variance analysis.
V	Sampling Theory : Sampling distribution , type of sampling standard error, principal of validity, biased and unbiased error, testing of hypothesis
	Graph Theory: Representation of graphs, Breadth-first search, Depth-first search, Applications of BFS and DFS; Directed Acyclic Graphs - Complexity of BFS and DFS, Topological sorting.
	Longest path, Transitive closure, Matrix multiplication Graph theory Algorithms - Single-source shortest paths, Dijkstra's algorithm, Minimum cost spanning trees, Prim's algorithm, Kruskal's algorithm.

Course Outcomes:

The students will be able to:

- Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.
- Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.
- Apply statistical tools for analyzing data samples and drawing inference on a given data set.
- Graphs are used in Neural Networks where vertices represent neurons and edges represent the synapses between them. Neural networks are used to understand how our brain works and how connections change when we learn.

Learning Resources:

Text Books:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.

Reference Books:

1. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
3. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

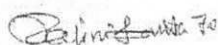| |
|---|
| **Course title: Computer Architecture & Organization** |
| **Course code: BC24-AEC-201** |
| **LTP: 3-1-0** |
| **Credit: 4** |
| **Revision of basics in Boolean logic and Combinational/Sequential Circuits.** |
| **Functional blocks of a computer:** CPU, memory, input-output subsystems, control unit. |

Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

Data representation: Signed number representation, fixed and floating point representations, character representation.

Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

Introduction to x86 architecture.

CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

Memory system design: Semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O Transfers– program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes

– Role of interrupts in process state transitions, I/O device interfaces – SCII, USB.

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books:

1. Computer System Architecture M. M. Mano:, 3rd ed., Prentice Hall of India, New Delhi, 1993.

2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy.

3. Computer Organization and Embedded Systems, Carl Hamacher.

Reference Books:
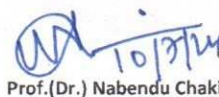
1. Computer Architecture and Organization, John P. Hayes.

2. Computer Organization and Architecture: Designing for Performance, William Stallings.

3. Computer System Design and Architecture, Vincent P. Heuring and Harry F. Jordan
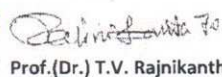
Course code: BC24-CC-201	Category:
Course Title: Data Structure using C	Semester: II
L-T-P : 3-1-0	Credit: 4

Detailed Contents

Basic Terminologies and Introduction to Algorithm & Data Organisation: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

Linear Data Structure: Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

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Non-linear Data Structure: Trees (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and Graphs (Directed, Undirected), Various Representations, Operations & Applications of Non-Linear Data Structures

Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Comparison Trees, Breadth First Search, Depth First Search Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap sort, Introduction to Hashing

File Organization (Sequential, Direct, Indexed Sequential, and Hashed) and various types of accessing schemes.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text Books:
1. Fundamentals of Data Structures, E. Horowitz, S. Sahni, S. A-Freed, Universities Press.
2. Data Structures, R.S. Salaria, Khanna Book Publishing, Delhi.
3. Data Structures and Algorithms, A. V. Aho, J. E. Hopperoft, J. D. Ullman, Pearson.
4. Expert Data Structures with C, R.P. Patel, Khanna Publishing House.

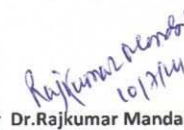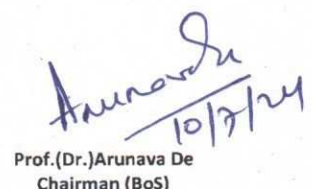### Reference Books:
1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth.
2. Design and Analysis of Algorithms, Gajendra Sharma, Khanna Book Publishing
3. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, .

Course Code : BC24-AEC-202	Category :
Course Title : English Language and Communication	Semester : Second
L-T-P : 3-1-0	Credit:4
Pre-Requisites:	

Detailed contents

1. Vocabulary Building
1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills
2.1 Sentence Structures & Types: Simple, Compound, Complex
2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
2.3 Importance of proper punctuation
2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
2.5 Creating Cohesion: Organizing principles of paragraphs in documents

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2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing
3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

4. Nature and Style of sensible Writing
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing
5.4 Business Letter, Cover Letter & CV; E-mail

Learning Resources:

(i)	Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
(ii)	Practical English Usage. Michael Swan. OUP. 1995.
(iii)	Remedial English Grammar. F.T. Wood. Macmillan.2007
(iv)	On Writing Well. William Zinsser. Harper Resource Book. 2001
(v)	Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(vi)	Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vii)	Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(viii)	Universal English Prof. Prasad Kataria Publications, 2019.
(ix)	"Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
(x)	Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

Course Outcomes

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course code: BC24-CC-291	Category:
Course Title: Data Structure using C Laboratory	Semester: II
L-T-P : 0-0-4	Credit: 2

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The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

List of Practical:

1. Implementation of searching and sorting techniques.
2. Implementation of linked list.
3. Implementation of push and pop operation on stack
4. Implementation of inqueue and dequeue operation.
5. Write a program to solve the problems using iteration/recursion
6. Write a program to implement Merge Sort
7. Write a program to implement Bubble Sort
8. Program for storing data as tree structure and implementation of various traversal techniques
9. Program for storing data as graph structure and implementation of various traversal techniques
10. Write a program to implement Linear Sort
11. Write a program to implement Binary Sort

** **Faculty may add or remove experiments as per syllabus requirements.**

Course Title : Business Presentation and Language Laboratory
Course code: BC24-AEC-292
LTP: 0-0-4
Credit: 2

1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device;
2) Honing 'Speaking Skill' and its sub skills
3) Helping them master Linguistic/Paralinguistic features(Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) ofconnected speech

4) Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode)

5) Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success

6) G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD

7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non Technical Passages/Learning Global / Contextual / Inferential Comprehension;
8) Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice

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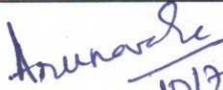Chairman (BoS)

Sessions

Course Outcomes

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Title : Software Engineering
Course code: BC24-CC-301
LTP: 3-1-0
Credit: 4

Unit	Content
1	**Introduction:** Programming in the small vs. programming in the large; software project failur and importance of software quality and timely availability; of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline, Software Engineering Historical Development from Jackson Structured Programming to Agile Development.
2	**Software Project Management:** Basic concepts of life cycle models – different models and milestones; software project planning –identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.
3	**Software Quality Management and Reliability:** Software quality; Garvin's quality dimension McCall's quality factor, ISO 9126 quality factor; Software Quality Dilemma; Introduction Capability Maturity Models (CMM and CMMI); Introduction to software reliability reliability models and estimation.
4	**Software Requirements Analysis, Design and Construction:** Introduction to Software Requirement Specifications (SRS) and requirement elicitatic techniques; techniques for requirement modelling– decision tables, event tables, state transition tables Petrinets; requirements documentation through use cases; introduction UML, introduction to software metrics and metrics-based control methods; measure of code and design quality.
5	**Object Oriented Analysis, Design and Construction:** Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object-oriented construction principles; object oriented metrics.

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6	**Software Testing:** Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume performance and efficiency; concepts of inspection; Unit Testing, Integration Testing, System Testing and Acceptance Testing.
7	**Agile Software Engineering:** Concepts of Agile Methods, Extreme Programming; Agile Process Model - Scrum, Feature; Scenarios and Stories

Course code: BC24-CC-302	Category:
Course Title: Operating Systems	Semester: III
L-T-P : 3-1-0	Credit: 4

Detailed Content

Unit I.

Overview of Operating Systems: OS and the Computer System, Efficiency, System Performance and User Convenience, Classes of Operating Systems, Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems, Distributed Operating Systems, Modern Operating Systems.

Unit II.

Processes and Threads: Processes and Programs, Programmer view of Processes, OS view of Processes, Threads, Case studies of Processes and Threads.
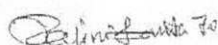
Scheduling: Preliminaries, Non-preemptive Scheduling Policies, Preemptive Scheduling Policies, Scheduling in Practice, Real Time Scheduling, Scheduling in Unix, Scheduling in Linux, Scheduling in Windows, Performance Analysis of Scheduling Policies.

Unit III.

Memory Management: Managing the Memory Hierarchy, Static and Dynamic Memory Allocation, Memory Allocation to a Process, Reuse of Memory, Contiguous Memory Allocation, Noncontiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging, Kernel Memory Allocation, Virtual Memory: Virtual Memory Basics, Demand Paging, Page Replacement Policies, Memory Allocation to a Process, Shared Pages, Memory Mapped Files, Unix Virtual Memory, Linux Virtual Memory, Virtual Memory using Segmentation.

Unit IV.

Security and Protection: Overview of Security and Protection, Goals of Security and Protection, Security Attacks, Formal and Practical aspects of Security, Encryption, Authentication and Password Security, Access

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Descriptors and the Access Control Matrix, Protection Structures, Capabilities, Unix Security, Linux Security, WindowsSecurity

TEXT BOOK:

- Silberschatz et.al.-Operating System Concepts , 6th Edition, John Wiley Inc., 2003
- H.M. Deitel -Operating Systems , 6th Edition, Pearson Education, 2006
- Robbins- Linux Programming by Example- Pearson Education, New Delhi- 2005
- Sumitabh Das : Your UNIX The Ultimate Guide; TMH

REFERENCE BOOKS:

- D.M. Dhandhare - Operating Systems, 2nd Edition, Tata McGraw Hill, New Delhi, 2006
- J.Goerzen- Linux Programming Bible, IDG Books, New Delhi- 2001
- N.Mathew & R.Stones- Beginning Linux Programming Wiley Publishing India, 2004.
- S.E. Mandnick & J.J. Donovan : Operating System; TMH

Course Title : Management and Accounting
Course code: BC24-AEC-301
LTP: 3-1-0
Credit: 4

Basics of management; Planning, scheduling, organising, staffing, directing, controlling Managerial economics and financial management, productivity management

Financial accounting, financial statements and analysis Conceptual framework of cost accounting

Cost-volume profit relationship, budgeting, cost accumulation system, variable and absorption costing system Financial accounting computer packages

Financial Management-Finance functions in Business. Relation of finance with other functions.
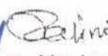
Source of finance long term and short term. Financial institution – IDBI, ICICI, IFCI and Commercial Banks.
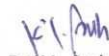
Conceptual framework of Cost-Accounting- Basic cost concept. Cost determination process, costing for materials, labour and overheads. Profitability Analysis – budgeting – application of Capital budgeting techniques for decision making.

Books:

1.Management Accounting,M.E.Thukaram Rao,New Age International 2.Management Accounting, Khan & Jain, TMH

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3.Cost Accounting-An Introduction, Nigam & Jain, PHI 4.Management Accounting, Pande, VIKAS

Accounting and Financial Management for MCA & MBA students,SCITECH

Management Accounting, A.P.Rao. EPH.

Cost & Management Accounting ,Inamdar.EPH

Course Title: Data Base Management Systems
Course code: BC24-CC-401
LTP:3-1-0
Credit: 4

Detailed content

UNIT-I: Database system architecture:

Data   Abstraction, Data Independence, Data Definition Language (DDL),Data   Manipulation Language(DML).

Data   models: Entity-relationshipmodel, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit-II: Relational query languages and Relational algebra and calculus:

Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver.

Relational database   design: Domain   and   data dependency,Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

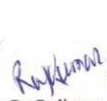Query processing and optimization: Evaluation of relational algebra expressions,Query equivalence, Join strategies, Query optimizationalgorithms.

Unit-III: Storage strategies: Indices, B-trees, hashing.
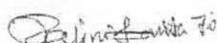
Unit-IV TRANSACTION PROCESSING:

Concurrencycontrol, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Unit-V Database Security:

Authentication, Authorization and access control, DAC,MAC and RBAC models, Intrusion detection, SQL injection.

Unit-VI Advanced topics:

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Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Course Title: Values and Ethics in Profession
Course code: BC24-VAC-401
LTP: 3-1-0
Credit: 4

Science, Technology and Engineering as Knowledge and as Social and Professional Activities (2 lectures)

Effects of Technological Growth: Rapid Technological growth and depletion of resources. Reports of the Club of Rome. Limits of growth; sustainable development(2 lectures)

Energy Crisis; Renewable Energy Resources   (2 lectures)

Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations. Environmental Ethics(4 lectures)

Appropriate Technology Movement of Schumacher: later developments (2 lectures)

Technology and developing nations. Problems of Technology transfer. Technology assessment, impact analysis (4 lectures)

Human Operator in Engineering projects and industries. Problems of man machine interaction. Impact of assembly line and automation. Human centered Technology(4 lectures)

Ethics of Profession

Engineering profession: Ethical issues in engineering practice. Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond. Case studies. (8 lectures)

Profession and Human Values Value Crisis in contemporary society   (2 lectures)

Nature of values: Value Spectrum of a 'good' life   (2 lectures)
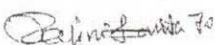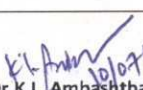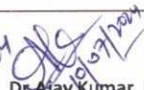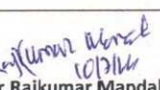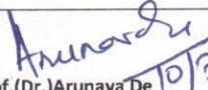
Psychological values: Integrated personality; mental health   (2 lectures)

Societal values: The modern search for a 'good' society, justice, democracy, secularism, rule of law; values in Indian Constitution. (4 lectures)

Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity   (2 lectures)

Moral and ethical values: Nature of moral judgments; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility

Books:

Prof.(Dr.) Nabendu Chaki Prof.(Dr.) T.V. Rajnikanth Dr.K.L.Ambashtha Dr.Ajay Kumar Dr.Rajkumar Mandal Prof.(Dr.)Arunava De
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- Ethics in Mgmt & Indian Ethos,Ghosh, VIKAS
- Business Ethics,G.Pherwani,EPH.
- Ethics, Indian Ethos & Mgmt, Balachandran, Raja & Nair,SHROFF Publishers

Course Title: Database Management System Laboratory

Course code: BC24-CC-491

LTP:0-0-4

Credit: 2

Structured Query Language

1. Creating Database
- Creating a Database
- Creating a Table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes

2. Table and Record Handling
- INSERT statement
- Using SELECT and INSERT together
- DELETE, UPDATE, TRUNCATE statements
- DROP, ALTER statements

3. Retrieving Data from a Database
- The SELECT statement
- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause
- Using Aggregate Functions
- Combining Tables Using JOINS
- Subqueries

4. Database Management
- Creating Views
- Creating Column Aliases

5. Creating Database Users and using Grant and Revoke

Course code: BC24-CC-501	Category:
Course Title: Computer Networks	Semester: V
L-T-P : 3-1-0	Credit: 4

Detailed content

Unit 1:

Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization:Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit 2:
Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back –
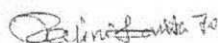N ARQ, Selective Repeat ARQ, Sliding   Window,   Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA.

Unit 3:

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Unit 4:

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP),Transmission Control   Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit 5:

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP),WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

Course Title: **Design and Analysis of Algorithms**
Course code: **BC24-CC-502**
LTP:**3-1-0**
Credit: **4**
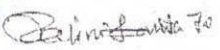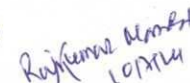
1	Introduction: Characteristics of algorithm.Analysis of algorithm: Asymptotic analysis of complexity bounds – best,average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method andMasters'theorem
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and Backtrackingmethodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search(BFS); Shortest Path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm. Tractable and Intractable Problems: Computability.
4	Design of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

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6	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text books/ reference books:

- Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, RonaldL Rivestand Clifford Stein, MIT Press/McGraw-Hill.
- Fundamentals of Algorithms – E. Horowitz et al.
- Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
- Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,Michael T Goodrich and Roberto Tamassia, Wiley.
- Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading,MA Design & Analysis of Algorithms, Gajendra Sharma, Khanna Publishing House (AICTE Recommended Textbook – 2018)
- Algorithms Design and Analysis, Udit Agarwal, Dhanpat Rai

Course Title: Computer Networks Laboratory

Course code: BC24-CC-591

LTP:0-0-4

Credit: 2

1. NIC Installation & Configuration (Windows/Linux).
2. Understanding IP address, subnet etc.

Familiarization with
- Networking cables (CAT5, UTP)
- Connectors (RJ45, T-connector)
- Hubs,Switches

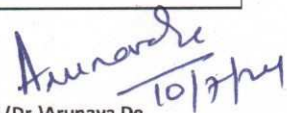TCP/UDP-Socket Programming
- Simple, TCP based, UDP based
- Multicast & Broadcast Sockets
- Implementation of a Prototype Multithreaded Server
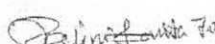
Implementation of
- Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
- Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
- Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)
- Server Setup/Configuration : FTP, Telnet, NFS, DNS, Firewall

List of Experiments-
1. Implement the data-link layer framing methods such as character, character stuffing and bit stuffing.
2. Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP 15
3. Implement Dijkstra's algorithm to compute the Shortest path thru a graph.
4. Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm
5. Take an example subnet of hosts. Obtain broadcast tree for it.
6. Take a 64 bit playing text and encrypt the same using DES algorithm.
7. Write a program to break the above DES coding
8. Using RSA algorithm Encrypt a text data and Decrypt the same

Course Title: Environment and Ecology
Course code: BC24-VAC-601
LTP: 3-1-0
Credit: 4

Introduction , components of the environment, environmental degradation

Ecology: Elements of Ecology ; Ecological balance and consequences of change, principles of environmental impact assessment

Air Pollution and Control: Atmospheric composition, energy balance, climate, weather, dispersion, sources and effects of pollutants, primary and secondary pollutants, green house effect, depletion of ozone layer, standards and control measures.

Water Pollution and Control: Hydrosphere, natural water, pollutants: their origin and effects, river / lake / ground water pollution, standards and control.

Land Pollution: Lithosphere, pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes); their origin and effects, collection and disposal of solid waste, recovery and conversion methods.

Noise Pollution: Sources, effects, standards and control.

Books:

- Environmental Science, Cunningham, TMH
- Environmental Pollution Control Engineering,C.S.Rao,New Age International
- Environmental Science,Wright & Nebel, PHI
- Environmental Pollution Analysis,S.M.Khopkar,New Age International
- Environmental Mgmt, N.K. Oberoi, EXCEL
- Environmental Mgmt, Mukherjee, VIKAS
- Ecosystem Principles & Sustainable Agriculture,sithambaranathan,Scitech

Course Title: Image Processing
Course code:BC24-DSE-501A
LTP: 3-1-0
Credit: 4
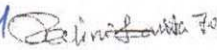
Unit	Content
1	**Introduction** Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.
2	**Digital Image Formation** A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization -Uniform & Non uniform.

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3	**Mathematical Preliminaries** Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.	
4.	**Image Enhancement** Spatial Domain Method, Frequency Domain Method, Contrast Enhancement - Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High- pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	
5	**Image Restoration** Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation Spatial Transformation, Gray Level Interpolation.	
6	**Image Segmentation** Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.	

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.

2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.

2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition.

3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.

4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH.

5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning.

6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

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Course Title: Pattern Recognition
Course code: BC24-DSE-501B
LTP: 3-1-0
Credit: 4

Unit	Content
1.	Basics of pattern recognition
2.	Bayesian decision theory-Classifiers, Discriminant functions,Decision surfaces, Normal density and discriminant functions Discrete features
3.	Parameter estimation methods -Maximum-Likelihood estimation Gaussian mixture models Expectation- maximization method Bayesian estimation
4.	Hidden Markov models for sequential pattern classification Discrete hidden Markov models Continuous density hidden Markov models
5.	Dimension reduction methods Fisher discriminant analysis, Principal component analysis, Parzen-window method,K-Nearest Neighbour method
6.	Non-parametric estimation techniques forDensity estimation
7.	Linear discriminant function based classifier Perceptron Support vector machines
8.	Non-metric methods for pattern classification Non-numeric data or nominaldata Decision trees
9.	Unsupervised learning and clustering Criterion functions for clustering Algorithms for clustering: K-means, Hierarchical and other methods

Course Title: Compiler Design
Course code:BC24-DSE-501C
LTP: 3-1-0
Credit: 4

Objective:

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

Unit 1: Introduction to Compiling

Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.

Unit 2: Lexical Analysis

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, from a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator(Lex).

Unit 3: Syntax Analysis

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The role of a parser, Context freegrammars, Writing a grammar, Top downParsing, Non- recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Unit 4: Syntax directed translation

Syntax director definitions, Construction of syntaxtrees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Unit 5: Type checking

Typesystems, Specification of a simple type checker, Equivalence of type expressions, Type conversions.

Unit 6: Run time environments

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques

Unit 7: Intermediate code generation

Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Unit 8: Code optimization

Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in

flow graph, Peephole optimization.

Unit 9: Code generations

Issues in the design of code generator, a simple code generator, Register allocation &assignment.

Text book and Reference books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" - PHI.

Course Outcomes:

- On completion of the course students will be able to
- Understand given grammar specification develop the lexical analyser
- Design a given parser specification design top- do and bottom-up parsers
- Develop syntax directed translation schemes
- Develop algorithms to generate code for a target machine

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BC24-AEC-102
Credit-4
L-T-P-3-1-0

SOFTWARE FOUNDATION AND PROGRAMMING with C

Course Objective:

1. Understand the basic concepts of programming, including algorithms, flowcharts, and pseudocode.
2. Learn about the history and evolution of the C programming language.
3. Understand the concept of functions and their importance in code reusability and modularity.
4. Learn how to declare, define, and call functions.
5. Explore the scope and lifetime of variables.

Learning Outcome:

After completing the course, the students should be able to:

1. Understanding and describe concept related to Software Development using C.
2. Implement different programming constructs and decomposition of problems into functions
3. Use and implement data structures like arrays and structures to obtain solutions
4. Define and use of pointers with simple applications.
5. Analyzing the expected to have learnt programming concepts and technical aspects of C programming.

Course Contents:

UNIT NUMBER	CONTENTS	NO. OF HOURS
UNIT-I	**INTRODUCTION TO C PROGRAMMING** **Introduction to Computing:** Introduction, Art of Programming through Algorithms and Flowcharts **Overview of C:** History and importance of C, Basic structure of C program, executing a C program. **Constants, Variable and Data Types:** Introduction, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables, Defining Symbolic Constants. **Managing Input and Output Operations**: Reading a Character, Writing a Character, Formatted Input, Formatted Output. **Operators and Expressions:** Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and	8

	Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversions in Expressions, Operator Precedence and Associativity.	
UNIT-II	**CONTROL STRUCTURES** **Decision Making and Branching:** Introduction, Decision Making with IF Statement, Simple IF Statement, the IF-ELSE Statement, Nesting of IF-ELSE Statements, The ELSE IF Ladder, The Switch statement, The ? : Operator, The goto statement. **Decision Making and Looping:** Introduction, The while Statement, The do statement, The for statement, Jumps in LOOPS.	8
UNIT-III	**INTRODUCTION TO ARRAYS AND STRINGS** **Arrays:** One-dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Example programs-Bubble sort, Selection sort, Linear search, Binary search, Two-dimensional Arrays, Declaration of Two-dimensional Arrays, Initialization of Two-dimensional Arrays, Example programs-Matrix Multiplication, Transpose of a matrix. **Character Arrays and Strings:** Declaring and Initializing String Variables, Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, String-handling Functions, Example Programs (with and without using built-in string functions)	8

IBM

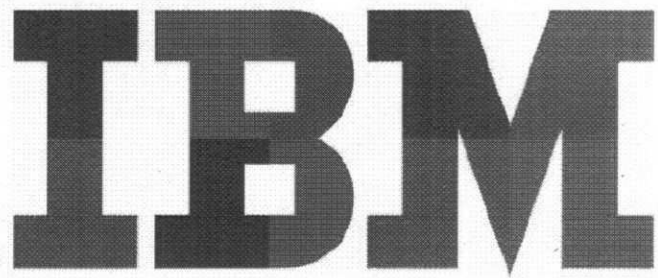|	FUNCTIONS AND INTRODUCTION TO POINTERS	
UNIT-IV	**User-defined Functions:** Need for functions, Elements of User-defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, No Arguments and no Return Values, Arguments but no Return values, Arguments with Return Values, No Arguments but Returns a Value, Passing Arrays to Functions, Recursion, The Scope, Visibility and Lifetime of variables. **Pointers:** Introduction, Declaring Pointer Variables, Initialization of Pointer variables, accessing a Variable through its Pointer, Pointer Expressions, Pointer Increments and Scale Factor	8
	STRUCTURES AND FILE MANAGEMENT	
UNIT-V	**Structures:** Introduction, Defining a structure, declaring structure variables, accessing structure members, structure initialization, array of structures. **File Management in C:** Introduction, Defining and opening a file, closing a file, Input/output and Error Handling on Files **Introduction to Linux:** Open Standards, Open Source and IBM, Introduction to Linux	8

Text/Reference Books:

1. The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie

2. "C Programming: A Modern Approach" by K.N. King

3. Programming in C" by Stephen G. Kochan

BC24-CC-101
Credit-4
L-T-P- 3-1-0

IBM

DATA VISUALIZATION TRAINING MODULE

(CLASSROOM)

DATA VISUALIZATION TRAINING MODULE

The Data Visualization Training module will give the reader a thorough introduction to Data Science, Statistics, R, IBM Watson Studio and python using real life examples. This course does not require a prior quantitative or mathematics background. The course introduces the basic concepts such as the mean, median etc. Then it eventually covers all aspects of an analytics (or) data science career from analyzing and preparing raw data to visualizing your findings. It covers both the theoretical aspects of statistical concepts and the practical implementation using R, IBM Watson Studio and python

DELIVERY METHOD

100 % Instructor led training

VERSION

2019

LEARNING OBJECTIVES

- Introduction to Statistics
  - o Introduction to Statistics
  - o Difference between inferential statistics and descriptive statistics
- Inferential Statistics
  - o Drawing Inferences from Data
  - o Random Variables
  - o Normal Probability Distribution
  - o Sampling
  - o Sample Statistics and Sampling Distributions
- R overview and Installation
  - o Overview and About R
  - o R and R studio Installation
- Descriptive Data analysis using R
  - o Description of basic functions used to describe data in R
- Data manipulation with R
  - o Introduction to dplyr (filter, select, arrange, mutate, summarize)
  - o Introduction to data.table
  - o Introduction to reshape2 package
  - o Introduction to tidyr package
  - o Introduction to Lubridate package
- Data visualization with R
  - o Working with Base R Graphics (Scatter Plot, Bar Plot, and Histogram)
  - o Working with ggplot2
- Data visualization in Watson Studio
  - o Adding data to data refinery
  - o Visualization of Data on Watson Studio
- Introduction to Python
  - o Python and Anaconda Installation
  - o Introduction to Jupyter Notebook
  - o Python scripting basics

- Numpy and Pandas
  - o Numpy overview - Creating and Accessing Numpy Arrays
  - o Introduction to pandas
  - o Pandas read and write csv
  - o Descriptive statistics using pandas
  - o Pandas working with text data and datetime columns
  - o Pandas Indexing and selecting data
  - o Pandas - groupby
  - o Merge / Join datasets
- Introduction to Data Visualization Tools in Python
  - o Introduction to Matplotlib
  - o Read a CSV and Generate a line plot with matplotlib
- Basic plots using matplotib
  - o Area Plots
  - o Bar Charts
  - o Histograms
- Specialized Visualization Tools using Matplotlib
  - o Pie Charts
  - o Box Plots
  - o Scatter Plots
  - o Bubble Plots
- Advanced Visualization Tools using Matplotlib
  - o Waffle Charts
  - o Word Clouds
- Introduction to Seaborn
  - o Seaborn functionalities and usage with Hands-on
- Spatial Visualizations and Analysis in Python with Folium
  - o Introduction to Folium
  - o Case Study (Analyze New York City Taxi Trip Ride Data Set to Identify best locations for taxi stops)

PREREQUISITES SKILLS
Basic knowledge of Python

DURATION

32 Hours

SKILL LEVEL

Advanced

Notes
The following unit and exercise durations are estimates and might not reflect every class experience. The estimates do not include the duration of optional exercises or sections. Students in this course use an IBM Cloud account to perform the exercises.

COURSE AGENDA

UNIT I. Introduction to Statistics

Duration: 1 Hr.

Overview	This chapter introduces you to Statistics.
Learning Objectives	After completing this unit, you should be able to: • Understand the different methods of data collections • Difference between descriptive and inferential statistics • Understanding on Descriptive Statistics: Mean, Median, Mode

UNIT II. Inferential Statistics

Duration: 3.5 Hrs.

Overview	In this chapter, you will be introduced to Inferential Statistics.
Learning Objectives	After completing this unit, you should be able to: • Understand the importance of making inference from Data • Understand Inferential Statistics: Random Variables, Probability Distributions, Normal Distribution, Sampling and Sampling Distribution

UNIT III. R overview and Installation

Duration: 45 Minutes.

Overview	In this unit, we will discuss overview on R and then install R and R studio
Learning Objectives	After completing this unit, you should be able to: • Understand R basics • Install R and R studio

UNIT IV. Descriptive Data analysis using R

Duration: 1 hr.

Overview	In this unit, you learn the basic functions, mathematical functions, graphical functions, statistical functions, summary function used to describe data in R. We will use R to calculate summary statistics, including mean, standard deviation, range, and percentile
Learning Objectives	After completing this unit, you should be able to: • Understand the different used to describe data including basic functions, mathematical, graphical and statistical functions. • We will use R to calculate summary statistics, including mean, standard deviation, range, and percentile

UNIT V. Data manipulation with R

Duration: 2.5 hrs.

Overview	In this chapter, you learn data manipulation with R to improve data accuracy and precision. We will see the usage of inbuilt R function, CRAN packages, and use ML algorithms
Learning Objectives	After completing this unit, you should be able to: • Different Ways to Manipulate / Treat Data: • List of available Packages and its usages with hands on

UNIT VI. Data visualization with R

Duration: 1 Hr.

Overview	This chapter introduces you to data visualization with R. We will learn the basic visualization like Histogram and then advanced visualization like Heat Map and its usage in detail
Learning Objectives	After completing this unit, you should be able to: • Visualize data with R • Good understanding of various basic visualization like Histogram, Bar / Line Chart, Box plot, Scatter plot

UNIT VII. Data visualization in Watson Studio

Duration: 6 Hrs.

Overview	In this chapter, you will be introduced to IBM Watson Studio for data visualization. Visualizing information in graphical ways can give you insights into your data. By enabling you to look at and explore data from different perspectives, visualizations can help you identify patterns, connections, and relationships within that data as well as understand large amounts of information very quickly.
Learning Objectives	After completing this unit, you should be able to: • Visualize data using IBM Watson Studio • Manage Data Refinery flows

UNIT VIII. Introduction to Python

Duration: 4.25 hrs.

Overview	In this unit, we will install Python and Anaconda. We will learn usage of Jupyter notebook and then do scripting using Python
Learning Objectives	After completing this unit, you should be able to: • Install Python and Anaconda. • Understanding on Jupyter notebook and Python

UNIT IX. Numpy and Pandas

Duration: 3 hrs.

Overview	In this unit, you learn the Pandas and Numpy for fast numeric array computations. We will learn the common functionalities of NumPy and Pandas with existing toolboxes in R. the added flexibility have resulted in wide acceptance of python in the scientific community lately.
Learning Objectives	After completing this unit, you should be able to: • use Numpy functions for scientific studies • use Pandas for data manipulation and analysis

UNIT X. Introduction to Data Visualization Tools in Python

Duration: 30 minutes.

Overview	In this chapter, you learn the basics of Matplotlib which is a 2d plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments. Matplotlib can be used in Python scripts, Python and IPython shell, Jupyter Notebook, web application servers and GUI toolkits.
Learning Objectives	After completing this unit, you should be able to: • Data visualization and some of the best practices to keep in mind when creating plots and visuals. • The history and the architecture of Matplotlib. • Basic plotting with Matplotlib. • The dataset on immigration to Canada, which will be used extensively throughout the course. • Generating line plots using Matplotlib.

UNIT XI. Basic plots using matplotib

Duration: 45 Minutes.

Overview	This chapter introduces you to basic plots using Matplotlib.
Learning Objectives	After completing this unit, you should be able to: • Plot 2d graph and plots using Matplotlib • Area plots, and how to create them with Matplotlib. • Histograms, and how to create them with Matplotlib. • Bar charts, and how to create them with Matplotlib.

UNIT XII. Specialized Visualization Tools using Matplotlib

Duration: 1.0 Hr.

Overview	In this chapter, you will be introduced to Specialized Visualization Tools using Matplotlib
Learning Objectives	After completing this unit, you should be able to: • Pie charts, and how to create them with Matplotlib. • Box plots, and how to create them with Matplotlib. • Scatter plots and bubble plots, and how to create them with Matplotlib.

UNIT XIII. Advanced Visualization Tools using Matplotlib

Duration: 30 Minutes.

Overview	In this unit, we will discuss overview on R and then install R and R studio
Learning Objectives	After completing this unit, you should be able to: • Understand the R basics • Install of R and R studio

UNIT XIV. Introduction to Seaborn

Duration: 2 hrs.

Overview	In this unit, we will introduce you to seaborn. We will see how to use it to generate attractive plots.
Learning Objectives	After completing this unit, you should be able to: • Seaborn, and how to use it to generate attractive regression plots.

UNIT XV. Spatial Visualizations and Analysis in Python with Folium

Duration: 4.25 hrs.

Overview	In this chapter, you learn Folium to visualize geospatial data, create maps with markers and Chropleth maps with Folium
Learning Objectives	After completing this unit, you should be able to: • Folium, a data visualization library in Python. • Creating maps of different regions of the world and how to superimpose markers on top of a map. • Creating Choropleth maps with Folium.

IBM

BC-24-AEC-204
Credit- 4
L-T-P-3-1-0

Programming with Java

Course Objective:

1. Understanding the fundamentals of OOPS basic terminology used.
2. Applying advanced Java concepts to real-world programming scenarios.
3. Analyzing the structure and architecture of web applications using Servlets and JSP.
4. Evaluating the effectiveness of different software development methodologies.
5. Creating innovative Android applications integrating various components.

Learning Outcome:

1. Able to write Java programs using correct syntax.
2. Able to use the Java Standard Library effectively to perform common tasks such as input/output operations
3. Able to design and implement graphical user interfaces (GUIs) using Java libraries
4. Able to connect Java applications to databases using JDBC, execute SQL queries, and handle database transactions effectively.

Course Contents:

UNIT NUMBER	CONTENTS	NO. OF HOURS
UNIT-I	**Basic OOPS and Core Java:** Introduction to Java and Eclipse, Java Basics (The basic building blocks of Java, variables and primitive types, Objects and Messages, String & StringBuffer, Wrapper classes, Building Classes Core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association), Managing memory with garbage collector, abstraction, access specifiers, Collection framework, keywords (static, final, abstract etc.)	8
UNIT-II	**Advanced Java Programming & Modeling:** Debugging, Inheritance and Refactoring, Interfaces, Collections, Serialization and Streams, Exceptions and Exception Handling, Utility Classes, Threads and Synchronization, Introduction to SDLC, Introduction to UML	8
UNIT-III	**Java Database Connectivity (JDBC):** accessing data from tables: Joining, manipulating Databases with JDBC, Prepared Statements, Transaction Processing.	8

IBM

UNIT-IV	**Servlets and Java Server Pages (JSP):** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, using cookies. Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries.	8
UNIT-V	**Introduction to Application Development:** Introduction to android platform, creating application template, adding activity, intent, services to application, using Google mapAPI.	8

Text/Reference Books:

1. Java: A Beginner's Guide" by Herbert Schildt
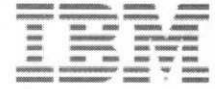2. Java: An Introduction to Problem Solving and Programming" by Walter Savitch and Frank Carrano

BC24-AEC-203
Credit-4
L-T-P-3-1-0

IBM

FRONT END TECHNOLOGIES OUTLINE

The Frontend Development course is designed to provide participants with a comprehensive understanding of the Web Development. The course divided into five units, covering essential topics such as HTML, CSS, Java Script, jQuery, React.js, Next.js.

By the end of the course, participants will have gained a solid foundation in Web Development create impact in the job profile and this course help to success in life

LEARNING OBJECTIVES

- Understand the fundamental concepts Frontend Technologies.
- The learning objective of web frontend development is to acquire the skills and knowledge necessary to build and maintain both the front-end components of a web application.
- This includes understanding and proficiency in various programming languages, frameworks, and technologies used in client-side (front-end) development.

COURSE AGENDA

Unit 1. Introduction of JavaScript

Overview	• Data types, data structure
	• Variables, operators, Arrays, String, Objects, Loops
	• Conditions & Switches, Function, methods, Arrow Function
	• classes modules, High Order Function, IIFE
	• Event loop, Hoisting, Spread operator, Destructuring
	• Fetch API, ES6 syntax, Asynchronous behaviour
	• Inbuilt Methods (exp: - sort, reverse, random)
	• Error types in JavaScript, Closures, Promises

Unit 2. Introduction of HTML, CSS

Overview	• Intro of HTML, Basic Elements & Document, Tags and Attributes
	• Lists & Tables - Project List & Table
	• Forms & Input - Project Registration Form, Navigation Bar
	• Header and footer, aside, HTML5 media
	• Web storage API and Geo location API
	• All Important elements
	• Intro of CSS, CSS Basic Styling - Project on Basic Styling
	• Positioning & Background Images - Project on Images
	• Pseudo Classes - Project on Pseudo Classes
	• Colors, Backgrounds & Gradients - Project on Color Backgrounds

- Text & Box Shadows - Project Text Shadows, Selectors, Combinators
- Box model, Media query, Transitions & Animation - Project on Animations
- Grid & Flex box - Project in Flex Box and Grid
- CSS3 - Project using Drop down Menu Canvas - Project on Drawing with Canvas
- SVG - Project on Vector Graphics, Drag and Drop with JS

Unit 3. Basics of jQuery and Advance JavaScript

Overview	
	• Selectors & Mouse Events - Project on Selectors
	• Form Events - Project Form Events
	• DOM Manipulation - Project on DOM
	• Effects & Animation - Project on Effect and Animation
	• Traversing & Filtering - Project on Filtering, HTML manipulation, Ajax /fetch with Json
	• DOM, Error handling, JavaScript Form Validation - Form Project, HOF
	• Fetch and JSON with JavaScript
	• Local Storage, Session Storage, Cookies

Unit 4. Introduction of React.js

Overview	
	• React intro, React. components, React props, React DOM, and events, Conditional rendering, React-Router-Dom, React CSS, React Hooks, CRUD operations, Redux (Global State Management Library)
	• Virtual DOM, Axios, Context API
	• External library Chakra UI and Bootstrap, Styled components
	• JSON server, Side effect in react components
	• Higher Order Components, React events

Unit 5. Introduction of Next.js

Overview	
	• Understand what Next.js is and its benefits.
	• Learn about server-side rendering and static pre-rendering.
	• Setting Up Next.js: Installation and project setup, Creating a basic Next.js app.
	• Automatic Routing: How Next.js maps URLs to files in the pages folder, Customizing routes.
	• Server Rendering (SSR): Rendering React components on the server side, Improving page load times.
	• Dynamic Routing: Creating dynamic routes with parameters, Handling route data.

IBM SKILLS ACADEMY

BC24-CC-304
Credit-4
L-T-P- 3-1-0

IBM

PYTHON TRAINING MODULE

(CLASSROOM)

PYTHON TRAINING MODULE

The Python Training module will make the reader accustomed to python language. This material will help the reader in understanding the basics of the python language, Python libraries and the use of python for the analytics.

DELIVERY METHOD

25 % Self-paced Learning

75 % Instructor led training

VERSION

2019

LEARNING OBJECTIVES

- Explain what Python is
- Advantages and disadvantages of Python
- Getting started with Python and its different versions
- Explain variables, strings and functions
- Use of mathematical operators and functions
- Explain different statements like if, for etc.
- Explain the python libraries
- Explain Details of the Pandas library
  - Series and Data Frames
  - Grouping and aggregating
  - Merging and joining
- Define error handling in Python
- Define RE objects
- Define pattern matching and Parsing of data
- Define regression with Use case study
- Define exploratory data analysis
- Define correlation matrix
- Define visualization using matplotlib
- Define churn analysis with Use case
- Define advance Machine learning Algorithms
- Define Support vector machine
- Define Random forest

PREREQUISITES SKILLS

- Computer Science fundamentals
- Basic knowledge of applied math, algorithms, and data modelling
- Basic knowledge of statistics

DURATION

40 Hours

SKILL LEVEL

Basic – Intermediate

HARDWARE REQUIREMENTS

Processor	2 GHz or Higher
GB RAM	8 GB
GB Disk Free	80 GB
Network Requirements	Yes

Notes

The following unit and exercise durations are estimates and might not reflect every class experience. The estimates do not include the duration of optional exercises or sections. Students in this course use an IBM Cloud Lite account to perform the exercises. This account will never expire; therefore, students can continue working on the optional exercises after the class

COURSE AGENDA

UNIT I. Introduction to PYTHON

Duration: 6 Hrs.

Overview	This unit explains what is Python, its advantages and disadvantages, how to run python scripts, how to use variables, string operator and functions.
Learning Objectives	After completing this unit, you should be able to: • Explain what Python is • How to install and get start with python • How to use basic variables and stings in python • Work with Mathematical operators in python

UNIT II. Deep dive into PYTHON

Duration: 8 Hrs.

Overview	This unit consist more in depth working of Python like inputting the data, working with Boolean and other statements.
Learning Objectives	After completing this unit, you should be able to: • How to input data in Python • Use Boolean with python • Use If and elif statement in python • Use while loop in python • Work with lists • Use For statement

UNIT III. Python Libraries

Duration: 8 Hrs.

Overview	This unit explains the use of pandas library for data analysis
Learning Objectives	After completing this unit, you should be able to: • Install Pandas • Work with series and data frames • Work on grouping, aggregating and applying different functions on data • Merge and Join the data

UNIT IV. Error Handling

Duration: 4 hrs.

Overview	This unit explains how to deal with different type of errors that one can encounter while working with Python.
Learning Objectives	After completing this unit, you should be able to: • Deal with Syntax errors • Deal with the exceptions

UNIT V. Other Topics

Duration: 4 hrs.

Overview	This unit explains how to deal with miscellaneous things in python
Learning Objectives	After completing this unit, you should be able to: • Work with regular expression • Work with Pattern matching • Parse data

UNIT VI. Regression (Use case study)

Duration: 3 hrs.

Overview	This unit explains regression analysis with the help of a use case.
Learning Objectives	After completing this unit, you should be able to: • Define regression analysis • Work with regression analysis

UNIT VII. Other Regression related topics

Duration: 4 hrs.

Overview	This unit explains different topics which are important from the point of view of data analytics.
Learning Objectives	After completing this unit, you should be able to: • Define exploratory analysis • Define correlation matrix • Perform visualization using matplotlib • Implement linear regression

UNIT VIII. Advance

Duration: 3 hrs.

Overview	This unit explains some advance data analytics techniques.
Learning Objectives	After completing this unit, you should be able to: • Apply advanced Machine learning algorithms • Work on Support vector machines • Define Random forest

IBM CE – Predictive Analytics using IBM SPSS Modeler   **BC24-CC-303**
Credit-4
L-T-P-3-1-0

IBM

IBM is empowering university graduates and working IT professionals in India/South Asia with knowledge and skills to serve the largest enterprise business software suite in the world. The IBM Career Education Program is a comprehensive software education program designed by IT professionals, for graduates, post graduates and experienced professionals to accelerate their skills and knowledge so that they succeed in this dynamic industry. The Program curriculum brings together the latest software content, real-world industry experience, hands-on lab courses and best practices, all into a single unique education program.

The Program provides:

- A blended learning approach, integrating classroom, hands-on lab exercises and real life case studies to provide both theoretical and practical training to solve real world problems
- The latest software content and knowledge of IT developments in the market to keep you ahead of technology trends
- A top-class faculty comprising of field consultants, technical specialists and education experts
- A comprehensive semester based format to build technical foundation and widen skill specialties quickly
- IBM leadership and professional certification in IBM software technology

Courses are available across all Software Brands and various levels of proficiency. The extensive portfolio of integrated certifications also focuses on the competencies required in early stages of a professional career. Experiential learning through projects/cases, the most important aspect that companies look for in fresher also forms a critical part of the offering.

At the end of the course, certificates of participation or completion are issued by IBM.

Delivery Method

Delivered through authorized IBM Career Education partners across India/South Asia, students can be sure that they are getting the same quality curriculum, software solutions exposure and knowledge, wherever they are located. Acquire all the skills you need to advance onto a successful career path and stay on top of the latest technology.

- The Trainer Pool is trained & evaluated by IBM Education Services
- The course material is developed & given by IBM Education Services
- Session plan and course conduct is defined by IBM Education Services
- Certification of Completion of Participation (Course)

Engagement Details

- IBM Education Services provides content, technology and enablement
- IBM Career Education Business Partner will conduct the training as per IBM Guidelines
- College needs to provide Lab facilities as described in the concept note
- Delivery of course will be defined & monitored by IBM Career Education

IBM CE – Predictive Analytics using IBM SPSS Modeler

Technologies

IBM SPSS Modeler

People spend 30% of their time and income on daily commutes. Public transportation agencies are challenged to find ways to increase convenience, improve the travel experience and lower costs. Business analytics uses real-time data to anticipate and control congestions, helping traffic systems flow smoothly.

About Course:

The Predictive Analytics Modeler career path prepares students to learn the essential analytics models to collect and analyze data efficiently. This will require skills in predictive analytics models, such as data mining, data collection and integration, nodes, and statistical analysis. The Predictive Analytics Modeler will use tools for market research and data mining in order to predict problems and improve outcomes.

Target Audience:

Students of:

Pre-requisites:

Prior to attending this course, knowledge of working on spreadsheets is required.

Concepts in Basic Statistics will help, but not mandatory

Infrastructure specifications

- Hardware requirement – Systems with minimum 8GB memory, Windows 7 OS & 2.5 GHZ plus Processor
- Classroom set up
- Machines: 50 Computers with above specified hardware
- Operating system: Windows
- White Board: 1
- LCD Projector: 1
- Instructor Machine: 1
- Flip Chart board: 1
- All machines to be fully networked.

IBM CE – Predictive Analytics using IBM SPSS Modeler

Course Contents

Student Development Program Overview

- Prepare Data for Modeling
- Data Reduction: Principal Components
- Decision Trees / Rule Induction
- Neural Networks
- Support Vector Machines
- Linear Regression
- Cox Regression for Survival Data
- Time Series Analysis
- Logistic Regression
- Discriminant Analysis
- Bayesian Networks
- Finding the Best Model for Categorical Targets
- Finding the Best Model for Continuous Targets
- Getting the most from Models

Advanced Data Preparation

- Introduction to Data Preparation
- Sampling Data
- Working with Dates
- Working with String Data
- Data Transformations
- Working with Sequence Data
- Exporting Data Files
- Efficiency within PASW Modeler

IBM CE - Predictive Analytics using IBM SPSS Modeler

IBM Career Education

BC24-CC-402
Credit-4
L-T-P-3-1-0

IBM
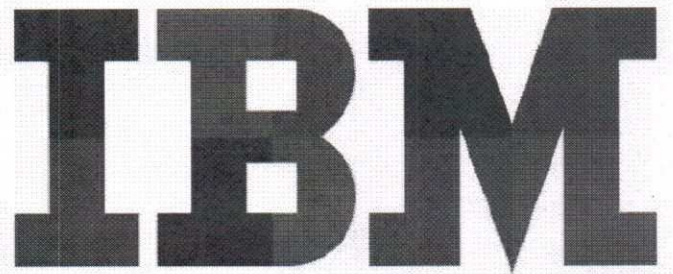
IBM Cloud Fundamentals

(Classroom)

IBM Cloud Fundamentals Module

IBM Cloud Fundamentals is a comprehensive course that provides a solid foundation in understanding and utilizing IBM Cloud services. Participants will gain practical knowledge in deploying, managing, and securing applications on the IBM Cloud platform. Ideal for individuals seeking to enhance their cloud computing skills.

DELIVERY METHOD

- 25% Self-Paced Learning
- 75% Instructor Led Training

PREREQUISITES SKILLS

Basic computer knowledge and familiarity with web technologies preferred.

DURATION

32 Hours

SKILL LEVEL

Basic – Intermediate

HARDWARE REQUIREMENTS

Processor	2 GHz or Higher
GB RAM	8 GB + SSD Based Internal Storage
GB Disk Free	80 GB
Network Requirements	Yes

SOFTWARE REQUIREMENTS

Operating System	Windows 8 or above / Linux
Other essential software	IBM Cloud Account
Editor	Jupyter notebook
Browser	Chrome

The following chapter and exercise durations are estimated and might not reflect every class experience. The estimates do not include the duration of additional exercises or sections. Students in this course to have setup the software requirement as stated. The course contains test your knowledge after each chapter.

COURSE AGENDA

Chapter 1. Introduction to Cloud Computing and IBM Cloud:

Duration: 4 Hrs.

Overview	Understand the fundamentals of cloud computing, including key concepts and benefits. Explore the IBM Cloud platform, its core services, and the various deployment models. Learn how to navigate the IBM Cloud console and interact with the platform.
Learning Objectives	After completing this unit: • Understand the basics of cloud computing and its advantages. • Explore the key features and components of the IBM Cloud platform. • Navigate the IBM Cloud console and perform basic tasks.

Chapter 2. IBM Cloud Infrastructure Services:

Duration: 6 Hrs.

Overview	Discover the infrastructure services offered by IBM Cloud. Learn how to provision virtual servers, create storage resources, configure networking components, and manage security. Understand concepts such as virtual private clouds (VPCs), security groups, and load balancers.
Learning Objectives	After completing this unit, you should be able to: • Provision virtual servers and storage resources on IBM Cloud. • Configure and manage networking components such as VPCs, security groups, and load balancers. • Implement security measures and best practices for IBM Cloud infrastructure.

Chapter 3. IBM Cloud Platform Services:

Duration: 6 Hrs.

Overview	Explore the platform services available on IBM Cloud for building and deploying applications. Learn about serverless computing, containerization with Kubernetes, databases, AI and .machine learning services, and more. Understand how to integrate different services to create comprehensive applications.
Learning Objectives	After completing this unit, you should be able to: • Deploy applications using IBM Cloud platform services. • Utilize serverless computing and containerization for scalable and flexible application architectures. • Integrate and utilize various IBM Cloud services to enhance application functionality.

Chapter 4. DevOps and CI/CD on IBM Cloud:

Duration: 6 Hrs.

Overview	Learn about DevOps practices and tools for deploying applications on IBM Cloud. Understand the concepts of continuous integration and continuous deployment (CI/CD) and how to automate the software development lifecycle. Explore DevOps toolchains, deployment pipelines, and monitoring.
Learning Objectives	After completing this unit, you should be able to: • Implement CI/CD pipelines for deploying applications on IBM Cloud. • Use DevOps tools like IBM Cloud Continuous Delivery, GitLab, and Jenkins for automation. • Monitor and optimize application performance and availability in a DevOps environment.

Chapter 5. Visualization by using Tableau:

Duration: 4 Hrs.

Overview	Explore security and compliance considerations when working with IBM Cloud. Understand identity and access management (IAM), network security, encryption, and compliance frameworks such as GDPR and HIPAA. Learn how to protect applications and data on IBM Cloud.
Learning Objectives	After completing this unit, you should be able to: • Implement security measures for protecting applications and data on IBM Cloud. • Manage user access and permissions using IAM. • Ensure compliance with data protection regulations and industry standards on IBM Cloud.

Chapter 6. Monitoring and Troubleshooting on IBM Cloud:

Duration: 4 Hrs.

Overview	Learn how to monitor and troubleshoot applications and services on IBM Cloud. Explore tools and techniques for monitoring performance, logs, and metrics. Understand how to identify and resolve common issues to maintain application health and availability.
Learning Objectives	After completing this unit, you should be able to: • Monitor application performance and troubleshooting issues on IBM Cloud. • Utilize logging and monitoring tools to gather and analyze application metrics. • Implement troubleshooting strategies and best practices for maintaining application health on IBM Cloud.

BC24-SEC-401
Credit-4
L-T-P-3-1-0

Spark and Scala	
Course Code:	Internal Examination: 50
No. of Lectures (Hrs./Week):	External Examination: 50
Total No. of Lectures:	Total: 100
Credits:	End Semester Exam Hours: 3

COURSE OBJECTIVE
• To provide an overview of an exciting field of big data analytics
• Develop an understanding of the complete open-source scala and spark and its near term future direction
• To introduce the spark library required to manage and analyze data
• To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
• To enable students to have skills that will help them to solve complex real-world problems in for decision support.

UNIT NUMBER	CONTENTS	NO. OF LECTURES	BLOOM'S TAXONOMY LEVELS (BL)
UNIT-I	.Introduction to Scala Explain the use and advantages of Scala Programming • Explain types of variables in Scala, Functions, Flow Control Statements. • Implement programs to experience hands on.	8	BL2 & BL3 – UNDERSTAND AND APPLY
UNIT-II	**Introduction to Spark** Understand the need and use of Spark. • Explain the Spark Unified Stack. • Explain the Spark Runtime Architecture.	8	BL2 & BL3 – UNDERSTAND AND APPLY
UNIT-III	**Spark Fundamentals** Explain Resilient Distributed Datasets (RDD). • Understand the Transformations and Actions on RDDs. • Understand and Explain the need and use of Spark Libraries. • Implement programs to experience hands o	16	BL3 & BL4 – APPLY AND ANALYZE

UNIT-VI	PROJECT	7	BL6 - CREATE

COURSE LEARNING OUTCOMES (CLO)

The syllabus adhere to all Bloom's Taxonomy Levels and has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

- Understand the concept of programming and problem solving. The CLO has been achieved according to BL1 and BL2 in Unit 1.
- To understand and apply the concepts of Spark to solve real life problems. The CLO has been achieved according to BL2 and BL3 in Unit 2.
- Applying the advanced concepts of data to solve complex problems. The CLO has been achieved according to BL3 and BL4 in Unit 3.
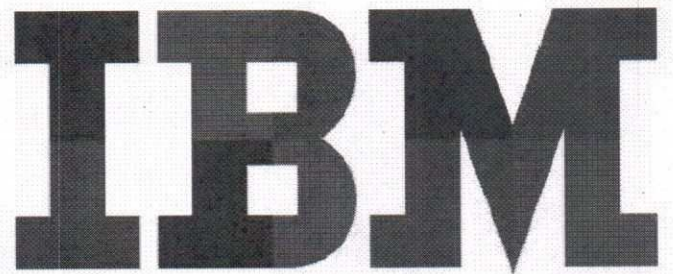
TEXT/REFERENCE BOOKS

- Learning Spark by Matei Zaharia, Patrick Wendell, Andy Konwinski, Holden Karau

- Advanced Analytics with Spark by Sandy Ryza, Uri Laserson, Sean Owen and Josh Wills

Further suggested Readings

- **Programming Scala by Dean Wampler, Alex Payne**
- Scala in depth by Joshua D. Suereth

IBM Career Education

BC24-CC-503
Credit-4
L-T-P-3-1-0

IBM

Data Science

(Classroom)

Data Science With Python Module

Analytics is the systematic computational analysis of data or statistics. It is used for the discovery, interpretation, and communication of meaningful patterns in data. It also entails applying data patterns towards effective decision-making.

Data Science has been around for a long time. But up until a few years ago, developers practiced it using expensive, closed-source tools like Tableau. But recently, Python, SQL, and other open libraries have changed Data Analysis forever.

DELIVERY METHOD

- 25% Self-Paced Learning
- 75% Instructor Led Training

LEARNING OBJECTIVES

- The course will cover a number of different concepts such as introduction to Data Science including concepts such as Linear Algebra, Probability and Statistics, Matplotlib, Charts and Graphs
- Data Analysis, Visualization of non-uniform data, Hypothesis and Gradient Descent, Data Clustering and so much more.
- That's not all, we'll also include projects to help you show exactly how to build visuals using Python.

PREREQUISITES SKILLS

Understanding of Core Python

DURATION

32 Hours

SKILL LEVEL

Basic – Intermediate

HARDWARE REQUIREMENTS

Processor	2 GHz or Higher
GB RAM	8 GB + SSD Based Internal Storage
GB Disk Free	80 GB
Network Requirements	Yes
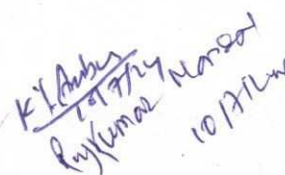
SOFTWARE REQUIREMENTS
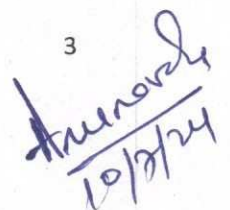
Operating System	Windows 8 or above / Linux
Other essential software	Anaconda
Editor	Jupyter notebook
Browser	Chrome

The following chapter and exercise durations are estimated and might not reflect every class experience. The estimates do not include the duration of additional exercises or sections. Students in this course to have setup the software requirement as stated. The course contains test your knowledge after each chapter.

COURSE AGENDA

Chapter 1. Statistics and Linear Algebra:

Duration: 4 Hrs.

Overview	In this chapter introduces Intro to Statistical Linear algebra. Traditional methods use to do analysis mathematical concept will be covered in deep.
Learning Objectives	After completing this unit: • You can start doing analysis using traditional methods • You can extract the summary of dataset.

Chapter 2. Python:

Duration: 8 Hrs.

Overview	This chapter provides introduction to Python and scientific libraries pandas and Numpy and handle the DataFrame and apply statistical functions
Learning Objectives	After completing this unit, you should be able to: • Handle the array and perform the complex calculation • Handle the DataFrame like merge and concatenation and you can create report using inbuild function of pandas

Chapter 3. Exploratory data analysis:

Duration: 8 Hrs.

Overview	This chapter provides information to handle missing values and convert the categorial column into numerical columns. Correlation of matrix to find the relation between features. Handle the outlier of dataset.
Learning Objectives	After completing this unit, you should be able to: • Data Preprocessing of dataset • Handle the outlier of dataset

Chapter 4. Supervised Machine learning

Duration: 8 Hrs.

Overview	This chapter provides an introduction of supervised machine learning algorithm along with that python implementation to create regression model which predict the continuous value. Evaluation of model by using error rate of model.
Learning Objectives	After completing this unit, you should be able to: • Understand the working of how model is being trained. • Know the mathematical logic behind the algorithm. • How model predict the future like predict the sales for company.

Chapter 5. Visualization by using Tableau and IBM Watson:

Duration: 4 Hrs.

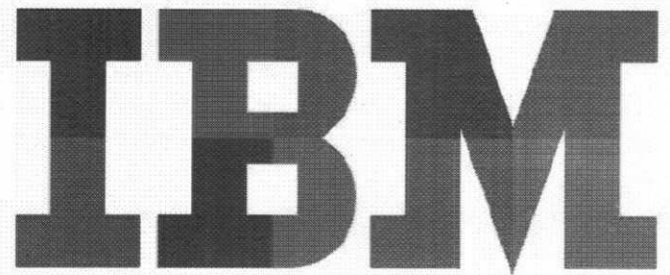|	
Overview	This chapter provides information of Tableau, Deep diving with data and connection, creating charts, Mapping data in Tableau, Dashboards and stories, and detecting fraud using Watson.
Learning Objectives	After completing this unit, you should be able to: • Create the visualization reports • Show your analysis into different type of graphs • Predict Using IBM Watson Using Machine Learning Service

IBM SKILLS ACADEMY

BC24-CC-504
Credit-4
L-T-P-3-1-0

IBM

Artificial Intelligence

(CLASSROOM)

Artificial Intelligence

The term artificial intelligence broadly refers to applications of technology to perform tasks that resemble human cognitive function and is generally defined as "[t]he capability of a machine to imitate intelligent human behavior." AI typically involves "[t]he theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages." John McCarthy, one of the founders of AI research, "once defined the field as getting a computer to do things which, when done by people, are said to involve intelligence."

DELIVERY METHOD

25 % Self-paced Learning
75 % Instructor led training

LEARNING OBJECTIVES

- Provides introduction about Artificial Intelligence.
- Machine learning and deep learning in detail.
- Work on IBM Watson.
- Computer vision technologies in the real world.
- Natural language processing explained.
- Deep learning explained and future of AI.

PREREQUISITES SKILLS

- Understanding of Python and IBM cloud.

DURATION

32 Hours

SKILL LEVEL

Basic - Intermediate

HARDWARE REQUIREMENTS

Processor	2 GHz or Higher
GB RAM	8 GB
GB Disk Free	80 GB
Network Requirements	Yes

SOFTWARE REQUIREMENTS

Operating System	Windows / Linux
Python	Python version 3.6+
Browser	Chrome

The following chapter and exercise durations are estimated and might not reflect every class experience. The estimates do not include the duration of additional exercises or sections. Students in this course to have setup the software requirement as stated. The course contains test your knowledge after each chapter.

COURSE AGENDA

Chapter 1. AI landscape

Duration: 2 Hrs.

Overview	This chapter Introduces the Overview of AI in detail with history.
Learning Objectives	After completing this unit, you should be able to: • What is AI and its types in detail with example, Impact of AI in the world today in the industries as well, History in detail, evolution of AI, evolution factors of AI, AI explained, AI key Technologies in detail.

Chapter 2. AI Industry adoption approaches

Duration: 4 Hrs.

Overview	This chapter provides information about the adoption of AI in the different industries in the real world.
Learning Objectives	After completing this unit, you should be able to: • AI industry impact, Autonomous vehicles, gathered data in Autonomous vehicles, smart robotics and its types, Future workforce and AI, Six key technologies of AI, Industrial revolution, Automation process levels, Future job market of AI.

Chapter 3. NLP and Virtual Assistants

Duration: 12 Hrs.

Overview	This chapter will give an idea about the NLP, virtual agents, chatbot works in the real world in detail.
Learning Objectives	After completing this unit, you should be able to: • NLP overview, what is NLP and its application in real time, components of NLP, Explained NLP in detail, Virtual agents overview, what are the virtual agents and how they work, Virtual agents for the Enterprise, Chatbot and its parts, how the social uses the NLP, Tokenization in NLP, five processing steps in NLP.

Chapter 4. Computer Vision

Duration: 7 Hrs.

Overview	This chapter gives an overview computer vision technology which is widely used now a days in every field.
Learning Objectives	After completing this unit, you should be able to: • Computer vision overview, CV – history and advancement with AI, Pipeline with in a CV application, Feature Extraction, image classification and recognition, image classification and tagging works in the CV, AI vision through Deep learning, Computer vision for the Enterprise, experiments, which technology uses the CV.

Confidential

Chapter 5. Machine learning and Deep Learning and Future of AI

Duration: 7 Hrs.

Overview	This chapter will provide you very important information related to machine learning and Deep learning and what the future can be.
Learning Objectives	After completing this unit, you should be able to: • Machine learning explained, Traditional systems and AI systems, what is optimization in ML, bias and variance, what is Gradient descent in ML and its algorithms, what is activation function and its types, Backpropagation, Architecture of neural network, Perceptron, multilayer perceptron and deep learning, Decision tree classifier, Deep learning explained, Deep learning ecosystem, Experiments. • Future of AI, Current trend of AI, Limits of machine and human, Human advantages over the machines, CIMON, API used in CIMON, Debater, machine debate, AI predictions in the next 5 years,

BC24-CC-601
Credit-4
L-T-P-3

IBM

Deep Learning

Course Objective:

1. To understand the historical evolution and contemporary importance of advanced deep learning, neural network concepts, and explore optimization techniques.
2. To grasp the architecture, operations, and significance of padding, convolutional layers, and filters in advanced Convolutional Neural Networks (CNNs), addressing bias and fairness.
3. To gain an overview of Recurrent Neural Networks (RNNs), tackle challenges like vanishing gradients, and comprehend the workings of Long Short-Term Memory (LSTM) Networks.
4. Explore encoder-decoder networks, diverse Generative Adversarial Networks (GANs), and Variational Autoencoders (VAEs) for image generation and manipulation.
5. To acquire practical skills in image processing, edge detection (Sobel, Prewitt, Canny) using OpenCV, and real-time object detection with systems like YOLO and applying techniques in augmented reality (AR) and virtual reality (VR) systems.

Learning Outcome:

After completing the course, the students should be able to:

1. Understand the evolution of deep learning, key neural network concepts, and implement optimization techniques for enhanced model performance.
2. Integrate advanced Convolutional Neural Networks (CNNs), architectural elements, and bias-aware models for fair and effective image processing.
3. Understand Recurrent Neural Networks (RNNs), integrate solutions to vanishing gradient challenges, and implement Long Short-Term Memory (LSTM) Networks for sequential data tasks.
4. Integrate encoder-decoder networks and diverse Generative Adversarial Networks (GANs), and implement image generation using Variational Autoencoders (VAEs).
5. Implement practical image processing and edge detection using OpenCV, integrate computer vision fundamentals, and implement real-time object detection systems like YOLO and applying techniques in augmented reality (AR) and virtual reality (VR) systems.

Course Contents:

Unit Number	Contents	No. Of hours
UNIT-I	**Foundations of Advanced Deep Learning** Overview of deep learning evolution, importance of advanced deep learning in contemporary applications, introduction to neural network, how does neural network work, key concepts of neural networks, layers, and activations, train neural network with backpropogation, optimization techniques.	08
UNIT-II	**Advanced Convolutional Neural Networks (CNNs)** Overview of cnn architecture, convolution operation in cnn, padding in convolutional neural network, convolutional layers and filters, max pooling layer in cnn, data augmentation in cnn, exploration of popular architectures (e.g.,vgg,resnet, inception), addressing bias and fairness in cnn models.	08
UNIT-III	**Recurrent Neural Networks (RNNs) and LSTMs** Overview of recurrent neural networks, application of rnn, recurrent neural network forward propogation, back propagation in rnn, vanishing and exploding gradient problems, working procedure of long short-term memory (lstm) networks, overview of bidirectional lstm,introduction to gated recurrent units (grus).	08
UNIT-IV	**Encoder-Decoder Networks And Generative Adversarial Networks (Gans)** Introduction to encoder-decoder networks, exploring different encoder and decoder architectures, overview of gan architecture and principles, training dynamics of gans, diverse gan architectures (e.g., dcgan, wgan, cyclegan), vaes for image generation and latent space manipulation.	08
UNIT-V	**Advanced Applications in Computer Vision** Overview of computer vision and its applications, image processing & transformation, image processing with opencv, sobel, prewitt, and canny edge detection algorithms in opencv,real-time object detection with systems like yolo, integration of computer vision in augmented reality (ar) and virtual reality (vr) systems.	08

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Text/Reference Books:

1. Goodfellow, Y. Bengio, and A. Courville, "Deep Learning," MIT Press, 2016.
2. C. C. Aggarwal, "Neural Networks and Deep Learning: A Textbook," Springer, 2018.
3. R. Atienza, "Advanced Deep Learning with TensorFlow 2 and Keras," Packt Publishing, 2020.
4. R. Shanmugamani, "Deep Learning for Computer Vision," Packt Publishing, 2018.

Further suggested Readings

1. Adam Gibson and Josh Patterson, "Deep Learning: A Practitioner's Approach," O'Reilly Media, 2017.
2. François Chollet, "Deep Learning with Python," Manning Publications