P. D. E. A's
Prof. Ramkrishna More Arts, Commerce and Science
College Akurdi Pune-411044

Affiliated to

Savitribai Phule Pune University [SPPU]

B.C.A. (Under AICTE)

Choice Based Credit System- Pattern-24

Under

Autonomy and NEP-2020

From Academic Year 2024-2025

Syllabus

T.Y. B. C.A. (Under AICTE)
Academic Year :2026-27

Board of Studies B.C.A.

Board of Studies B.C.A. (Science)

Preamble of the syllabus

B.C.A.(Science) program is designed to bridge the gap between IT industries and academic institutes by incorporating the latest development into the curriculum and to give students a complete understanding within a structured framework. This is intended to provide a broad framework within which help to create an academic base that responds to the need of the students to understand the basics of Computer. The curriculum framework is designed and formulated in order to acquire and maintain standards of achievement in terms of knowledge, understanding and skills in Computer Science and their applications, critical thinking and developing skills for problem solving and initiating research which are competitive globally. This program is for candidates who wish to explore new emerging technologies using computer languages.

It will provide the necessary skills to make the successful candidate proficient in software development, paving the way for self-employment. The curriculum is oriented more towards Programming and Software. Ability to apply the algorithmic principles, mathematical foundations and computer science theory for designing computer-based systems.

Goals:

- The Department BCA(Science) degree is to give students the information and skills required for careers in the software business, as well as computer application. To provide high-quality computer education to enhance logical programming and computing skills.
- To prepare students for carriers in software industry understanding and skills related to the use of computers and its applications.

Objectives:

1. **Advanced Computing Knowledge**
   To provide students with in-depth knowledge of advanced computer science concepts such as software development, database systems, networking, and emerging technologies.
2. **Programming and Development Skills**
   To enhance students' ability to design, develop, test, and maintain software applications using modern programming languages and development tools.
3. **Problem-Solving and Analytical Thinking**
   To develop logical reasoning, analytical ability, and problem-solving skills required for designing efficient computing solutions.
4. **Database and Information Management**
   To enable students to understand database design, data management techniques, and information systems used in real-world organizations.
5. **Project Development and Practical Exposure**

To provide hands-on experience through major projects, enabling students to apply theoretical knowledge to practical software development.

6. **Industry Readiness and Professional Skills**
   To prepare students for careers in IT by developing teamwork, communication skills, and professional ethics required in the software industry.
7. **Foundation for Higher Studies and Research**
   To build a strong academic foundation for pursuing advanced studies such as MCA, MSc (Computer Science), or specialized IT programs.

Eligibility Criteria:

1. The candidate must have **passed 10+2 (Higher Secondary Examination)** or an equivalent examination from a recognized board.
2. Admission may be based on: **Merit (12th marks)** and **Entrance tests conducted by AICTE**.

Rules and Regulations:

3. National Credit Framework (NCrF): For creditisation and integration of all higher education qualifications leading to a certificate/ diploma/ degree with multiple entry and exit options, college will refer to National Credit Framework (NCrF) which encompasses the qualification frameworks for higher education, vocational and skill education and school education, namely National Higher Education Qualification Framework (NHEQF), National Skills Qualification Framework (NSQF) and National School Education Qualification Framework (NSEQF) respectively.

4. Structure of Four years multidisciplinary UG Programme and Five Years Integrated Multidisciplinary Master's Degree Programmes with Multiple Entry and Exit Options at Different Levels:

i. Students will have the flexibility to enter four years multidisciplinary Under Graduate Programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.

ii. Students will get a Certificate after a One year programme (minimum 40 Credits), a Diploma after two years (minimum 80 Credits), a Bachelor's degree after three years (minimum 120 Credits), and a Bachelor's degree with Research or Honours after Four years (minimum 160 Credits).

(i) Qualification Type and Credit Requirements of Four Years Multidisciplinary Degree Programme with Multiple Entry and Exit Options

(ii) Details of qualifications, minimum credit requirements, exit credit courses, year and semester are as under:

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	UG Certificate	40	44	2	1
5.0	UG Diploma	80	88	4	2
5.5	Three Years Bachelor's degree	120	132	6	3
6.0	Bachelor's degree Honour's with Major	160	176	8	4
	Bachelor's degree Honour's with Major	160	176	8	4
7.0	Master's Degree	200	220	10	5
8.0	Ph. D.	----	-----	-----	----

(iii) An exit 6-credit bridge course(s) lasting two months, including at least 6-credit job specific internship/apprenticeship that will help the graduates acquire job-ready competencies required to enter the workforce will be an additional requirement for the award of the undergraduate Certificate/ Diploma/ three year Bachelor's Degree.

(iv) On exit, the students will have the option to re-enter the programme in the college, or in a different higher education institution. Re-entry at various levels for lateral entrants in academic programmes should be based on the earned and valid credits as deposited and accumulated in the Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records.

(v) Eligibility for admission to the fourth year of four-year Honours with Research Degree Programmes as per UGC guidelines: Minimum CGPA of 7.5 or minimum 75% at three-year degree.

(vi) PG curriculum, as illustrated below, have flexibility

a) One-year Post-Graduate Diploma (PGD), b) Two-year Post-graduate Programme and c) 5 Years Master's degree programmes with multiple Entry and Exit options at different

levels.

(a) Post-Graduate Diploma (PGD): Programme duration- One year (2 semesters) after any bachelor's degree, min. 40 credits

(i) UGC: 1-Year (2 semesters) Post-Graduate Diploma (PGD) after 3-years Bachelor's degree: Level 6.0

(ii) UGC: 1-Year (2 semesters) PGD after 4 years Bachelor's degree (Honors/ Research): Level 6.5

(b) Master's Degree:

(c) UGC: 2-Years (four semesters) Master's Degree after obtaining a 3-years Bachelor's degree, Minimum 40 credits/year, second year devoted entirely to research, PG – 2nd year: Level 6.5 1-Year (two semesters) Master's Degree after obtaining a 4-year Bachelor's degree (Honours/Research): Minimum 40 credits: Level 6.5

(d) Level 8 represents Ph. D. Research Degree.

(e) A 5-year Integrated Bachelor's and Master's programme shall have a minimum of 220 credits.

(f) Master's and doctoral programmes, while providing rigorous research-based specialization, should also provide opportunities for multidisciplinary work, in academia, government, research institutions, and industry.

2. Lateral Entry/ Re-entry at higher Levels after exit from lower levels of four years multidisciplinary UG degree programme:

(i) The credit points earned and accumulated shall be used to determine the eligibility for taking admission to various programs at multiple levels, subject to fulfilment of the broad principles laid down under NCrF. Students who leave with a Certification, Diploma, or a Basic Bachelor's Degree will be eligible to re-enter the programme at the exit level to complete or progress to the next level through lateral entry mode. Depending upon the academic and physical facilities available, the State Universities/ Autonomous Colleges (Higher Education Institutions or HEI) may earmark specific seats/ intake for lateral entry into the second year/ third year/ fourth year of a four years multidisciplinary UG degree programme as approved by Professional Standard Setting Bodies (PSSB/Govt. of Maharashtra/ statutory council of affiliating University plus any consequential vacancies caused by exits to an ongoing programme (four- year Degree Programme and Integrated Master's or second year Master's). Lateral entry or Re-entry is open to those students if he/she has either –

(a) successfully completed the first year/second year/third year of the particular four years multidisciplinary degree programme in any ABC registered HEI with valid credits in ABC and re-entering into the second year/third year/fourth year, respectively of the same four years degree programme of any ABC registered HEI, within stipulated/ permissible period of years as decided by Statutory Councils of that HEI

OR

(b) Already successfully completed a multidisciplinary four-year first-degree programme and is desirous of and academically capable of pursuing

another multidisciplinary four years first-degree programme in an allied subject.

(ii) A student will be allowed to enter/re-enter only at the odd semester. Re-entry at various levels for lateral entrants in academic programmes should be based on the earned and valid credits as deposited and accumulated in Academic Bank of Credits (ABC) through Registered Higher Education Institutions (RHEI) and proficiency test records. However, in terms of the admission eligibility requirements, the student shall belong to the same faculty/ discipline in terms of Major Subject i.e., the Major subject of his earlier Programme and the Major subject of the new Programme for which he is seeking admission must be from the same faculty/discipline. Reservation for lateral entry will be executed as per the Government of Maharashtra norms.

3. Distribution of Credits across Multidisciplinary Four Years Degree Programme:

(i) Four-year multidisciplinary degree programme with Honours/ Specialization Degree will have Internship and Core /Major Courses with a minimum of 22 credits per sem. in the Fourth Year.

(ii) Four-year multidisciplinary degree programme with Research will have Research Projects, Seminars, Dissertations and Internships with a minimum of 22 credits per Sem. in the Fourth Year.

(iii) Students shall select a 'Major or Core Subject/ Discipline' and a 'Minor Subject/Discipline' from the lists of various Subject Combinations and Options provided the Colleges. In general, for the four years multidisciplinary bachelor's degree programme, the distribution of credits will be as follows:

(a) Disciplinary/interdisciplinary Major/ Core Subject (minimum of 68 credits)- Mandatory and Elective Courses

(b) Disciplinary/interdisciplinary Minor Subject (maximum of 22 credits)

(c) Skill based/Vocational studies corresponding to the Major/ Core Subject (8 credits)

(d) Field projects/internship/apprenticeship/community engagement and service corresponding to the Major/ Core Subject (14-22 credits) with a maximum of six credits per Semester

(e) Generic/ Open Electives through Baskets of Elective Courses (12 credits),

(f) Ability Enhancement Courses including Languages, Literature and Environmental Studies (12 credits),

(g) In-built modules on the Indian Knowledge System (IKS) in Major/ Core Subject at Level 4.5 – 2 credits

(h) Value-based Education, Life Skills and Professional Ethics: Co-curricular Courses such as Sports and Culture, NSS/NCC and Fine/ Applied/Visual Arts (8 credits).

Student can earn some credits (SEC/VSC/GE/OE) in the form of online from-

(i) The National Skills Qualifications Framework (NSQF) organizes

qualifications for Vocational and Skill Courses in a series of 8 levels based on professional knowledge, professional skills, core skills and responsibilities, in the increasing order of complexity and competency.

(ii) University Grants Commission (Credit Framework For Online Learning Courses through Study Webs of Active-Learning for Young Aspiring Minds) Regulations, 2021, permits up to 40 per cent of the total courses being offered in a particular programme in a semester through the Online Learning Courses offered through the Study Webs of Active-Learning for Young Aspiring Minds (SWAYAM) platform.

4. Examination and Assessment Process:

(i) The basic principle of the credit framework is that credits are a function of the successful completion of a program of study/ vocational education/ training and assessment. No credit can be earned by the student unless the student is assessed for the achievement of the desired competencies and outcome of a program.

(ii) Exit options are provided with certification, diploma and basic Bachelor's degrees to the students at the end of the second, fourth and sixth semesters of a four years multidisciplinary degree programme. Students will receive a Bachelor's degree with Honours/ Research on successfully completing of all eight semesters of the UG Program either at a stretch or with opted exits and re-entries.

(iii) For the smooth success of four-year multidisciplinary degree programme with multiple entry and exit systems, the examination mode will be based on the combination of innovative trends in formative (informal and formal tests administered during the learning process) and summative (evaluation of students learning at the end of an instructional unit) examination modes. This is in line with the UGC Report on 'Evaluation Reforms in Higher Educational Institutions (2019)'.

(iv) Evaluation of each students in each course will be done as follows

a. Each theory or practical course will be of 2 credits = 50 mark

b. Internal evaluation 30% weightage (15 mark)

c. External evaluation 70% weightage (35 marks)

d. Students should secure 40% marks in each type of evaluation for successful completion of a course (student should secure at least 6 marks in internal and 14 marks in external evaluation).

(v) Evaluation Pattern.

a. Internal evaluation - Two written test, each of 20 marks will be conducted i. e. two tests on two modules. 1st assignment after completing 6 weeks of teaching and 2nd on completion of 13th week of teaching. Question paper should be designed so that evaluation of CO, PO, PSO can be performed. 10 marks out of 15 will be assigned from these written tests. Remaining 5 marks will be assigned from other types of evaluation such as seminars, orals, poster presentation, open book challenging tests, surprise test, objective test on whole syllabus of the course (at least 40 questions of objective type must be

designed), etc. for 5 marks at least two different types technique must be utilized.

b. External Evaluation - External evaluation will be done at the end of semester. For theory, 35 marks written examination will be conducted and time of examination will be 2-hours.

5. Declaration of Results:

(i) Declaration of result is based on the Semester Grade Point Average (SGPA) earned towards the end of each semester or the Cumulative Grade Point Average (CGPA) earned at the completion of all eight semesters of the programme and the corresponding overall alpha-sign or letter grades as given in Table 2. If some candidates exit at the completion of the first, second or third year of the four years Undergraduate Programmes, with Certificate, Diploma or Basic Degree, respectively, then the results of successful candidates at the end of the second, fourth or sixth semesters shall also be classified on the basis of the CGPA obtained in the two, four, six or eight semesters, respectively. Successful candidates at the end of the tenth semester of the integrated Master's Degree Programmes shall also be classified on the basis of CGPA obtained in the ten semesters of the Programmes. Likewise, the successful candidates of one year or two semesters Master's Degree Programme are also classified on the basis of the CGPA of two semesters of the Master's Degree Programme.Table-2: Grades on degree certificate/mark sheet will be assigned to the students as per the following table

Semester GPA/ Program CGPA Semester/Program	**% of Marks**	**Alpha-Sign / Letter Grade Result**
9.00-10.00	90-100	O (outstanding)
8.00 - <9.00	80.00 – <90.00	A+ (Excellent)
7.00 - <8.00	70.00-<80.00	A (Very Good)
6.00 - <7.00	60.00-<70.00	B+ (Good)
5.50 - <6.00	55.00-<60.00	B (Above Average)
5.00 - <5.50	50.00-<55.00	C (Average)
4.00 - <5.00	40.00-<50.00	P (Pass)
Below 4.00	< 40	F (Fail)
Ab	----------	Absent

(ii) A student obtaining Grade F shall be considered failed and will be required to reappear in the examination. For non-credit courses 'Satisfactory' or "Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

6. Award of Major and Minor Degree:

(i) A student pursuing four-year multidisciplinary UG programme will be awarded an appropriate Honours/ Research degree in Major/ Core Subject on completion of VIII Semester with the minimum of 176 credits if he secures in that

Subject at least 50% of the total credits for that programme. He shall thus study the specific number of Mandatory Core Courses, Core Electives, Vocational and Skill Courses and Field projects/ Internships connected to Core Subjects in eight semesters so as to cover at least 50% of the total credits.

(ii) In case of Research Degree, a student shall pursue research project and write dissertation in that Major in the VII and VIII semesters. On the basis of above rules and regulations under NEP-2020 following course frame work is adopted by the Prof. Ramkrishna More Arts, Commerce and Science College, Akurdi, Pune-411044 for the completing of four years honours degree in Major and Minor subjects.

7. Distribution of Credits across Four Years Degree Programmes: In general, for the four years' bachelor's degree programme, the distribution of credits will be as follows:

(a) Major (Core) Subject comprising Mandatory and Elective Courses:

i. Minimum 50% of total credits corresponding to Three/Four - year UG Degree- Mandatory Courses offered in all Four years;

ii. 2 credit course on Major Specific IKS shall be included under Major;

iii. Elective courses of Major will be offered in the third and/or final year.

iv. Vocational Skill Courses, Internship/ Apprenticeship, Field Projects, Research Projects connected to Major first to fourth year.

(b) Minor Subject: 18-20 Credits

i. The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether.The credits of Minor subjects shall be completed in the first three years of UG Programme.

(c) Generic/ Open Elective Courses (OE): 10-12 credits

i. It is to be offered in I and/or II year

ii. Faculty-wise baskets of OE shall be prepared by University/ Autonomous Colleges.

iii. OE is to be chosen compulsorily from faculty other than that of the Major.

(d) Vocational and Skill Enhancement Courses (VSEC): 14-16 credits

Vocational Skill Courses (VSC): 8-10 credits, including Hands on Training corresponding to the Major and/or Minor Subject:

i. To be offered in first to three years;

ii. Wherever applicable vocational courses will include skills based on advanced laboratory practicals of Major

Skill Enhancement Courses (SEC): 06 credits

i. To be offered in I and II year;

ii. To be selected from the basket of Skill Courses approved by University/ Autonomous Colleges

(e) Ability Enhancement Courses (AEC), Indian Knowledge System (IKS) and Value Education Courses (VEC): 14 Credits

- AEC: 08 credits
  i. To be offered in I and II year
  ii. English: 04 Credits
  iii. Modern Indian Language: 04 credits
  iv. To be offered from the Basket approved by the College;

The focus for both languages should be on linguistic and communication skills.

- IKS: 2 Credits
  i. To be offered in I Year
  ii. Courses on IKS to be selected from the basket of IKS courses approved by the Colleges
- VEC: 04 Credits
  i. To be offered in I year
  ii. Value Education Courses (VEC) Environmental Science Education (Compulsory), Understanding India, and Digital and Technological Solutions.

Field Projects/ Internship/ Apprenticeship/ Community Engagement and Service corresponding to the Major (Core) Subject, Co-curricular Courses (CC) and Research Project

- Internship/Apprenticeship corresponding to the Major (Core) Subject: 8 Credits

iii. Field Projects/Community Engagement and Service corresponding to the Major (Core) Subject: minimum 4-6 credits

iv. To be offered in II, and III years of UG Degree Programmes.

v. ● Co-curricular Courses (CC) such as Health and Wellness, Yoga education sports, and fitness, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts: 8 credits. To be offered in I and/or II year

vi. ● Research Projects: 12 credits

vii. To be offered in the final year for 4-year Honours with Research UG Degree The UGC Regulations, 2021 permit up

viii. to 40% of the total courses being offered in a particular programme in a semester through the Online Learning Courses offered through the SWAYAM platform and/or other State Level Common Platforms which can be developed in due course with the participation of different Universities/ HEIs.

ix. Abbreviations: Generic/ Open Electives: GE/OE; Vocational Skill and Skill Enhancement Courses: VSEC; Vocational Skill Courses: VSC; Skill Enhancement Courses: SEC; Ability Enhancement Courses: AEC; Indian Knowledge System: IKS; Value Education Courses: VEC; OJT: On Job Training: Internship/ Apprenticeship; Field projects: FP; Community engagement and service: CEP; Co- curricular Courses: CC; Research Methodology-RM; Research Project: RP Note: The Credit Distribution Table given above is illustrative only. The Universities/ Autonomous Colleges may suitably modify within the broader framework of credit distribution across six verticals.

P.D.E. A's. Prof. Ramkrishna More Arts, Commerce and Science College Akurdi, Pune-411044

Revised Credit Framework / Structure for NEP-2020; CBCS Pattern-2024 with two Major at FY

Implemented from Academic Year 2024-25

Level / Difficulty	Sem	Subject-1	Subject-2	Subject-3	GE/OE	SEC	IKS	AEC	VEC	CC	Total
Certificate											
4.5 / 100	I	4T + 2P/T	4T + 2P/T	0	2T	2T/P	2T (Generic)	2T	2T	0	22
	II	4T + 2P/T	4T + 2P/T	0	2T/P	2T/P	0	2T	2T	2T/ P	22
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor **Continue option:** Student will select one subject among the (subject 1, subject 2 and subject 3) as major and another as minor and third subject will be dropped.											
Diploma											
Level / Difficulty	**Sem**	**Credits Related to Major**				**Subject-2**	**Subject-3**	**GE/OE**	**SEC**	**IKS**	**AEC**	**VEC**	**CC**	**Total**
		Major Core	**Major Elective**	**VSC**	**FP / CEP / OJT**									
5.0 / 200	III	4T + 2P/T	0	2T	2 FP	2T + 2P/T	0	2T	0	2T (Major Specific)	2T	0	2T/ P	22
	IV	4T + 2P/T	0	2P	2 CEP	2T + 2P/T	0	2T/P	2T/P	0	2T	0	2T/ P	22
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor														
Three years Graduation Degree														
5.5 /300	V	8T + 4P/T	4T + 2P/T	2P	2 FP/RP	0	0	0	0	0	0	0	0	22
	VI	8T + 4P/T	2T + 2P/T	2T	4 OJT	0	0	0	0	0	0	0	0	22
	Total Credits	**48**	**8**	**8**	**10**	**20**	**0**	**8**	**8**	**4**	**8**	**4**	**6**	**132**
Four Years Graduate Degree with Honours (Major and Minor subjects)														
6.0 /400		10T + 4P/T	2T + 2P/T	0	0	4T RM	0	0	0	0	0	0	0	22
		10T + 4P/T	2T + 2P/T	0	0	4 OJT	0	0	0	0	0	0	0	22
Four Years Graduate Degree with Honours (Research)														
6.0 /400		6T + 4P/T	2T + 2P/T	0	4 RP	4T RM	0	0	0	0	0	0	0	22
		6T + 4P/T	2T + 2P/T	0	8 RP	0	0	0	0	0	0	0	0	22

Program Outcomes (POs):

PO1: Problem Analysis and Design:

- Graduates will be able to identify, analyze, and define computing problems and apply appropriate methods, algorithms, and solutions to solve them effectively.

PO2: Software Development:

- Graduates will demonstrate the ability to design, implement, test, and maintain software systems. They should be proficient in various programming languages and software development tools.

PO3: Mathematical and Computing Foundations:

- Graduates will have a strong foundation in mathematics, computer science principles, and theory, which they can apply in solving computing problems.

PO4: Professional Ethics and Responsibility:

- Graduates will recognize the importance of professional ethics, legal, and societal responsibilities related to the practice of computer science.

PO5: Communication Skills:

- Graduates will possess effective communication skills to present technical information and interact with colleagues, stakeholders, and clients clearly and professionally.

PO6: Teamwork and Leadership:

- Graduates will be capable of working effectively in teams, as well as demonstrating leadership and project management skills when required.

PO7: Lifelong Learning:

- Graduates will have the ability to engage in continuous learning, staying updated with emerging technologies and advancements in the field of computer science.

PO8: Problem-Solving and Decision-Making:

- Graduates will have the abilityto think critically, analyze data, and make informed decisions to solve complex computing problems.

PO9: Technological Competency:

- Graduates will be familiar with modern computing technologies, tools, and frameworks, and will be able to apply them to practical problems in various domains.

PO10: Global and Societal Impact:

- Graduates will understand the global, economic, environmental, and societal context of computer science and computing systems and will strive to contribute positively to society.

PO11: Project Management:

- Graduates will be able to manage projects, including the ability to plan, design, implement, and evaluate projects in computer applications, considering time, resources, and quality.

Program Specific Outcomes(PSOs):

PSO1: Proficiency in Programming and Software Development:

- Graduates will demonstrate the ability to design, develop, and implement software solutions using various programming languages (e.g., C, Java, Python) and frameworks. They will be skilled in writing efficient and optimized code to address real-world problems.

PSO2: Database Management and Data Handling:

- Graduates will possess knowledge in database design, management, and optimization using relational database management systems (RDBMS) such as MySQL, SQL Server, and Postgres. They will be able to develop, query, and manage databases for handling large datasets efficiently.

PSO3: Web Technologies and Development:

- Graduates will be proficient in web development technologies, including HTML, CSS, JavaScript, and server-side technologies (e.g., PHP). They will be capable of designing and developing dynamic, responsive, and user-friendly web applications.

PSO4: Mobile Application Development:

- Graduates will have the ability to design, develop, and deploy mobile applications for platforms like Android. Theywill understand the mobile app development lifecycle and use tools like Android Studio.

Abbreviations:

VSC - Vocational Skill Course; **SEC –** Skill Enhancement Course; **IKS –** Indian Knowledge System

FP – Field Project **CEP –** Community Engagement Project **OJT –** On Job Training

AEC – Ability Enhancement Courses **VEC –** Value Education Course **CC –** Curricular Courses

GE/OE – Generic or Open elective courses **RP** – Research Project **RM** – Research Methodology

T – Theory **P –** Practical

1. A student can select two subject from the same faculty in first year. **At second year, from Subject-1 and -2 student will select any one subject as major and one subject as minor.** Student cannot select Major and Minor subjects other than these two subjects taken at first year.
2. **VSC, IKS-2, OJT, FP, CEP, RP, RM should be related to Major subject**
3. OE/GE – Must be selected form basket approved by college and **selected from the faculty other than faculty of Major subject.**
4. **SEC should be selected from the basket of same faculty approved by the college**.
5. Each theorycourse may be of 2 or 4 credit while each practical course must be of 2 credit only.
6. For those subject's practical cannot be conducted, they have to convert practical credits into theory credits. The decision should be taken BOS of respective subject.
7. This credit framework is applicable to all faculties in the college.

Courses Offered by B.C.A(Under AICTE) Department at Third year of Graduation Year 2026-27

Major B.C.A.(Science) Courses			
Semester	**Course code**	**Title of the paper**	**Credit**
V	BSMAT-351	Core Java	2
	BSMAT-352	Web Technology	2
	BSMAT-353	Introduction to Data Science	2
	BSMAT-354	Data Mining	2
	BSMAP-355	Core Java Lab	2
	BSMAP-356	Web Technology Lab	2
Major Elective BCA (under AICTE)			
V	BSMET-357A	Principles of Operating System	2
	BSMEP -357A	Operating System Lab	2
OR			
	BSMET-358B	Advanced Python Programming	
	BSMEP-358B	Advanced Python Programming Lab	2
	BSMET-359	Cloud Computing	2
Vocational Skill Courses (VSC) Related to Major			
V	BSVSP-351	Data Mining Lab	2
V	BSRPP-351	Research Project	2

Major B.C.A.(Science) Courses			
Semester	**Course code**	**Title of the paper**	**Credit**
VI	BSMAT-361	Advanced Java	2
	BSMAT-362	Internet Of Things	2
	BSMAT-363	Introduction to AI and Machine Learning	2
	BSMAT-364	Go Programming	2
	BSMAP-365	Go Programming Lab	2
	BSMAP-366	Advanced Java Lab	2
Major Elective BCA (under AICTE)			
VI	BSMET-367A	Android Programming	2
	BSMEP-367A	Android Programming Lab	2
OR			
	BSMET-367B	Data Visualization	2
	BSMEP-367B	Data Visualization Using Power BI	2
Vocational Skill Courses (VSC) Related to Major			
VI	BSVST-361	BlockChain Technology	2
VI	BSOJT-361	OJT	4

SEMESTER V

NEP-2020: Third Year UG Major BCA(Under AICTE)

Course Code: BSMAT-351 **Course Type: Theory**

Course Name: Core Java **Credits allotted:2**

credits Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Java Fundamentals	6L
2	Classes, Objects and Methods	5L
3	Inheritance, Package and Collection	4L
4	Exception Handling	4L
5	File Handling	5L
6	Applet, AWT, Event and Swing Programming	6L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Java Fundamentals**	**[6 L]**
	1.1 Introduction to Java 1.2 Basics of Java Data Types. Variable. Expression, Operators, Constant 1.3 Structure of Java Program 1.4 Execution Process of Java Program 1.5 JDK Tools 1.6 Command Line Arguments 1.7 Array and String 17.1 Single Arrayand Multidimensional Array 1.7.2 String. String Buffer 1.8 Built In Packages and Classes 1.8.1 java.util. Scanner, Date, Math etc. 1.8.2 java.lang	
Unit II	**Classes, Objects and Methods**	**[5 L]**
	2.1 Class and Object 2.2 Object Reference 2.3 Constructor: Constructor Overloading 2.4 Method: Method Overloading, Recursion, Passing and Returning Object Form Method 2.5 New Operator, this and static keyword, finalize() Method 2.6. Nested Class, Inner Class and Anonymous Inner Class	
Unit III	**Inheritance, Package and Collection**	**[4 L]**

	3.1 Overview of Inheritance 3.2 Inheritance in Constructor 3.3 Inheriting Data Members and Methods 3.4 Multilevel Inheritance - Method Overriding Handle Multilevel Constructors 3.5 Use of Super and Final Keyword 3.6 Interface 3.7 Creation and Implementation of an Interface, Interface Reference 3.8 Interface Inheritance 3.9 Dynamic Method Dispatch 3.10 Abstract Class 3.11 Comparison between Abstract Class and Interface 3.12 Access Control 3.13 Packages 3.13.1 Packages Concept 3.13.2 Creating User Defined Packages 3.13.3 Java Built Inpackages 3.13.4 Import Statement, Static Import 3.14 Collection 3.14.1 Collection Framework 3.14.2 Interfaces: Collection, List, Set 3.14.3 Navigation: Enumeration, Iterator, Listiterator 3.14.4 Classes LinkedList, ArrayList, Vector, HashSet	
	MODULE-2 [12L+3T]	
Unit IV	**Exception Handling**	**[4 L]**
	4.1 Exception and Error 4.2 Use of try, catch, throw, throws and finally 4.3 Built in Exception 4.4 Custom exception 4.5 Throwable Class	
Unit V	**File Handling**	**[5 L]**
	5.1 Overview of Different Stream (Byte Stream, Character stream) 5.2 Readers and Writers class 5.3 File Class 5.4 File Input Stream, File Output Stream 5.5 Input Stream Reader and Output Stream Writer 5.6 FileReader and FileWriter Class 5.7 Buffered Reader Class	
Unit VI	**Applet, AWT, Event and Swing Programming**	**[6 L]**

	Applet 6.1 Introduction 6.2. Types Applet 6.3. Applet Lifecycle 6.3.1 Creating Applet 6.3.2 Applet Tag 6.3.3 Applet Classes 6.4 AWT 6.4.1 Color 6.4.2 Graphics 6.4.3 Font 6.5 Components and container used in AWT 6.6 Layout Managers 6.7 Listeners and Adapter Classes 6.8 Event Delegation Model **Swing** 6.9 Introduction to Swing Component and Container Classes 6.10 Exploring Swing Controls - JLabel and Image Icon, JText Field, The Swing Butto JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Par JList, JTable, JComboBox, Swing Menus, Dialogs, JFileOpen, JColorChooser	

Reference Books:
Reference Book 1: Programming with JAVA - E Balgurusamy
Reference Book 2: The Complete Reference – JAVA Herbert Schildt

Course Outcome

After studying this course, student will able to –

CO1: Understand the Fundamentals of Java Programming;
CO2: Master Object-Oriented Programming (OOP) Concepts;
CO3: Work with Java Libraries and API;
CO4: Design and Develop Java
Applications; CO5: Debug, Test, and
Optimize Java Code;
CO6: Gain Practical Experience in Java Development;

SEMESTER-V

NEP-2020: Third Year BCA(Under AICTE)

Course Code: BSMAT-352 **Course Type: Theory**
Course Name: Web Technology **Credits allotted:2**
Credits Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction to PHP	4L
2	Web Techniques	5L
3	Functions and Arrays	8L
4	Object Oriented Programming	8L
5	Databases	5L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Introduction to PHP**	**[4L]**
	1. HTTP basics, Introduction to web server and web browser 2. Introduction to PHP 3. PHP - Lexical structure, Language basics.	
Unit II	**Web Techniques**	**[5L]**
	1. Variables 2. Server information 3. Processing forms 4. SSL	
Unit III	**Functions and Arrays**	**[8L]**

	1. Defining and calling a function 2. Default parameters 3. Variable parameters, Missing parameters 4. Variable function, Anonymous function 5. Indexed Vs Associative arrays 6. Identifying elements of an array 7. Storing data in arrays 8. Multidimensional arrays 9. Extracting multiple values 10. Traversing arrays 11. Sorting Using arrays	

MODULE-2 [12L+3T]		
Unit IV	**Object Oriented Programming**	**[8L]**
	1. Classes 2. Objects 3. Introspection 4. Serialization 5. Inheritance 6. Interfaces 7. Encapsulation	
Unit V	**Databases**	**[5L]**
	1. Using PHP to access a database 2. Relational databases and SQL 3. PEAR DB basics 4. Advanced database techniques	

Course Outcome:

After successfully completing this course, students will be able to:

CO1: understand basic concepts of HTTP & PHP;
CO2 describe the concept of web techniques;
CO3: describe the concepts of Functions &
Arrays;
CO4: explain the Object Oriented Programming concepts;
CO5: illustrate the different methods to interact with the databases;

Reference Books: -

1 Programming PHP By Rasmus Lerdorf and Kevin Tatroe, O'Reilly publication
2. Beginning PHP5, Wrox publication
3. PHP for Beginners, SPD publication

SEMESTER V

NEP-2020: Third Year UG Major BCA

Course Code: BSMAT-353 **Course Type: Theory**
Course Name: Introduction to Data Science **Credits allotted:2**
credits Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	**Introduction to Data Science**	4L
2	**Data Collection and Preprocessing**	5L
3	**Exploratory Data Analysis (EDA)**	6L
4	**Basics of Statistics for Data Science**	5L
5	**Introduction to Data Analysis Tools**	6L
6	**Applications and Future of Data Science**	4L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Introduction to Data Science**	**[4L]**
	1.1 Overview of Data Science 1.2 Importance and Applications of Data Science 1.3 Difference between Data, Information, and Knowledge 1.4 Data Science vs. Machine Learning vs. Artificial Intelligence 1.5 Lifecycle of Data Science Project	
Unit II	**Data Collection and Preprocessing**	**[5L]**
	2.1 Types of Data (Structured, Unstructured, Semi-structured) 2.2 Types of Data (Structured, Unstructured, Semi-structured) 2.3 Data Cleaning (handling missing values, duplicates, errors) 2.4 Data Transformation (normalization, standardization)	
Unit III	**Exploratory Data Analysis (EDA)**	**[6L]**
	3.1 Introduction to EDA 3.2 Measures of Central Tendency (Mean, Median, Mode) 3.3 Measures of Dispersion (Variance, Standard Deviation) 3.4 Data Visualization (Bar chart, Histogram, Pie chart, Scatter plot)	

MODULE-2 [12L+3T]

Unit IV	**Basics of Statistics for Data Science**	**[5L]**
	4.1 Probability Basics 4.2 Correlation and Causation 4.3 Hypothesis Testing (basic idea, not advanced) 4.4 Sampling and Population	
Unit V	**Introduction to Data Analysis Tools**	**[6L]**
	5.1 Introduction to Python for Data Science 5.2 Libraries: NumPy, Pandas, Matplotlib (basic overview, not coding- heavy) 5.3 Introduction to Excel/Spreadsheets for Data Analysis 5.4 Case Study: Simple dataset analysis	
Unit VI	**Applications and Future of Data Science**	**[4L]**
	6.1 Applications in Healthcare, Education, Business, Social Media 6.2 Ethical Issues in Data Science (privacy, security, fairness) 6.3 Future Trends (Big Data, AI, Cloud in Data Science)	

Reference Books:

1. **"Introduction to Data Science"** – by Laura Igual and Santi Seguí
   - Beginner-friendly, covers basics of data science, EDA, and simple tools.
2. **"Data Science for Beginners"** – by Andrew Park
   - Easyto understand, explains concepts in a simple waywithout going too deep into advanced mathematics.
3. **"Python for Data Analysis"** – by Wes McKinney
   - Focused on practical data analysis with Python using **Pandas, NumPy, and Matplotlib**

Course Outcomes:

After studying this course, students will able to..

CO1: Understand the basic concepts and importance of Data Science. CO2: Collect, clean, and pre-process different types of data.
CO3: Applyexploratory data analysis to summarize and visualize datasets. CO4: Use basic statistical techniques for data interpretation.
CO5: Familiarize with Python/Excel tools for data analysis.
CO6: Recognize real-life applications and ethical issues of Data Science.

SEMESTER V

NEP-2020: Third Year UG Major BCA(Under AICTE) Course Code: BSMAT-354 Course Type: Theory
Course Name: Data Mining Credits allotted: 2
credits Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction to Data Mining	7L
2	Data Warehousing	8L
3	Classification	8L
4	Clustering and Association Rule Mining	7L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Introduction to Data Mining**	**[7L]**
	1.1 Definition Data mining 1.2 Data Mining issues 1.3 Stages of the Data Mining Process (KDD) 1.4 Data Mining Techniques/Tasks 1.5 Knowledge Representation Methods 1.6 Applications of Data mining 1.7 Data Pre-processing 1.7.1 Data Cleaning 1.7.2 Data Transformation 1.7.3 Data Reduction 1.7.4 Data Discretization	
Unit II	**Data Warehousing**	**[8L]**
	2.1 Introduction to Data Warehouse 2.2 Data Warehouse Architecture and its components 2.3 Data Modeling with OLAP 2.3.1 Introduction 2.3.2 Difference between OLTP and OLAP 2.3.3 Data Mart 2.3.4 Fact Table, Dimension Table, OLAP cube 2.3.5 Different OLAP Operations 2.4 Schema Design 2.4.1 Introduction 2.4.2 Star and snow-Flake Schema 2.5 Introduction to Machine Learning 2.6 Introduction to Pattern Matching	

MODULE-2 [12L+3T]

Unit III	Classification	[8L]
	3.1 Introduction, Definition	

	3.2 Decision Tree 3.2.1 Introduction 3.2.2 Construction Principle 3.2.3 Attribute Selection Measures 3.2.4 Tree Pruning	
	3.3 Rule-Based Classification 3.3.1 Using IF-THEN Rules for Classification 3.3.2 Rule Extraction from a Decision Tree 3.4 Bayes Classification Methods 3.4.1 Bayes‟ Theorem 3.4.2 Naive Bayesian Classification 3.5 Bayesian Networks 3.6 Parameter and structure learning 3.7 Linear classifier 3.8 Perceptron 3.9 k-Nearest-Neighbor Classifiers 3.10 SVM classifiers 3.10.1 Introduction 3.10.2 Types of SVM 3.10.3 Working of SVM 3.11 Regression 3.11.1 Linear Regression 3.11.2 Non linear Regression 3.12 Introduction to Prediction	
Unit IV	**Clustering and Association Rule Mining**	**[7L]**
	4.1 Cluster Analysis 4.1.1 Introduction 4.1.2 Requirements for Cluster Analysis 4.2 Hierarchical Methods 4.2.1 Agglomerative Hierarchical Clustering 4.2.2. Divisive Hierarchical Clustering 4.3 Partitioning Methods 4.3.1 k-Means: A Centroid-Based Technique 4.3.2 k-Medoids: A Representative Object-Based Technique 4.4 Introduction to Association Rule Mining Market Basket Analysis, Items, Itemsets and Large Itemsets 4.5 Apriori Algorithm	

Reference Books:

1)Data Mining : Introductory and Advanced Topics by Margaret Dunham, S. Sridhar, Pearson Publication

2) Data Mining concepts and Techniques by Jiawei Han and Micheline Kamber, ELSEVIER, Third Edition,

3) R and Data Mining, By Yanchang Zhao, Elsevier Inc., ISBN-10: 0123969638

Course Outcomes:

CO1: Identify the key processes of data mining, data warehousing and knowledge discovery CO2: Design data warehouse with dimensional modeling and apply OLAP operations.

CO3: Identify appropriate data mining algorithms to solve real world problems

CO4: Apply suitable classification algorithm to train the classifier and evaluate its performance.

CO5: Choose association rule mining algorithms and generate frequent item-sets and association rules.

SEMESTER V

NEP-2020: Third Year UG Major BCA(Under AICTE) Course
Code: BSMAP-355 Course Type: Practical
Course Name: Core Java Lab Credits allotted:2 credits Lectures allotted: 60 Lectures

Sr. No.	Assignment	No of Sessions
1	**Java Tools and IDE, Simple java programs** Introduction to the java environment Use of java tools like java, javac, jdk and javadoc Defining simple classes and creating objects.	2
2	**Array of Objects and Packages** Defining a class. Creating an array of objects. Creating a package	2
3	**Inheritance and Interfaces** To implement inheritance in java. To define abstract classes. To define and use interfaces and Functional Interface.	3
4	**Exception And File Handling** Demonstrate Exception Handling Mechanism in Java. Use of try, catch, throw, throws ,finally blocks Defining User defined Exception classes. Creation of files and demonstration of I-O operations	3
5	**GUI Designing, Event Handling** To demonstrate GUI creation using Swing Package and Layout managers. To understand Event handling mechanism in Java. Using Event classes, Event Listeners and Adapters	5
	Total 15	

Course Outcomes :

After studying this course, student will able to –

CO1: Use Java development tools and IDEs effectively;

CO2: Work with arrays of objects and organize code using packages in Java; **CO3**: Implement inheritance and interfaces for code reuse and abstraction; **CO4**: Handle exceptions and work with file input/output operations in Java; **CO5**: Develop simple GUI applications using Swing and handle user events;

SEMESTER V

NEP-2020: Third Year BCA(Under AICTE)
Course Code: BSMAP-356 Course Type: Practical
Course Name: Web Technology Lab Credits allotted:2 Lectures allotted: 60 Lectures

Sr. No.	Assignment	No of Sessions
1.	**PHP Programming:** Greeting Application Control Structures String Manipulation	02
2.	**Functions:** Function Usage Date and Time Functions	03
3.	**Arrays:** Creating and manipulating different types of arrays. Applying various array functions to solve specific problems.	03
	Developing small PHP scripts that utilize arrays for data management.	
4.	**Inheritance and Interfaces:** Inheritance Aggregation Superclass Subclass "extends" keyword "implements" keyword "protected" keyword "interface" keyword Polymorphism	03
5.	**Accessing Databases:** Database Connection Data Insertion	04
	Total 15	

Course Outcome:

After successfully completing this course, students will be able to:

CO1: understand simple programming in PHP using flow control statements;
CO2: illustrate user defined & library functions & their implementation in programs;
CO3: use of Arrays;
CO4: illustrate Object Oriented Programming concepts;
CO5: build Dynamic website using PHP & Database connectivity;

SEMESTER V		
NEP-2020: Third Year UG Major Elective BCA(Science) **Course Code: BSMET-359** **Course Type: Theory** **Course Name: Cloud Computing** **Credits allotted:2** **credits Lectures allotted: 30 Lectures**		
Chapter No	**Name of the Chapter**	**Lectures Assigned**
1	Introduction to Cloud Computing	5L
2	Cloud Architecture & Virtualization	5L
3	Cloud Services & Providers	5L
4	Cloud Security & Management	5L
5	Cloud Applications & Case Studies	5L
6	Emerging Trends in Cloud	5L
MODULE-1 [12L+3T]		
	Course Contents	
Unit I	**Introduction to Cloud Computing**	**[5L]**
	1.1. Basics of Cloud Computing 1.2. Characteristics of Cloud (On-demand, Elasticity, Pay-per-use) 1.3. Advantages & Challenges of Cloud 1.4. Cloud Service Models (IaaS, PaaS, SaaS) 1.5. Deployment Models (Public, Private, Hybrid, Community)	
Unit II	**Cloud Architecture & Virtualization**	**[5L]**
	2.1 Cloud Architecture Overview 2.2 Virtualization: concept and types (Server, Storage, Network) 2.3 Hypervisors – Type 1 & Type 2 2.4 Role of Virtualization in Cloud 2.5 Examples: VMware, VirtualBox, Hyper-V	
Unit III	**Cloud Services & Providers**	**[5L]**
	3.1 Major Providers: AWS, Azure, Google Cloud 3.2 Popular Services: Compute, Storage, Networking, Databases 3.3 Cloud Storage (Dropbox, Google Drive, iCloud) 3.4 Communication Services (Gmail, MS Teams, Zoom) 3.5 Applications in Daily Life	
	MODULE-2 [12L+3T]	
Unit IV	**Cloud Security & Management**	**[5L]**

	4.1 Basic Cloud Security Issues (Data Privacy, Data Loss, Hacking) 4.2 Security Mechanisms (Authentication, Encryption, Firewalls – simple overview) 4.3 Cloud Governance and Compliance (basics) 4.4 Cloud Monitoring & Management Tools (basic intro: CloudWatch, Azure Monitor) 4.5 Responsibility: Cloud Provider vs Customer	
Unit V	**Cloud Applications & Case Studies**	**[5L]**
	5.1 Cloud in Education, Healthcare, Banking 5.2 Cloud in Small Businesses & Startups 5.3 Cloud in Mobile Applications 5.4 Case Studies: Simple examples of real-world applications 5.5 Practical view of Cloud-based services	
Unit VI	**Emerging Trends in Cloud**	**[5L]**
	6.1 Edge Computing – basic concept 6.2 Serverless Computing – overview 6.3 Internet of Things (IoT) with Cloud 6.4 Artificial Intelligence & Big Data with Cloud 6.5 Future of Cloud Careers & Opportunities	

Reference Books:

1. **Cloud Computing: Principles and Paradigms** – Rajkumar Buyya, James Broberg, Andrzej M. Goscinski WileyIndia)
2. **Cloud Computing: A Practical Approach** – Anthony T. Velte, Toby J. Velte, Robert Elsenpeter (McGraw Hill Education)
3. **Cloud Computing: Concepts, Technology & Architecture** – Thomas Erl (Pearson Education)

Course Outcomes:

After studying this course, students will able to.

CO1: explain the fundamental concepts, service models, and deployment models of cloud computing.
CO2: describe cloud architecture and the role of virtualization in enabling cloud services.
CO3: identify major cloud service providers and their commonly used services in real- world applications.
CO4: analyze basic cloud security issues and apply simple security mechanisms for data protection.
CO5: understanding of cloud applications in various domains through examples and case studies.
CO6: explore emerging cloud trends such as Edge Computing, Serverless Computing, and IoTwith Cloud

SEMESTER V

NEP-2020: Third Year UG Major Elective BCA(Under AICTE)

Course Code: BSMET-357A Course Type: Theory

Course Name: Principles of Operating System Credits allotted: 2 credits Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction to Operating System Concepts	3L
2	Process and Thread Management	6L
3	Process Scheduling	6L
4	Process Synchronization	3L
5	Deadlocks	6L
6	Memory Management	6L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	Introduction to Operating System Concepts	**[3L]**
	1.1 Operating System Objectives and Functions - Definition of Operating System ,Role and Objectives of Operating System, Operating System as a User View and System View 1.2 Evolution of Operating System 1.3 Operating System Structure(Monolithic, Layered and Microkernel) 1.4 System Boot	
Unit II	Process and Thread Management	**[6 L]**
	2.1 Process Concept – Process , Process Model , Process Control Block 2.2 Operations on Process – Process creation , Process Termination 2.3 Process Scheduling - Scheduling queues, Schedulers, Context switch 2.4 Inter Process Communication –Cooperating Process, Shared Memory Systems, Message Passing Systems 2.5 Overview of Threads 2.6 Concept of Multithreaded Programming and Multicore Programming	

	2.7 Types of threads – User and Kernel 2.8 Multithreading Models – Many to One , One to Many, Many to Many	
Unit III	Process Scheduling	**[6L]**

	3.1 Basic Concept – CPU-I/O burst cycle, CPU scheduler, Preemptive scheduling, Dispatcher 3.2 Scheduling Criteria 3.3 Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling	
MODULE-2[12L+3T]		
Unit IV	Process Synchronization	**[3 L]**
	4.1 Background – Problems with Concurrency , Race Condition 4.2 Critical Section Problem – Peterson‟s Solution(for two process) 4.3 Semaphores: Usage, Implementation 4.4 Classic Problems of Synchronization – Producer Consumer problem, Reader Writer problem, Dining Philosopher Problem	
Unit V	Deadlocks	**[6 L]**
	5.1 System Model 6.2 Deadlock Characterization – Necessary Conditions, Resource Allocation Graph 5.3 Deadlock Prevention 5.4 Deadlock Avoidance - Safe State, Resource Allocation Graph Algorithm, Banker‟s Algorithm 5.5 Deadlock Detection 5.6 Recovery From Deadlock – Process Termination, Resource Preemption	
Unit VI	Memory Management	**[6 L]**
	6.1 Background – Basic Hardware, Address Binding, Logical Versus Physical Address Space, Dynamic Loading, Dynamic Linking and Shared Libraries 6.2 Swapping 6.3 Contiguous Memory Allocation – Memory Mapping and Protection, Memory Allocation, Fragmentation 6.4 Paging – Basic Method, Hardware Support, Protection, Shared Pages 6.5 Segmentation – Basic Concept, Hardware 6.6 Virtual Memory Management – Background, Demand Paging 6.7 Page Replacement Algorithms – FIFO, OPT, LRU, Second Chance Page Replacement.	

Reference Books:

"Operating System Concepts", 9 th Edition ,by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, John Wiley & Sons (ASIA) Pvt. Ltd, 2013.

"Operating Systems: Internals and Design Principles", 7th Edition, by William Stallings, Prentice Hall, 2011

"Modern Operating Systems", 4 th Edition, by Andrew S. Tanenbaum, Prentice Hall of India Pvt. Ltd, 2014.

4. "Operating Systems : Principles and Design" – Pabitra Pal Choudhary (PHI Learning Private Limited)

Course Outcomes:

After studying this course, students will be able to.

CO1 : To understand the objectives, structure and functions of operating system
CO2 : To learn about concept of processes, threads and its scheduling algorithms
CO3 :To understand design issues in process synchronization and
CO4 : deadlock management
CO5 : To study various memory management schemes

SEMESTER V		
NEP-2020: Third Year UG Major Elective BCA(Science) **Course Code: BSMEP- 357A** **Course Type: Practical** **Course Name: Operating System Lab** **Credits allotted:2** **credits Lectures allotted: 60 Lectures**		
Sr. No.	**Assignment**	**No of Sessions**
1	Operations on processes	2
2	CPU Scheduling	4
3	Deadlock detection and avoidance	4
4	Page Replacement Algorithms: FIFO, Optimal, LRU	5
	Total 15	

Course Outcome :

After studying this course, student will able to –

- Implement algorithms for Process scheduling and Memory management
- Describe process synchronization and multithreading Compare and contrast the algorithms for memory management and its allocation policies.
- Use searching algorithms
- Design a simple Expert system

SEMESTER V

NEP-2020: Third Year UG Major Elective BCA(Science)

Course Code: BSMET-358B **Course Type: Theory**

Course Name: Advanced Python Programming **Credits allotted:2**

Credits Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction OOPs	7L
2	Errors and Exception Handling	8L
3	Connecting Python Database with GUI and Widgets	8L
4	Graphical user interface	7L

MODULE-1 [12L+3T]

	Course Contents
Unit I	**Introduction OOPs**
	OOPs in python: Features of Object Oriented Programming system (oops)classes and objects, encapsulation, abstraction, inheritance, polymorphism, constructors and destructors **Classes and objects:** Creating a class, the self-variable, types of variables, namespaces, types of methods, instance methods, class methods, static methods, passing members of one class to another class, inner classes **Inheritance and polymorphism:** Inheritance in python, types of inheritance- single inheritance, multilevel inheritance, hierarchical inheritance, multiple inheritance, constructors in inheritance, overriding super class constructors and methods, the super() method, method resolution order (mro), polymorphism, duck typing, operator overloading, method overloading, method overriding, **Abstract classes and interfaces**: Abstract class, abstract method,interfaces in python, abstract classes vs. Interfaces.
Unit II	**Errors and Exception Handling**
	Exceptions in python: Errors in a python program, compile & run-time errors, logical error, exceptions- exception handling, types of exceptions, the except block, the assert statement, userdefined exceptions, logging the exceptions.

MODULE-2 [12L+3T]

Unit III	**Connecting Python Database with GUI and Widgets**	**[8L]**

	Types of data bases, working with MySQL, working with Mongo DB. Widgets: Button, Canvas,Check button,Entry,Frame,Label,List,List box, Menu button,Menu,Message,Radio botton,Scale,text,Top-level,spin box,paned window, label frame,tk message box. Handling standard attributes nad properties of widgets. Layout management: Designing GUI application with proper layput management features .Look and feel.	

	Customization: Enhancing Look and Feel of GUI using different Appearances of widgets.	
Unit IV	**Graphical User Interface**	**[7 L]**
	Storing Data in our Database via Our GUI: Connecting to a MySql Database from python,Configuring the MySql Connection,Designing the python GUI database,using the insert command,using the update command,using the delete command,storing and retrieving data from MySql database.	

Textbooks: 1. Paul Gries , Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 3rd Edition, 2018 2. Programming through Python, M. T Savaliya, R. K. Maurya, G M Magar, Revised Edition, Sybgen Learning India, 2020 Additional

References:

1. Advanced Python Programming, Dr. Gabriele Lanaro, Quan Nguyen, SakisKasampalis, Packt Publishing, 2019
2. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018
3. Python: The Complete Reference, Martin C. Brown, McGraw Hill, 2018
4. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress,2017
5. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018

Course Outcomes:

After studying this course, student will able to –

CO1: Demonstrate proficiency in object-oriented programming (OOP) principles: This includes understanding classes, inheritance, polymorphism, and encapsulation.

CO2: Apply advanced data structures and algorithms: This could involve using lists, dictionaries, sets, tuples, and understanding time/space complexity.

CO3: Utilize regular expressions, closures, and decorators: These are powerful tools for manipulating strings and code structure.

CO4: Implement and debug complex Python programs: This includes understanding error handling, exception handling, and testing.

CO5: Understand memory management in Python: This is crucial for writing efficient and robust code.

SEMESTER V

NEP-2020: Third Year UG Major Elective BCA(Science)

Course Code: BSMEP-358B **Course Type: Practical**

Course Name: Advanced Python Programming Lab **Credits allotted: 2**

Credits Lectures allotted: 60 Lectures

Sr. No.	Assignment
1	Write a program to Python program to implement various file operations
2	Write a program to Python program to demonstrate use of regular expression for suitable application.
3	Write a Program to demonstrate concept of threading and multitasking in Python
4	Write a Python Program to work with databases in Python to perform operations such as a. Connecting to database b. Creating and dropping tables c. Inserting and updating into tables
5	Write a GUI Program in Python to design application that demonstrates a. Different fonts and colors b. Different Layout Managers c. Event Handling
6	Write a program to Python program to implement concepts of OOP such as a. Types of Methods b. Inheritance c. Polymorphism
	Total 15

Course Outcomes:

After studying this course, student will able to –

CO1: Apply exception handling and user defined exception(s) CO2: Develop Module(s) and Package(s) in python

CO3: Make use of Pandas and Numpy Libraries

CO4: Implement Object Oriented concepts in programming

CO5: Apply Collection modules for the data types

SEMESTER V

NEP-2020: Third Year UG Major BCA(Under AICTE)

Course Code: BSVSP-351 **CourseType: Practical**
Course Name: Data Mining Lab **Credits allotted: 2 credits**
Lectures allotted: 60 Lectures

Sr. No.	Assignment	No of Sessions
1	R Programming Basics, Programs using List, Matrix, String and Factors, Program using data frame and visualization	4
2	Data Preprocessing	2
3	Classification	2
4	Association Rules	2
5	Regression Analysis and Outlier detection	2
6	Clustering	3
	Total 15	

Course Outcomes
After studying this course, student will able to –

CO1: Implement data mining tasks using R;
CO2: Perform different phases of data pre-processing such as data cleaning, data integration, Data transformation and data reduction ;
CO3: demonstrate the different classification algorithms;
CO4: Implement association rule mining algorithms; CO5:
Simulation of different regression analysis;
CO6: implement clustering algorithm;

SEMESTER - VI

SEMESTER VI

NEP-2020: Third Year UG Major BCA(Under AICTE)

Course Code: BSMAT-361 **Course Type: Theory**

Course Name: Advanced Java **Credits allotted:2 credits**

Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	JDBC	6L
2	Multithreading	5L
3	Networking	4L
4	Servlet and JSP	8L
5	Spring and Hibernate	7L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**JDBC**	**[6 L]**
	1.1 Introduction 1.2 JDBC Architecture 1.3 JDBC Process 1.4 Working with ResultSet Interface	
Unit II	**Multithreading**	**[5 L]**
	2.1 Introduction to Multithreading 2.2 Thread creation: Thread Class, Runnable Interface 2.3 Life cycle of Thread 2.4 Thread Priority 2.5 Execution of Thread Application 2.6 Synchronization and Interthread Communication	
Unit III	**Networking**	**[4 L]**
	3.1 Overview of Networking 3.2 Networking Basics: Port Number, Protocols and classes 3.3 Sockets, Reading from and Writing to a Socket	
	MODULE-2 [12L+3T]	
Unit IV	**Servlet and JSP**	**[8 L]**

	Servlet 4.1 Introduction to Servlet 4.2 Types of Servlet: Generic Servlet and Http Servlet 4.3 Life Cycle of Servlet 4.4 Session Tracking 4.5 Servlet with Database **JSP** 4.6 Introduction to JSP 4.7 JSP Life Cycle 4.8 Components of JSP	

	4.9 JSP with Database	
Unit V	**Spring and Hibernate**	**[7 L]**
	Spring: 5.1 Introduction 5.2 Applications and Benefits of Spring 5.3 Architecture and Environment Setup 5.4 Hello World Example 5.5 Core Spring - loC Containers, Spring Bean Definition, Scope, Lifecycle Hibernate: 5.6 Architecture and Environment 5.7 Configuration, Sessions, Persistent Class 5.8 Mapping Files, Mapping Types 5.9 Examples	

Reference Books:

Reference Book 1: The Complete Reference – JAVA Herbert Schildt
Reference Book 2: Core java –II By Cay S. Horstmann and Gary Cornell
Reference Book 3: Complete Reference J2EE – Jim Keogh

Course Outcomes:

After studying this course, student will able to –

CO1: Understand JDBC and its Components;
CO2: Master Multithreading Concepts and Java Threading
Models; CO3: Develop Networking Applications using Sockets;
CO4: Work with Servlets and JSP for Web Development;
CO5: Learn and Apply Spring Framework for Enterprise Applications;
CO6: Implement Advanced Java Concepts in Real-World Applications;

SEMESTER -V

NEP-2020: Third Year UG Major BCA(Under AICTE)

Course Code: BSMAT-362 **Course Type: Theory**

Course Name: Internet of Things(IoT) **Credits allotted:2 credits**

Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction to Embedded Systems	3L
2	Internet of Things : Concepts	3L
3	Introduction to IoT Design Methodology	4L
4	Introduction to IoT Protocols	5L
5	Cloud Platforms for IoT	3L
6	Security in IoT	6L
7	IoT Application and Case study	6L

MODULE-1[12L+3T]

	Course Contents	
Unit I	**Introduction to Embedded Systems**	**[3L]**
	1.1 Definition, Characteristics of Embedded System, 1.2 Real time systems, Real time tasks 1.3 Processor basics: General Processors in Computer Vs Embedded Processors, Micro controllers and Properties, Components of Microcontrollers, System-On- Chip and its examples. 1.4 Components of Embedded Systems, Introduction to embedded processor.	
Unit II	**Internet of Things : Concepts**	**[3 L]**
	2.1 Definition, Characteristics of IoT, Trends in Adoption of IoT, 2.2 IoT Devices, IoT Devices Vs Computers. 2.3 Basic Building Blocks. 2.4 Physical Design of IoT: - Things in IoT, Interoperability of IoT Devices, Sensors and Actuators, Need of Analog/Digital Conversion. 2.5 Logical Design of IoT:- IoT functional blocks, IoT Enabling technologies, IoT levels and deployment templates, Applications of IoT.	

Unit III	**Introduction to IoT Design Methodology**	**[4 L]**
	3.1 Design Steps 3.2 Basics of IoT Networking, Networking Components, Internet Structure 3.3 IoT Communication Models and IoT Communication APIs, 3.4 Sensor Networks 3.5 Four pillars of IoT: M2M, SCADA,WSN, RFID	
Unit IV	**Introduction to IoT Protocols**	**[5 L]**
	4.1 Protocol Standardization for IoT 4.2 M2M and WSN Protocols 4.3 RFID Protocol, 4.4 Modbus Protocol, ZigBee Architecture. 4.5 IP based Protocols: MQTT (Secure), 6LoWPAN, LoRa.	
MODULE-2 [12L+3T]		
Unit V	**Cloud Platforms for IoT**	**[3 L]**
	5.1 Introduction to Cloud Storage Models, Communication API 5.2 Cloud for IoT 5.3 Introduction to Amazon Web Services for IoT and Skynet IoT 5.4 Messaging Platform 5.5 Introduction to RESTful Web Services -GRPC,SOAP.	
Unit VI	**Security in IoT**	**[6 L]**
	6.1 Introduction, Vulnerabilities of IoT, Security Requirements 6.2 Challenges for Secure IoT, Threat Modeling 6.3 Key elements of IoT Security: Identity establishment, Access control, Data and message security, Non-repudiation and availability 6.4 Security model for IoT 6.5 Challenges in designing IOT applications, Introduction to Lightweight cryptography	
Unit VII	**IoT Application and Case study**	**[6 L]**

	Application of IoT and Case studies: Home Automation, Smart Parking, Water Management, Agriculture, Citizen Safety, Waste Management, Smart city.	

Course Outcome:

After successfully completing this course, students will be able to:

CO1: By the end of this course students will be able to define the vision and introduction of IoT.

CO2: By the end of this course students will be able to explain IoT Market perspective and State of the Art IoT Architecture

CO3: By the end of this course students will be able to use devices, Gateways and Data Management in IoT.

CO4: By the end of this course students will be able to classify Real World IoT Design Constraints, Industrial Automation in IoT.

CO5: By the end of this course students will be able to evaluate the data received through sensors in IOT.

CO6: After the completion of the course, the students will be able design some IOT based prototypes.

REFERENCES:

1. The Internet of Things: From RFID to the Next-Generation Pervasive Networked Lu Yan, Yan Zhang, Laurence T. Yang, Huansheng Ning
2. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , Arshdeep Bahga
3. Designing the Internet of Things , Adrian McEwen (Author), Hakim Cassimally
4. "Mobile Computing," Tata McGraw Hill, Asoke K Talukder and Roopa R Yavagal, 2010.
5. Computer Networks; By: Tanenbaum, Andrew S; Pearson Education Pte. Ltd., Delhi, 4th Edition
6. Data and Computer Communications; By: Stallings, William; Pearson Education Pte. Ltd., Delhi, 6th Edition

SEMESTER VI
NEP-2020: Third Year UG Major BCA(Under AICTE) **Course Code: BSMAT-363** **Course Type: Theory** **Course Name: Introduction To AI and Machine Learning** **Credits allotted:2 credits** **Lectures allotted: 30 Lectures**

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction to Artificial Intelligence	4L
2	Machine Learning Basics	6L
3	Problem-Solving in AI	5L
4	Knowledge Representation	5L
5	Reasoning in AI	5L
6	Natural Language Processing (NLP)	5L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Introduction to Artificial Intelligence**	**[4L]**
	1.1. What is AI? History & evolution 1.2. AI vs ML vs Deep Learning 1.3. Types of AI: Narrow AI, General AI, Super AI 1.4. Applications of AI in real life	
Unit II	**Machine Learning Basics**	**[6L]**
	2.1 Introduction to ML as part of AI 2.2 Types of ML: Supervised, Unsupervised, Reinforcement 2.3 Regression & Classification (basic concepts) 2.4 Simple algorithms: Decision Trees, KNN (conceptual only) 2.5 Applications in daily life	
Unit III	**Problem-Solving in AI**	**[5L]**
	3.1 Concept of problem-solving using AI 3.2 Search strategies: • Uninformed (Blind search: BFS, DFS) • Informed (Heuristic search, A*) 3.3 Real-life examples of AI search (maze solving, Google Maps)	
	MODULE-2 [12L+3T]	

Unit IV	**Knowledge Representation**	**[5 L]**
	4.1 What is knowledge in AI? 4.2 Knowledge-based systems 4.3 Representation techniques: • Logic (Propositional, Predicate) • Semantic networks • Ontologies (simple intro)	
Unit V	**Reasoning in AI**	**[5 L]**
	5.1 Types of reasoning: Deductive, Inductive, Abductive 5.2 Rule-based reasoning (IF–THEN rules) 5.3 Fuzzy logic (handling uncertainty) 5.4 Simple examples in decision-making	
Unit VI	**Natural Language Processing (NLP)**	**[5 L]**
	6.1 What is NLP? 6.2 NLP tasks: speech recognition, sentiment analysis, translation 6.3 Chatbots as an AI application	

Reference Books:

1. Flach, P. A. (2012). Machine Learning: The Art and Science of Algorithms that Make Sense of Data. Cambridge University Press. ISBN: 9781107422223, 2012.
2. Duda, R. O., Hart, P. E., Stork, D (2007). Pattern classification (2Ed), John Wiley & Sons, ISBN-13: 978-8126511167.
3. Haykin S. (2009). Neural Networks and Learning Machines, Third Edition, PHI Learning.
4. Chollet, F. (2018). Deep Learning with Python. Manning Publications.
4. Bishop, C. M. (2006). Pattern Recognition and Machine Learning. Springer.

Course Outcomes:

After studying this course, students will able to.

CO1: Define and explain machine learning concepts, types, and basic metrics.

CO2: Implement and apply supervised learning techniques (e.g., KNN, Linear Regression, Logistic Regression).

CO3: Applyunsupervised learning methods (e.g., K-Means, Hierarchical Clustering, Association Rules).

CO4: Develop and evaluate simple machine learning models (e.g., Perceptron, single- layer neural networks).

CO5: Analyze and apply appropriate machine learning algorithms depending on the problems with some real-world data.

SEMESTER VI

NEP-2020: Third Year UG Major BCA(Under AICTE)

Course Code: BSMAT-364 **Course Type: Theory**

Course Name: Go Programming **Credits allotted: 2**

Credits Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction	6L
2	Functions	5L
3	Working with Data	4L
4	Methods and Interfaces	5L
5	Goroutines and Channels	5L
6	Packages and Files	5L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Introduction**	**[6 L]**
	1.1 Go Runtime and Compilations 1.2 Keywords and Identifiers 1.3 Constants and Variables 1.4 Operators and Expressions 1.5 Local Assignments 1.6 Booleans, Numeric , Characters 1.7 Pointers and Addresses 1.8Strings 1.9 if-else, switch, for loop 1.10 Iterations 1.11 Using break and continue	
Unit II	**Functions**	**[5 L]**
	2.1 Parameters and Return Values 2.2 Call by Value and Reference 2.3 Named Return Variables 2.4 Blank Identifiers 2.5 Variable Argument Parameters 2.6 Using defer statements 2.7 Recursive Functions 2.8 Functions as Parameters	
Unit III	**Working with Data**	**[4 L]**

	3.1 Array Literals 3.2 Multidimensional Arrays 3.3 Array Parameters 3.4 Slices and Slice Parameters 3.5 Multidimensional Slices 3.6 Structures and Structure Parameters	
	MODULE-2 [12L+3T]	
Unit IV	**Methods and Interfaces**	**[5 L]**
	4.1 Method Declarations 4.2 Functions vs. Methods 4.3 Pointer and Value Receivers 4.4 Method Values and Expressions 4.5 Interface Types and Values 4.6 Type Assertions and Type Switches 4.7 Method Sets with Interfaces 4.8 Embedded Interfaces 4.9 Empty Interfaces	
Unit V	**Goroutines and Channels**	**[5 L]**
	5.1 Concurrency vs. Parallelism 5.2 Goroutine Functions and Lambdas 5.3 Wait Groups 5.4 Channels 5.5 Sending and Receiving 5.6 Unbuffered and Buffered Channels 5.7 Directional Channels 5.8 Multiplexing with select 5.9 Timers and Tickers	
Unit VI	**Packages and Files**	**[5L]**
	6.1 Packages and Workspaces 6.2 Exporting Package Names 6.3 Import Paths and Named Imports 6.4 Package Initializations 6.5 Blank Imports 6.6 Unit Testing with Test Functions 6.7 Table Tests and Random Tests 6.8 Benchmarking 6.9 Working with Files	

Reference Books:

Reference Book 1: The Go Programming Language by Alan A. A. Donovan & Brian W. Kernighan

Reference Book 2: Get Programming with Go by Roger Peppe & Nathan Youngman

Reference Book 3: Head First Go by Jay McGavren

On completion of this course, students will be able to:

CO-1 Describe the core features and concepts in Go;

CO-2 Write simple Go programs using functions;
CO-3 Applydefining methods and Go Interfaces;
CO-4 Use Go routines and Channels;
CO-5 Explore Go Packages;

SEMESTER VI

NEP-2020: Third Year UG Major BCA(Science)

Course Code: BSMAP-365 **Course Type: Practical**

Course Name: Go Programming Lab **Credits allotted: 2 Credits**

Lectures allotted: 60 Lectures

Prerequisite Courses:

- Knowledge of Programming Languages C, C++, Java, Python

Companion Courses:

- BCA362 Programming in GO

Course Objectives:

- To introduce essential programming features in GO
- To become familiar with programming techniques in GO
- To understand the technique of building Packages and File handling

Sr. No.	Assignment	No of Sessions
1	Introduction to Go Programming	02
2	Functions	02
3	Working with data	03
4	Methods and Interfaces	02
5	Go routines and channels	03
6	Packages and files	03
	Total 15	

Course Outcome:

On completion of this course, students will be able to:

CO1: Write programs using features supported in GO

CO2: Understand the concept of **functions in Go language**

CO3: Handle errors and utilize Goroutines and Channels

CO4: Implement different types of **functions in Go**, such as user-defined functions, anonymous functions, and functions with multiple return values.

CO5: Write programs on File handling

CO6: Compare and contrast features of GO with other object oriented languages

SEMESTER VI		
NEP-2020: Third Year UG Major BCA(Under AICTE) **Course Code: BSMAP-366** **Course Type: Practical** **Course Name: Advanced Java Lab** **Credits allotted:2 credits** **Lectures allotted: 60 Lectures**		
Sr. No.	**Assignment**	**No of Sessions**
1	**Database Programming** To communicate with a database using java. To execute queries on tables.	**4**
	To obtain information about the database and tables.	
2	**Multithreading** To create and use threads in java. To demonstrate multithreading using Thread Synchronization, Inter-thread . Communication, Thread Priorities.	**3**
4	**Servlets** To understand server-side programming. Simple steps to create and execute servlets. How to pass parameters using doGet and doPost methods. Handling data from HTML to servlet . How to connect a servlet to a database . Use of various session tracking methods like Cookies.	**3**
5	**Java Server Pages** JSP life-cycle. Use of JSP implicit objects. JSP Directives. Use of Scripting Elements. To understand actionstags in JSP. Understanding flow of JSP custom tags.	**3**
6	**Spring Framework** To create and understand the steps to develop Spring application.	**2**
	Total 15	

Course Outcome

After studying this course, student will able to –

CO1: Establish **JDBC connections**, execute SQL queries, and manage database interactions in Java;

CO2: Develop multithreaded applications and demonstrate **thread synchronization**, **inter- thread communication**, and **thread priorities**;

CO4: Develop and deploy **Servlets**, pass parameters via HTTP methods, and manage **session tracking** using **cookies**;

CO5: Create dynamic web pages using **JSP**, understand its lifecycle, and work with **JSP directives**, **scripting elements**, and **custom tags**;

CO6: Develop applications using the **Spring Framework**, implement **Inversion of Control**;

SEMESTER VI

NEP-2020: Third Year UG Major Elective BCA(Under AICTE)

Course Code: BSMET-367A **Course Type: Theory**

Course Name: Android Programming **Credits allotted: 2 Credits**

Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction to Android	6L
2	Activities, Fragments and Intents	5L
3	Android User Interface	4L
4	Designing Your User Interface with Views	8L
5	Databases - SQLite, Messaging and E-mail	7L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Introduction to Android**	**[6 L]**
	1.1 Overview 1.2 History 1.3 Features of Android 1.4 Architecture of Android 1.5 SDK Overview 1.6 Creating your first Android Application	
Unit II	**Activities, Fragments and Intents**	**[5 L]**
	2.1 Introduction to Activities 2.2 Activity Lifecycle 2.3 Introduction to Intents 2.4 Linking Activities using Intents 2.5 Calling built-in applications using Intents 2.6 Introduction to Fragments 2.7 Adding Fragments Dynamically 2.8 Lifecycle of Fragment 2.9 Interaction Between Fragment 2.10 Toast	

Unit III	**Android User Interface**	**[4 L]**

	3.1 Understanding the components of a screen 3.2 Adapting to Display Orientation 3.3 Split Screen/Multi-Screen Activities	
	MODULE-2 [12L+3T]	
Unit IV	**Designing Your User Interface with Views**	**[8 L]**
	4.1 Using Basic Views 4.2 Using Picker Views 4.3 Using List Views to Display Long Lists 4.4 Understanding Specialized Fragments 4.5 Displaying Pictures and Menus 4.6 Video View	
Unit V	**Databases - SQLite, Messaging and E-mail**	**[7 L]**
	5.1 Introduction to SQLite 5.2 SQLiteOpenHelper and SQLite Database 5.3 Creating and Using database 5.4 Working with Cursors 5.5 Building and Executing Quries 5.6 SMS Messaging 5.7 Sending E-mail	

Reference Books:

Reference Book 1: Android Programming with Kotlin for Beginners by John Horton **Reference Book 2:** Head First Android Development: A Brain-Friendly Guide **Reference Book 3:** Android App Development for Dummies, 3ed

Course Outcome

After studying this course, student will able to –

CO1: Understand the Basics of Android Development; CO2: Work with Android Activities, Fragments, and Intents; CO3: Design and Implement Android User Interfaces; CO4: Create Interactive and User-Friendly Interfaces; CO5: Use SQLite Database for Data Storage; CO6: Develop and Deploy Real-World Android Applications;

SEMESTER VI

NEP-2020: Third Year UG Major Elective BCA(Science)

Course Code: BSMEP-367A **Course Type: Practical**

Course Name: Android Programming Lab **Credits allotted: 2**

Credits Lectures allotted: 60 Lectures

Sr. No.	Assignment	No of Sessions
1	Introduction to Android	2
2	Activities, Fragments and Intents	2
3	Android User Interface	2
4	Designing User Interface with Views	3
5	Databases-SQLite, Messaging and E-mail	3
6	Location-Based Services and Google Map	3
	Total 15	

Course Outcome:

After studying this course, student will able to –

CO1: Understand Android Development Basics;

CO2: Work with Activities, Fragments, and Intents;

CO3: Design and Implement Android User Interfaces;

CO4: Create Dynamic User Interfaces with Views;

CO5: Implement SQLite Database for Local Data Storage;

CO6: Implement Location-Based Services and Google Maps;

SEMESTER VI

NEP-2020: Third Year UG Major Elective BCA(Under AICTE)

Course Code: BSMET-367B **Course Type: Theory**

Course Name: Data Visualization **Credits allotted: 2 Credits**

Lectures allotted: 30 Lectures

Prerequisite:

Familiarity with using a computer, including file management and basic software navigation. Basic knowledge of data structures, such as tables and databases. Basic understanding of data analysis concepts and familiarity with data types.

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction to Data Visualization	6L
2	Visualization tools & Data Storytelling	5L
3	Designing Effective Visualizations	4L
4	Visualization Tools	6L
5	Data Storytelling and Dashboard Design	5L
6	Designing Effective Visualizations	4L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Introduction to Data Visualization**	**[6 L]**
	1.1 1.1 Definition of Data Visualization 1.2 Importance of Data Visualization 1.3 Role of Data Visualization in Decision Making	
Unit II	**Types of Data and Visualization Process**	**[5 L]**
	2.1 Types of Data 2.1.1 Numerical Data 2.1.2 Categorical Data 2.1.3 Temporal Data 2.1.4 Geographical Data 2.2 Data Visualization Process 2.2.1 Data Collection 2.2.2 Data Exploration 2.2.3 Data Analysis	

	2.2.4 Data Visualization 2.2.5 Data Interpretation	
Unit III	**Challenges in Data Visualization**	**[4 L]**
	3.1 Challenges in Data Visualization 3.2 Limitations of Data Visualization 3.3 Common Issues in Representing Data Visually	
	MODULE-2 [12L+3T]	
Unit IV	**Visualization Tools**	**[6L]**
	4.1 Overview of Visualization Tools 4.1.1 Excel 4.1.2 Tableau 4.1.3 Power BI 4.1.4 Python 4.2 Features of Visualization Tools 4.3 Use Cases of Visualization Tools	
Unit V	**Data Storytelling and Dashboard Design**	**[5L]**
	5.1 Principles of Data Storytelling 5.2 Importance of Narrative and Context 5.3 Best Practices for Dashboard Layout 5.4 Dashboard Interactivity	
Unit VI	**Designing Effective Visualizations**	**[4L]**
	6.1 Principles of Good Visualization Design 6.2 Understanding and Using Color in Visualizations 6.3 Importance of Data Modeling in Visualization	

Course Objectives

CO1:Understand the fundamentals of data visualization and its importance.

CO2:Learn about visual perception and its impact on data interpretation.

CO3:Explore the ethical considerations and challenges in data visualization.

CO4:Study different types of visualizations and their appropriate uses.

CO5:Utilize Power BI to create and customize various types of visualizations

CO6: Develop and Deploy Real-World Android Applications;

Text Books

1. "Storytelling with Data: A Data Visualization Guide for Business Professionals" Cole Nussbaumer Knaflic, Wiley; 1st edition, 2015.
2. “The Visual Display of Quantitative Information” by Edward Tufte, Graphics Press USA; 2nd edition, 2001.

Reference Books

1. "Data Visualization: A Practical Introduction" Kieran Healy, Princeton University Press, 2018.
2. "Analyzing Data with Power BI and Power Pivot for Excel", Alberto Ferrari and Marco Russo, Microsoft Press; 1st edition, 2017.

"Microsoft Power BI Complete Reference", Devin Knight, Brian Knight, Mitchell Pearson, and Manuel Quintana, Packt Publishing; 1st edition, 2018

SEMESTER VI		
NEP-2020: Third Year UG Major Elective BCA(Science)		
Course Code: BSMEP-367B		**Course Type: Practical**
Course Name: Data Visualization using PowerBI		**Credits allotted: 2 Credits**
Lectures allotted: 60 Lectures		
Sr. No.	**Assignment**	**No of Sessions**
1	**Introduction to Power BI Interface and Basics**	**3**
	1.1 Installation and interface overview 1.2 Exploring the Power BI workspace 1.2.1 Ribbon 1.2.2 Panes 1.2.3 Canvas 1.3 Importing data 1.3.1 From Excel files 1.3.2 From CSV files 1.4 Introduction to multiple data sources 1.5 Basic report creation 1.5.1 Adding visuals 1.5.2 Saving a report	
2	**Data Transformation and Preparation** 2.1 Using Power Query Editor	

	2.2 Cleaning data 2.2.1 Removing duplicates 2.2.2 Handling missing values 2.3 Transforming data 2.3.1 Splitting columns 2.3.2 Changing data types 2.3.3 Renaming columns 2.4 Merging and appending queries 2.5 Creating custom columns and calculated columns	**3**
3	**Data Modeling** 3.1 Creating relationships between tables 3.2 Identifying and resolving data inconsistencies 3.3 Creating calculated columns and measures	**3**
4	**Creating Basic Visualizations** 4.1 Creating various chart types 4.1.1 Bar chart 4.1.2 Column chart 4.1.3 Line chart 4.1.4 Pie chart 4.1.5 Area chart 4.2 Formatting and customizing visualizations	**3**
5	**Publishing and Sharing Reports** 5.1 Publishing a report to Power BI Service 5.2 Sharing reports and dashboards with team members 5.3 Setting up data refresh schedules 5.4 Managing permissions	**3**
	Total 15	

SEMESTER VI

NEP-2020: Third Year UG VSC BCA(Under AICTE)

Course Code: BSVST-361 **Course Type:Theory**

Course Name: BlockChain Technology **Credits allotted:2 Credit**

Lectures allotted: 30 Lectures

Chapter No	Name of the Chapter	Lectures Assigned
1	Introduction to Blockchain Technology	4L
2	Cryptography and Security in Blockchain	3L
3	Blockchain Fundamentals	8L
4	Blockchain Mechanics	8L
5	Blockchain Ecosystem & Applications	7L

MODULE-1 [12L+3T]

	Course Contents	
Unit I	**Introduction to Blockchain Technology**	**[4 L]**
	1.1 Understanding Blockchain 1.1.1 Definition 1.1.2 History 1.1.3 Evolution of Blockchain 1.2 Key Concepts 1.2.1 Distributed Ledger 1.2.2 Foundational Computing Concepts(Client-Server Systems vs Peer-to-Peer Systems) 1.2.3 Basic ideas behind Blockchain	
Unit II	**Cryptography and Security in Blockchain**	**[3 L]**
	2.1 Terminology 2.2 Private and Public keys 2.2 Objectives 2.3 Hashing(SHA-256) 2.4 Digital Signature	
Unit III	**Block Chain Fundamentals**	**[8 L]**
	3.1 Essentials of Blockchain 3.1.1 Block structure 3.1.2 Blockchain Generations 3.1.3 Types of Blockchain 3.1.4 Benefits and Challenges of Blockchain Usage 3.2 Components of Blockchain 3.3 Types of Networks 3.4 Blockchain vs Database 3.5 Layered Architecture of Blockchain 3.6 Blockchain Use Cases	

	MODULE-2 [12L+3T]	

Unit IV	Blockchain Mechanics	[8 L]
	4.1 Consensus Mechanisms 4.1.1 Proof of Work(PoW) 4.1.2 Proof of Stake(PoS) 4.1.3 Byzantine Fault Tolerant(BFT) 4.2 Cryptocurrency 4.2.1 Digital Currency Bitcoin 4.2.2 Digital Currency Ethereum 4.3 Smart Contract 4.3.1 What are smart contracts? 4.3.2 Working 4.3.3 Benefits and Applications 4.4 Ethereum Virtual Machine 4.4.1 Ether 4.4.2 Gas 4.5 Decentralized Autonomous Organization(DAO) 4.6 Decentralized Applications(DApps) 4.7 Hard and Soft Forks	
Unit V	**Blockchain Ecosystem & Applications**	**[7 L]**
	5.1 Blockchain Platforms 5.1.1 Introduction to Hyperledger 5.1.2 Hyperledger Fabric and its Architecture 5.1.3 Hyperledger Layers 5.1.4 Role of Peers 5.1.5 Corda, Polkadot, Stellar and Solana 5.2 Emerging Trends in Block Chain 5.2.1 Cloud based blockchains 5.2.2 Blockchain vs Cloud 5.2.3 Benefits of Cloud in Blockchain 5.2.4 Limitations of Cloud in Blockchain 5.3 Real-world Applications 5.3.1 Supply Chain, healthcare 5.3.2 Governments 5.3.3 Finance	

Reference Books:

Reference Book 1: Blockchain for Beginners - By Mark Watney..

Reference Book 2: Blockchain Technology Explained - By Alwyn Bishop.

Course Outcomes:

After studying this course, student will able to –

CO1: Understand basic concepts of blockchain including cryptography and security in Blockchain; CO2: Analyze various blockchain architectures and their characteristics;

CO3: Evaluate with a real-world applications of blockchain technology across different industries;

CO4: Explore various blockchain concepts such as smart contracts, cryptocurrency and blockchain protocols;

CO5: Assess advanced blockchain concepts such as blockchain used in enterprises and emerging trends;

P.D.E. A's

Prof. Ramkrishna More Arts, Commerce & Science College, Akurdi, Pune 44 (Autonomous)

Under NEP -2020

Internal – Examination

2026 T.Y.B.C.A.(Science)

Subject Code: - **Subject Name: -**

Time: 1hour **Total Marks: 20M**

Q.1) Attempt the following questions. (Any 5) **[1M X5=5M]**

1. . [CO]
2. . [CO]
3. . [CO]
4. . [CO]
5. . [CO]
6. . [CO]
7. [CO]

Q.2) Attempt the following questions. (Any 3) **[2M X3=6M]**

1. . [CO]
2. . [CO]
3. . [CO]
4. . [CO]
5. . [CO]

Q.3) Attempt the following questions. (Any 3) **[3M X3=9M]**

1. . [CO]
2. . [CO]
3. . [CO]
4. . [CO]
5. . [CO]

****

P.D.E. A's

Prof. Ramkrishna More Arts, Commerce & Science College, Akurdi, Pune 44 (Autonomous)

Under NEP -2020

External – Examination

2026 T.Y.B.C.A.(Science)

Subject Code: - **Subject Name: -**

Time: 2hour **Total Marks: 35M**

Q.1.Attempt any *Five* of the following. **[1 Marks*5=5Marks]**

a) . [CO]

b) . [CO]

c) . [CO]

d) . [CO]

e) . [CO]

f) . [CO]

Q.2 A) Attempt any *TWO* of the following. **[3Marks*2=6Marks]**

a) . [CO]

b) . [CO]

c) . [CO]

Q.2. B) Attempt any *ONE* of the following. **[4Marks*1=4Marks]**

a) [CO]

b) . [CO]

Q.3. A) Attempt any *TWO* of the following. **[3Marks*2=6Marks]**

a) . [CO]

b) . [CO]

c) . [CO]

Q.3 B) Attempt any *ONE* of the following. **[4Marks*1=4Marks]**

a) . [CO]

b) . [CO]

Q) 4. Attempt any *FOUR* of the following **[2.5Marks*4=10Marks]**

a) . [CO]

b) . [CO]

c) . [CO]

d) . [CO]

e) . [CO]