Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce, and Science College, Ahmednagar (Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

National Education Policy (NEP)
Choice Based Credit System (CBCS)

Programme Skeleton and Syllabus of
B.Sc. Cloud Computing (Major)

Implemented from

Academic Year 2023-24

1. Preamble:

The Bachelor of Science degree in Cloud Computing is a comprehensive program that is designed to provide students with the knowledge and skills needed to become experts in the field of cloud computing. This program is ideal for individuals who are interested in pursuing careers in the rapidly evolving technology industry, particularly in areas such as cloud infrastructure, security, and software development. The Bachelor of Science degree in Cloud Computing is a comprehensive program that covers a variety of topics related to cloud computing. Major areas of study in this program include introduction to cloud computing, cloud economics, cloud infrastructure, security, software development, networking, virtualization and DevOps. By the end of this program, graduates will be equipped with the skills and knowledge needed to pursue a variety of careers in cloud computing, including roles such as cloud architects, cloud engineers, cloud developers, cloud security specialists, and more. Whether you are a recent high school graduate or a working professional looking to advance your career in the technology industry, this program offers a comprehensive and practical approach to cloud computing education. Major areas of study included in the program are – Introduction to cloud computing: Learning about the fundamentals of cloud computing, its history, types, models, and its benefits to businesses and organizations. Cloud economics: Learning about the financial aspects of cloud computing, including cost models, pricing structures, and how to analyze the costs and benefits of cloud-based solutions. Cloud infrastructure: Students learn about the design and deployment of scalable and reliable cloud-based systems and services, including various types of cloud architectures and deployment models. Security: Understanding the threats to cloud computing and how to implement security measures to protect data and infrastructure, including encryption, access control, and compliance. Software development: Gaining skills in developing and deploying cloud-based software applications using various programming languages, development platforms, and tools. Networking: Studying the principles and practices of cloud networking, including virtual private networks, load balancing, and content delivery networks, as well as cloud-based storage and data management. Virtualization: Understanding how to create and manage virtualized environments using hypervisors such as VMware, Hyper-V, and KVM. DevOps: Understanding how to integrate development and operations to improve the efficiency and reliability of cloud-based systems and services, using tools such as continuous integration, continuous delivery, and infrastructure as code.

2. Programme Objectives:

The main objective of the Bachelor of Science Cloud Computing degree program is to provide students with the knowledge and skills necessary to design, develop, and deploy cloud-based solutions for modern businesses and organizations. Graduates of this program will be able to analyze business requirements, evaluate cloud technologies, and design and implement cloud-based systems that are secure, reliable, and scalable. Additionally, they will have a comprehensive understanding of the financial aspects of cloud computing, as well as the principles and practices of DevOps, enabling them to effectively manage cloud-based infrastructure and applications throughout their lifecycle.

3. Programme Outcomes: Upon completion of the Bachelor of Science Cloud Computing degree program, students will be able to:

- Design and implement cloud-based solutions that meet the requirements of modern businesses and organizations.

• Evaluate and select appropriate cloud technologies and deployment models for specific use cases.

• Implement and maintain cloud-based infrastructure and services in a secure, reliable, and scalable manner.

• Develop and deploy cloud-based applications using various programming languages, development platforms, and tools.

• Analyze the costs and benefits of cloud-based solutions and make informed decisions about cloud adoption and migration.

• Apply principles of DevOps to manage cloud-based systems and services throughout their lifecycle, including continuous integration and delivery, and infrastructure as code.

• Understand the ethical and legal considerations associated with cloud computing, including privacy, data protection, and compliance.

• Communicate effectively with stakeholders in the organization about the value and benefits of cloud computing solutions.

• Work effectively in a team-based environment to design, develop, and deploy cloud-based solutions that meet business needs.

• Continuously learn and adapt to emerging trends and technologies in the field of cloud computing to stay current and relevant in the industry.

Features of Cloud Computing:

• Scalability: Cloud computing enables the rapid and flexible deployment of computing resources, allowing businesses to easily scale up or down as needed.

• Cost-effectiveness: Cloud computing reduces the need for upfront hardware and infrastructure investment, making it more cost-effective for businesses.

• Availability: Cloud computing enables 24/7 access to applications and services from anywhere with an internet connection, improving business continuity.

• Security: Cloud computing providers implement a range of security measures to protect data and infrastructure, often providing better security than traditional on-premises solutions.

• Virtualization: Cloud computing heavily relies on virtualization technologies, enabling the creation of virtual machines and containers to provide computing resources.

• Automation: Cloud computing enables the automation of many processes, including scaling, deployment, and monitoring, leading to more efficient and effective operations.

• Big data: Cloud computing provides an ideal environment for big data processing and analysis, due to its ability to scale rapidly and handle large datasets.

• Mobility: Cloud computing enables the use of mobile devices for accessing applications and services, leading to increased mobility and flexibility for businesses.

• Internet of Things (IoT): Cloud computing is a key enabler of IoT applications, providing the necessary infrastructure for processing and analyzing data from connected devices. Global reach: Cloud computing enables businesses to operate globally with ease, providing access to Features of Cloud Computing:

• Scalability: Cloud computing enables the rapid and flexible deployment of computing resources, allowing businesses to easily scale up or down as needed.

• Cost-effectiveness: Cloud computing reduces the need for upfront hardware and infrastructure investment, making it more cost-effective for businesses.

• Availability: Cloud computing enables 24/7 access to applications and services from anywhere with an internet connection, improving business continuity.

• Security: Cloud computing providers implement a range of security measures to protect data and infrastructure, often providing better security than traditional on-premises solutions. • Virtualization: Cloud computing heavily relies on virtualization technologies, enabling the creation of virtual machines and containers to provide computing resources.

• Automation: Cloud computing enables the automation of many processes, including scaling, deployment, and monitoring, leading to more efficient and effective operations.

• Big data: Cloud computing provides an ideal environment for big data processing and analysis, due to its ability to scale rapidly and handle large datasets.

• Mobility: Cloud computing enables the use of mobile devices for accessing applications and services, leading to increased mobility and flexibility for businesses.

• Internet of Things (IoT): Cloud computing is a key enabler of IoT applications, providing the necessary infrastructure for processing and analyzing data from connected devices. Global reach: Cloud computing enables businesses to operate globally with ease, providing access to requirements, set pricing, and develop marketing strategies to promote the product.

4.Program Structure:

• The Program is of Four Year (Eight semesters) Full Time Degree Program.

• The program shall be based on credit system comprising 176 credit points.

• Theory Courses offered shall be of 2, 3 and 4 credits and practical courses will 2 credits each.

• For Theory Course, one credit is equivalent to one clock hour direct teaching in a week and for Practical Course, one credit is equivalent to 02 hours of laboratory work in a week.

5. Faculty: The 4 years under graduate degree program in B.Sc. CC (Honors) will be started under faculty of Science and Technology.

6. Eligibility for Admission: Any candidate who has passed the XII standard Examination in Science stream from Maharashtra State Board of Secondary and Higher Secondary Education or equivalent Board of Examination, is eligible for admission to the First Year of this degree program. OR Passed Three Year Diploma Course approved by the DTE, Maharashtra State or Equivalent authority. Admission will be given on the basis of Admission policies framed by college time to time. College will design admission policies before commencement of admission process of every academic year. College reserve rights to modify /change admission policies.

7. Intake: 80

Course Fees per student: By considering the infrastructural requirements and teaching resources approximate fees for this UG program will be Rs. 55000/- to 65000/-.

8. Medium of Instruction: English

9. Examination Patterns:

• Continuous Internal Evaluation is periodically conducted by the respective subject teacher.

• Semester End Examination will be conducted as per standard norms of autonomy.

• Course will be conducted in semester pattern viz for 4 years degree course - 8 Semesters.

• Duration of each semester should not be less than 14 weeks or 90 days.

• At end of each semester, semester end examination will be conducted and result will be declared with internal and external evaluation including practical examination. Question paper format: However minor changes in the format of question paper may be done time to time by considering the content of subject and approval for same will be taken from BOS of Autonomous college before implementation. A) Standard of passing: To pass the theory /practical course (For internal and external examination) the student must obtain minimum 40 % marks in each theory and practical course separately. B) Evaluation Pattern:

• Each course carrying 15/35 (For 2 credits) or 30/70 (For 3 and 4 credits) marks shall be evaluated with Continuous Assessment (CA) and University Evaluation (UE) mechanism. For Continuous assessment weightage of 30 % marks is given and 70% evaluation is carried out by external examination. To pass in a course, a student has to secure minimum 40 % marks separately for CA and external examination.

• CA (For 3 and 4 credit course) shall be based on internal tests (minimum 2 tests for 20 marks each). In addition, for remaining 10marks a teacher may assign various activities such as home assignments, tutorials, seminars, presentations, group discussion etc, to the students and evaluate accordingly.

• CA (For 2 credit course) shall be based on internal tests (minimum 2 tests) for 10 marks. In addition, for remaining 05 marks a teacher may assign various activities such as home assignments, tutorials, seminars, presentations, group discussion etc., to the students and evaluate accordingly.

10. ATKT Rules:

• Minimum number of credits required to take admission to Second Year of B.Sc. Cloud Computing: 22 (50%) • Minimum number of credits required to take admission to Third Year of B.Sc. Cloud Computing.: 66 (100 % of F.Y. and 50% of S.Y.)

• Minimum number of credits required to take admission to Fourth Year of B.Sc. Cloud Computing.: 110 (100 % of F.Y. and S.Y and 50% of T.Y.) 11. Award of Credits:

• Course having 2 credits shall be evaluated out of 50 (35:15) marks and student should secure at least 20 marks to earn full credits of that course.

• Course having 3 credits and 4 credits shall be evaluated out of 100 (70:30) marks and student should secure atleast 40 marks to earn full credits of that course.

• CGPA shall be calculated based on the marks obtained in the respective subject provided thatstudent should have obtained credits for that course.

12. Completion of Degree Program:

• After completion of 132 credit at the end of III year the student has choice to exit with B.Sc. Cloud Computing and is eligible to apply for 2 years P.G. programme. OR He / She is eligible to continue their admission for B.Sc. Cloud Computing (Honors) or B.Sc. Cloud Computing (Research) in the IV year.

• A student who earns 176 credits, shall be considered to have completed the requirements of theB.Sc. Cloud Computing (Honors / Research) degree program and CGPA will be calculated for such student. Verification and Revaluation rules: A candidate may be eligible to apply for Verification of marks and Revaluation of answer book(s), within 10 days from the date of declaration of result, subject to the following conditions:

• A candidate may apply for verification of marks of all subjects appeared at the examination concerned.

For revaluation of answer books, a candidate may apply up to 50% of heads of passing in theory subject/s or maximum three heads of passing in theory subject/s, whichever is less, at the semester end examination in which he/she has appeared at the said examination.

• Revaluation of answer books includes the process of verification of marks. Candidate can apply for revaluation of answer book(s) only out of the subject(s) applied for verification of marks.

• The revaluation of the answer book/s, however, shall not be permitted in respect of scripts of Practical Examination / Term work / Internal Assessment/ Sessional Marks / Dissertation / Thesis / Clinical / MCQ (Multiple Choice Question in practical examination) and Viva-Voce etc

1. Definitions and Keywords:

1.1 Academic Year: An academic year is divided into two semesters with a minimum of 180 working days.

1.2 Semester:
A semester comprises of minimum 90 working days.

1.3 Major Subject/Discipline

Major subject/discipline is the discipline or subject of main focus and the degree will be awarded in that discipline. Students should secure the prescribed number of credits (about 50% of total credits) through core courses in the major discipline.

1.4 Minor Subject/Discipline:

Minor discipline helps a student to gain a broader understanding beyond the major discipline. The minor is of 20 credits.

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 the UG Programme.

1.5 Open Elective (OE):
The OE are the multidisciplinary or generic elective courses. The students have to select OE compulsorily from faculty other than that of the major. It is to be offered in I and II years with a maximum of 12 credits. The college has made the bucket list of the OE courses.

1.6 Vocational Skill Courses (VSC):

VSC are the Hands-on Training Courses corresponding to the Major Subject, to be offered in the first three years. Wherever applicable vocational courses will include skills based on advanced laboratory practicals of Major.

1.7 Skill Enhancement Courses (SEC):

The skill-based courses related to the Major are to be offered in the I and II years.

1.8 Ability Enhancement Courses (AEC):

The AEC includes courses related to Modern Indian Language (MIL) and English. The AEC courses shall be offered in I and II years. The focus of the MIL and English should be on linguistic and communication skills

1.9 Indian Knowledge System (IKS):

The 02-credit course related to Major or general based on the Indian knowledge system shall be offered in the I year of the UG programme. The college has made the bucket list of the IKS courses.

1.10 Value Education Courses (VEC):

The Value Education Courses shall introduce students to the social value system as well as to important social concerns of the current times, helping them to make connections between what they learn and how they live. The VEC shall be offered in the first 2 semesters of the UG programme.

1.11 UG Certificate:

Students who opt to exit after completion of the first year and have secured 44 credits will be awarded a UG certificate if, in addition, they complete one vocational course of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

1.12. UG Diploma:

Students who opt to exit after completion of the second year and have secured 88 credits will be awarded the UG diploma if, in addition, they complete one vocational course of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.

1.13 3-year UG Degree:

Students who wish to undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 132 credits and satisfying the minimum credit requirement.

1.14 UG Degree (Honours):

A four-year UG Honours Degree in the major discipline will be awarded to those who complete a four-year degree programme with 176 credits and have satisfied the credit requirements.

1.15 4-year UG Degree (Honours with Research):

Students who obtain 75 % marks/ A grade and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a faculty member of the college. The research project/dissertation will be in the major discipline. The students who secure 176 credits, including 12 credits from a research project/dissertation, are awarded UG Degree (Honours with Research).

1.16 Infrastructure Requirement:

The Departments offering a 4-year UG Degree (Honours with Research) must have the required infrastructure such as the library, access to journals, computer laboratory and software and laboratory facilities to carry out experimental research work. The departments already recognized for conducting the Ph.D. programme may conduct a 4-year UG Degree (Honours with Research) without obtaining any approval from the affiliating University.

1.17 Summer Term:

A summer term is for eight weeks during summer vacation. Internship/apprenticeship/work-based vocational education and training can be carried out during the summer term, especially for students who wish to exit after two semesters or four semesters of study. Regular courses may also be offered during the summer on a fast-track mode to enable students to do additional courses or complete backlogs in coursework.

2.1 Letter Grades and Grade Points

Letter Grade	Meaning	Percentage of Marks	Grade Points
O	Outstanding	90 and above	10
A+	Excellent	80 to 89.99	9
A	Very Good	70 to 79.99	8
B+	Good	60 to 69.99	7
B	Above Average	55 to 59.99	6
C	Average	50 to 54.99	5
D	Pass	40 to 49.99	4
F	Fail	Less than 40	0
Ab	Absent	Absent	0

2.2. CGPA and Grade

Sr. No.	CGPA	Grade
1.	90 and above	O (Outstanding)
2.	80 to 89.99	A+ (Excellent)
3.	70 to 79.99	A (Very Good)
4.	60 to 69.99	B+ (Good)
5.	55 to 59.99	B (Above Average)
6.	50 to 54.99	C (Average)
7.	40 to 49.99	D (Pass)
8.	Less than 40	F (Fail)

* The statutory requirement for eligibility to enter as an assistant professor in colleges and universities in the disciplines of arts, science, commerce, etc., is a minimum average mark of 50% and 55% in relevant postgraduate degrees respectively for reserved and general categories. Hence, the cut-off marks for grade B shall not be less than 50% and for grade B+, it should not be less than 55% in CBCS System.

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

Credit Framework for Undergraduate Programmes (UG):

The structure of a three/four-year bachelor's programme allows the opportunity for the students to experience the full range of holistic and multidisciplinary education in addition to the focus on the selected Major and Minor subjects as per their choice.

3.1 Credit Framework:

Levels	Year	Semesters	Credits Requirements	Qualification Title
4.5	I	02	44	B.Sc. Certificate
5.0	II	04	88	B.Sc. Diploma
5.5	III	06	132	Bachelor's Degree
6.0	IV	08	176	Bachelor's Degree -Honours Or Bachelor's Degree – Honours with Research

3.2 Rules and regulations:

1. The curriculum shall offer 22 credits per semester which include courses under Major and Minor subjects and all the other courses like (Open Elective (OE), India Knowledge System (IKS), Ability Enhancement Courses (AEC), Value Education Courses (VEC), Co-curricular Courses (CC) listed in the Maharashtra Government GR (एनईपी-२०२२/प्र.क्र.०९/विवि-०३/विकानना दिनांक २० एवप्रल २०२३).
2. The departments which are already having recognized UG and PG degree programmes in the same Major subject shall offer 4-Year Bachelor's Degree -Honours.
3. The departments which are already having recognized UG and PG degree programmes and Ph.D. research centres in the same Major subject shall offer 4-Year Programme with Bachelor's Degree -Honours as well as Bachelor's Degree – Honours with Research.
4. The departments offering only 3-Year UG programmes shall offer only Bachelor's Degree in the specific major subject (3-Years Bachelor's Degree). The decision of offering a 4-Year Bachelor's Degree -Honours shall be taken as per government and university regulations.
5. The subjects offered at the general level shall be offered as Minor subject.

6. Each theory credit is equivalent to 15 clock hours of teaching and each practical, project, and internship credit is equivalent to 30 clock hours of laboratory/field work in a semester.
7. Semester Grade Points Average (SGPA) will be calculated based on 22 credits and Final Cumulative Grade Point Average (CGPA) will be calculated based on 132 credits for a Bachelor's Degree of all 6 semesters and 176 credits for Bachelor's Degree-Honours or Bachelor's Degree- Honours with research of all eight semesters.
8. The duration of each theory semester is 15-18 weeks in which at least 12-week classroom teaching and 03 weeks of continuous internal assessment are mandatory.
9. The duration of each practical semester is 15 to 18 weeks in which at least a 14-week laboratory session and one week of internal evaluation including viva and journal certification are mandatory.
10. All the students admitted to any UG programme in the college should register themselves on the Academic Bank of Credits (ABC) portal and create their ABC ID as early as possible. The ABC ID shall be mandatory for filling out examination forms. Students also need to share their ABC ID to the college examination cell at the beginning of the academic year.

3.1 Bucket list of other Courses

3.1.1 Ability Enhancement Courses (AEC)

Sr. No.	Course Code	Year	Semester	Humanities	Commerce	Science	Credits
1.	AEC-01	I	I	English	English	English	02
2.	AEC-02	I	II	English	English	English	02
3.	AEC-03	II	III	MIL (Marathi /Hindi)	MIL (Marathi /Hindi)	MIL (Marathi /Hindi)	02
4.	AEC-04	II	III	MIL (Marathi /Hindi)	MIL (Marathi /Hindi)	MIL (Marathi /Hindi)	02

3.5.2 Indian Knowledge System (IKS)

Sr. No.	Course Code	Year	Semester	Humanities	Commerce	Science	Credits
1.	IKS-01	I	I	IKS	IKS	IKS	02
2.	IKS-01	I	I	Literature in Indian Civilization	Indian Agriculture	Indian Metallurgy	02
3.	IKS-01	I	I	Indian Health Science	Indian Textiles	Vedik Mathematics	02
4.	IKS-01	I	I	Sanskrit Literature		Indian Astronomy	02
5.	IKS-01	I	I	Indian Architecture		Yoga	02
6.	IKS-01	I	I	Indian Fine Arts		Indian Rivers: History and Culture	02

7.	IKS-01	I	I	Indian Agriculture		Ayurveda	02
8.	IKS-01	I	I	Indian Polity and Economy		Archaeological Sites of India	02
9.	IKS-01	I	I	Indian Ethics (Values)		Animal Husbandry and Allied Technologies in Ancient India	02
10.	IKS-01	I	I	Indian Philosophy		Science and Technology in Ancient India	02
11.	IKS-01	I	I	*Modi* Script			
12.	IKS-01	I	I	Kautilya Arthshastra			

3.5.3 Bucket list of Value Education Courses (VEC)

Sr. No.	Course Code	Year	Semester	Humanities	Commerce	Science	Credits
1.	VEC-01	I	I	Democracy, Election and Governance	Democracy, Election and Governance	Democracy, Election and Governance	02
2.	VEC-02	I	II	(Any One of the following) 1. Digital and Technical Solutions 2. Ethics and Values 3. Critical Thinking 4. Understanding India 5. Scientific Temper 6. Health and Wellness 7. Gender Studies			02

3.5.4 Bucket List of Co-curricular Courses (CC)

Sr. No.	Course Code	Year	Semester	Humanities	Commerce	Science	Credits
1.	CC-01	I	I	Environmental Studies	Environmental Studies	Environmental Studies	02
2.	CC-02	I	II	Physical Education	Physical Education	Physical Education	02
3.	CC-03	II	III	(Any one of the following) * 1. NSS/NCC 2. Publication of an article, essay, or poem in the college magazine'*Spandan*', newspapers, or any other recognized magazine.			02

				3. Small project work showcasing achievements of India in different fields (Ex. Literature, Science and Technology, Women Empowerment, Democracy etc.) 4. Participation in cultural or sports activities at university/state/national level. 5. Participation in community works related to national integration, environment, Human rights, disaster management, etc. with recognized GO or NGO or College other than NSS and NCC Activities. 6. Completion of Certificate Course organized by any department of the college 7. SWAYAM Courses 8. Book Review as per guidelines prescribed by the college. 9. College representation in any dance /music /theatre/visual arts competitions at the university/state/national level.	
4.	CC-04	II	IV	(Any one of the following) * 1. NSS/NCC 2. Publication of an article, essay, or poem in the college magazine'*Spandan*', newspapers, or any other recognized magazine. 3. Small project work showcasing achievements of India in different fields (Ex. Literature, Science and Technology, Women Empowerment, Democracy etc.) 4. Participation in cultural or sports activities at university/state/national level. 5. Participation in community works related to national integration, environment, Human rights, disaster management, etc. with recognized GO or NGO or College other than NSS and NCC Activities. 6. Completion of Certificate Course organized by any department of the college 7. SWAYAM Courses. 8. Book Review as per guidelines prescribed by the college. 9. College representation in any dance /music /theatre/visual arts competitions at the university/state/national level.	
*** One Co-curricular course/activity shall have a capping of 02 credits except for SWAYAM Courses. If a student completes 02 SWAYAM courses in two semesters (III and IV) shall be considered under CC.**					

3.5.5. Common Bucket List of Open Elective Courses (OE) offered by the college

Sr. No.	School	Department	Credits/Course	Courses	Total Credits
1.	Language	Marathi	03	04	12
2.	Language	Hindi	03	04	12
3.	Language	English	03	04	12
4.	Economics	Economics	03	04	12

5.	Social Sciences	History, Political Science Sociology, Defense Studies	03	04	12
6.	Mental and Moral Sciences	Philosophy, Psychology	03	04	12
7.	Music	Music	03	04	12
8.	Commerce	Commerce	03	04	12
9.	Management	BBA and BBA(CA)	03	04	12
10.	Chemical Science	Chemistry	03	04	12
11.	Life Sciences	Botany, Zoology, Microbiology, and Biotechnology	03	04	12
12.	Physical Sciences	Physics and Electronics	03	04	12
13.	Mathematical Science	Mathematics and Statistics	03	04	12
14.	Computational Science	Centre for Advanced Studies Applied Sciences (CASAS)	03	04	12
15.	Media Studies	Communication Studies and Animation	03	04	12
16.	Earth and Environmental Science	Geography and Environmental Science	03	04	12

Credit Distribution: B.Sc. Cloud Computing (Major) including Minor and OE and other courses.

	Type of Courses	III Yr	IV Yrs (Honours)	IV Yrs Research
Major Cloud Computing	Discipline-Specific Courses (DSC)	46	74	66
	Discipline Specific Elective (DSE)	08	16	16
	Skill Enhancement Courses (SEC)	06	06	06
	Vocational Skill Courses (VSC)	08	08	08
	On-Job Training (OJT)	04	08	04
	Field Project (FP)	04	04	04
	Community Engagement and Service (CEP)	02	02	02
	Research project	00	00	12
	Research Methodology	00	04	04
	Total (I, II and III Year)	78	122	122
Minor	Minor	20	20	20
Other Courses	Open Elective (OE)/ Multidisciplinary Courses	12	12	12
	Indian Knowledge System	02	02	02
	Co-Curricular Courses	08	08	08
	Ability Enhancement Courses	08	08	08
	Value Education Courses	04	04	04
	Total	132	176	176

B.Sc. Cloud Computing Programme Framework: Credit Distribution

Year	Semester	Level	Major											Minor	OE	CC	AEC	VEC	Total
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP		IKS						
I	I	4.5	T	P	T	P	T	P	T	P	T	P		T/ P	-	-	-	-	-
I	II	4.5	4	2	-	-	-	2	-	-	-	-	2	03	3	2	2	2	22
			6	-	-	-		2	-	2	-	-		03	3	2	2	2	22
Exit Option: Award of UG Certificate in Major with 44 credits and an additional 4 credit core NSQF course /Internship or Continue with Major and Minor																			
II	III	5.0	6	2	-	-		2	-	-	-	2		03	3	2	2	-	22
II	IV	5.0	6	2	-	-		-	-	2	-	2		03	3	2	2	-	22
Exit Option: Award of UG Diploma in Major with 88 credits and an additional 4 credit core NSQF course /Internship or Continue with major and minor																			
III	V	5.5	8	2	2	2	-	-	-	2		2		04	-	-	-	-	-	22
III	VI	5.5	6	2	2	2	-	-	-	2		4		04	-	-	-	-	-	22
Exit Option: Award of UG Degree in Major and Minor with 132 credits or continue with Major for a 4-year Degree																			
IV	VII	6.0	8	6	2	2	RM-4		-	-	-	-		-	-	-	-	-	-	-	22
IV	VII I	6.0	8	6	2	2	-	-	-	-	-	4		-	-	-	-	-	-	-	22
Four Year UG Degree(Honours) with Major and Minor with 176 credits																			
IV	VII	6.0	6	4	2	2	RM-4		-	-	-	4		-	-	-	-	-	-	-	22
IV	VII I	6.0	6	4	2	2	-	-	0	-	-	8		-	-	-	-	-	-	-	22
Four Year UG Degree (Honours with Research) with Major and Minor with 176 credits																			

B.Sc. Cloud Computing Programme Framework: Course Distribution

Year	Semester	Level	Major											Minor		OE	CC	AEC	VEC	Total
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP		IKS							
I	-	-	T	P	T	P	T	P	T	P	T	P		T	P	-	-	-	-	-
I	I	4.5	**2**	**1**	-	-	-	1	-	-	-	-	1	1		1	1	1	1	10
	II	4.5	**2**	-	-	-		1	-	**1**	-	-		1		1	1	1	1	09
Exit Option: Award of UG Certificate in Major with 44 credits and an additional 4 credit core NSQF course /Internship or Continue with major and minor																				
II	III	5.0	**2**	**1**	-	-		**1**	-	-	-	**1**		1		1	1	1	-	09

II	IV	5.0	2	1	-	-		-	-	1	-	1		1	1	1	1	-	09
Exit Option: Award of UG Diploma in Major with 88 credits and an \additional 4 credit core NSQF course /Internship or Continue with major and minor																			
III	V	5.5	2	1	1	1	-	-	-	1		1		1	-	-	-	-	08
III	VI	5.5	2	1	1	1	-	-	-	1		1		1	-	-	-	-	08
Exit Option: Award of UG Degree in Major and Minor with 132 credits or continue with Major for a 4-year Degree																			
IV	VII	6.0	3	3	1	1	0	1	-	-	-	-		-	-	-	-	-	09
IV	VIII	6.0	3	3	1	1	-	-	-	-	-	1		-	-	- -	-	-	09
Four Year UG Degree(Honours) with Major and Minor with 176 credits																			
IV	VII	6.0	2	2	1	1	0	1	-	-	-	1		-	-	- -	-	-	08
IV	VIII	6.0	2	2	1	1	-	-	-	-	-	1		-	-	- -	-	-	07
Four Year UG Degree (Honours with Research) with Major and Minor with 176 credits																			

Programme Framework (Course Distribution): B.Sc. Cloud Computing (Major)

Year	Semester	Level	Major											Total	
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP/PR		IKS		
			T	P	T	P	T	P	T	P	T	P	T	T	P/PR
I	I	4.5	2	1	-	-	-	1	-	-	-	-	01	03	02
I	II	4.5	2	-	-	-		1	-	1	-	-		02	02
II	III	5.0	2	1	-	-		1	-	-	-	1		02	03
II	IV	5.0	2	1	-	-		-	-	1	-	1		02	03
III	V	5.5	2	1	1	1	-	-	-	1		1		03	04
III	VI	5.5	2	1	1	1	-	-	-	1		1		03	04
B.Sc. Honours															
IV	VII	6.0	3	3	1	1	RM-1		-	-	-	-		05	04
IV	VIII	6.0	3	3	1	1	-	-	-	-	-	1		04	05

Programme Framework (Credit Distribution): B.Sc. Cloud Computing (Major)

Year	Semester	Level	Major											Total
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP/RP		IKS	
			T	P	T	P	T	P	T	P	T	P	**T**	
I	I	4.5	4	2	-	-	-	2	-	-	-	-	02	10
I	II	4.5	6	-	-	-		2	-	2	-	-		10
II	III	5.0	6	2	-	-		2	-	-	-	2		12
II	IV	5.0	6	2	-	-		-	-	2	-	2		12
III	V	5.5	8	2	2	2	-	-	-	2		2		18
III	VI	5.5	6	2	2	2	-	-	-	2		4		18
IV	VII	6.0	8	6	2	2	RM-4		-	-	-	-		22
IV	VIII	6.0	8	6	2	2	-	-	-	-	-	4		22

Programme Framework (Courses and Credits): B.Sc. Cloud Computing (Major)

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	DSC-1	BS-CC111T	Mathematical Foundation for Cloud Computing.	02
2.	I	I	4.5	DSC-2	BS- CC112T	Database Management System –I.	02
3.	I	I	4.5	DSC-3	BS- CC113P	Laboratory Course on Mathematical Computing.	02
4.	I	I	4.5	SEC-1	BS- CC114P	Laboratory Course on Database Managemnet Systems-I.	02
5.	I	I	4.5	IKS-1	BS- CC115T	Science and Technology in Ancient India	02
6.	I	II	4.5	DSC-4	BS- CC121T	Introduction to Cloud Computing.	**03**
7.	I	II	4.5	DSC-5	BS- CC122T	Database Management Systems-II	**03**
8.	I	II	4.5	SEC-2	BS- CC123P	Laboratory Course on Cloud Computing	02
9.	I	II	4.5	VSC-1	BS- CC124P	Laboratory Course on Database Management Systems-II	02
10.	II	III	5.0	DSC-6	BS- CC231T	Linux Operating System	03
11.	II	III	5.0	DSC-7	BS- CC232T	Object Oriented Concepts Using Java Programming	03
12.	II	III	5.0	DSC-8	BS- CC233P	Laboratory Course on Linux Operating System	02
13.	II	III	5.0	SEC-3	BS- CC234P	Laboratory Course on Object Oriented Concepts Using Java Programming	02
14.	II	III	5.0	FP-01	BS- CC235P	Field Project	02
15.	II	IV	5.0	DSC-9	BS-CC241T	Cloud Computing Architecture	03
16.	II	IV	5.0	DSC-10	BS-CC242T	Advance Java Programming	03

17.	II	IV	5.0	DSC-11	BS-CC243P	Laboratory Course on Cloud Computing Architecture	02
18.	II	IV	5.0	VSC-2	BS-CC244P	Laboratory Course on Advance Java Programming	02
19.	II	IV	5.0	CEP-01	BS-CC245P	Community Engagement and Services	02
20.	III	V	5.5	DSC-12	BS-CC351T	Foundation of Data Storage	04
21.	III	V	5.5	DSC-13	BS- CC352T	Advance Cloud Architecture	04
22.	III	V	5.5	DSC-14	BS- CC353P	Laboratory Course on Data Storage	02
23.	III	V	5.5	DSE-01	BS- CC354T (A)	Data Communication and Networking	02
24.	III	V	5.5	DSE-02	BS- CC355P (A)	Laboratory Course on Networking	**02**
25.	III	V	5.5	DSE-01	BS- CC354T (B)	Software Engineering	02
26.	III	V	5.5	DSE-02	BS- CC355P (B)	Laboratory on Software Engineering	**02**
27.	III	V	5.5	VSC-3	BS- CC356P	Laboratory on Advance Cloud Architecture	02
28.	III	V	5.5	FP-02	BS- CC357P	Field Project	02
29.	III	VI	5.5	DSC-15	BS-CC361T	Virtualization Techniques	03
30.	III	VI	5.5	DSC-16	BS- CC362T	Big Data Analytics using Hadoop	03
31.	III	VI	5.5	DSC-17	BS- CC363P	Laboratory on Virtualization Techniques	**02**
32.	III	VI	5.5	DSE-03	BS- CC364T (A)	Advance Networking Concepts	02
33.	III	VI	5.5	DSE-04	BS- CC365P (A)	Laboratory on Advance Networking Concepts	02
34.	III	VI	5.5	DSE-03	BS- CC364T (B)	Object Oriented Software Engineering	02
35.	III	VI	5.5	DSE-04	BS- CC365P (B)	Laboratory on Object Oriented Software Engineering	02
36.	III	VI	5.5	VSC-4	BS- CC366P	Laboratory on Big Data Analytics using Hadoop	02
37.	III	VI	5.5	OJT-01	BS- CC367P	On –Job Training	04

B.Sc. Cloud Computing (Major with Honours)

38.	IV	VII	6.0	DSC-18	BS-CC471T	Containers and micro Services	03
39.	IV	VII	6.0	DSC-19	BS-CC472T	Cloud Computing Services	03

40.	IV	VII	6.0	DSC-20	BS-CC473T	Fog and Edge Computing	02
41.	IV	VII	6.0	DSC-21	BS-CC474P	Laboratory on Containers and micro Services	02
42.	IV	VII	6.0	DSC-22	BS-CC475P	Laboratory on Cloud Computing Services	02
43.	IV	VII	6.0	DSC-23	BS-CC476P	Laboratory on Fog and Edge Computing	02
44.	IV	VII	6.0	DSE-05	BS-CC477T (A)	Management Information System	02
45.	IV	VII	6.0	DSE-06	BS-CC478P (A)	Laboratory on Management Information System	02
46.	IV	VII	6.0	DSE-05	BS-CC477T (B)	Internet Security	02
47.	IV	VII	6.0	DSE-06	BS-CC478P (B)	Laboratory on Internet Security	02
48.	IV	VII	6.0	RM-01	BS-CC479T/P	Research Methodology	04
49.	IV	VIII	6.0	DSC-24	BS-CC481T	Apex and Visual Force Programming	03
50.	IV	VIII	6.0	DSC-25	BS-CC482T	Cloud Computing using Azure	03
51.	IV	VIII	6.0	DSC-26	BS-CC483T	PHP	02
52.	IV	VIII	6.0	DSC-27	BS-CC484P	Laboratory on Apex and Visual Force Programming	02
53.	IV	VIII	6.0	DSC-28	BS-CC485P	Laboratory on Cloud Computing using Azure	02
54.	IV	VIII	6.0	DSC-29	BS-CC486P	Laboratory on PHP	02
55.	IV	VIII	6.0	DSE-07	BS-CC487T (A)	Artificial Intelligence	02
56.	IV	VIII	6.0	DSE-08	BS-CC488P (A)	Laboratory on Artificial Intelligence	02
57.	IV	VIII	6.0	DSE-07	BS-CC487T (B)	Data Governance	02
58.	IV	VIII	6.0	DSE-08	BS-CC488P (B)	Laboratory on Data Governance	02
59.	IV	VIII	6.0	OJT-02	BS-CC489P	On-Job Training	04

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce, and Science College, Ahmednagar (Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

National Education Policy (NEP)
Choice Based Credit System (CBCS)

Programme Skeleton and Syllabus of
B.Sc. Cloud Computing (Major)

Implemented from

Academic Year 2023-24

Credit Distribution: B.Sc. Cloud Computing (Major) including Minor and OE and other courses.

	Type of Courses	III Yr	IV Yrs (Honours)	**IV Yrs Research**
Major Cloud Computing	Discipline-Specific Courses (DSC)	46	74	**66**
	Discipline Specific Elective (DSE)	08	16	**16**
	Skill Enhancement Courses (SEC)	06	06	**06**
	Vocational Skill Courses (VSC)	08	08	**08**
	On-Job Training (OJT)	04	08	**04**
	Field Project (FP)	04	04	**04**
	Community Engagement and Service (CEP)	02	02	**02**
	Research project	00	00	**12**
	Research Methodology	00	04	**04**
	Total (I, II and III Year)	78	122	**122**
Minor	Minor	20	20	**20**
Other Courses	Open Elective (OE)/ Multidisciplinary Courses	12	12	**12**
	Indian Knowledge System	02	02	**02**
	Co-Curricular Courses	08	08	**08**
	Ability Enhancement Courses	08	08	**08**
	Value Education Courses	04	04	**04**
	Total	132	176	**176**

Programme Framework (Course Distribution): B.Sc. Cloud Computing (Major)

Year	Semester	Level	Major											**Total**	
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP/PR		IKS		
			T	P	T	P	T	P	T	P	T	P	T	T	P/PR
I	I	4.5	2	1	-	-	-	1	-	-	-	-	01	03	**02**
I	II	4.5	2	-	-	-		1	-	1	-	-		02	02
II	III	5.0	2	1	-	-		1	-	-	-	1		02	**03**
II	IV	5.0	2	1	-	-		-	-	1	-	1		02	03
III	V	5.5	2	1	1	1	-	-	-	1		1		03	**04**
III	VI	5.5	2	1	1	1	-	-	-	1		1		03	04
B.Sc. Honours															
IV	VII	6.0	3	3	1	1	RM-1		-	-	-	-		05	04
IV	VIII	6.0	3	3	1	1	-	-	-	-	-	1		04	**05**

Programme Framework (Credit Distribution): B.Sc. Cloud Computing (Major)

Year	Semester	Level	Major											**Total**
			DSC		DSE		SEC		VSC		FP/OJT /IN/CEP/RP		IKS	
			T	P	T	P	T	P	T	P	T	P	**T**	
I	I	4.5	4	2	-	-	-	2	-	-	-	-	02	**10**
I	II	4.5	6	-	-	-		2	-	2	-	-		10
II	III	5.0	6	2	-	-		2	-	-	-	2		**12**
II	IV	5.0	6	2	-	-		-	-	2	-	2		12
III	V	5.5	8	2	2	2	-	-	-	2		2		**18**

III	VI	5.5	6	2	2	2	-	-	-	2		4		18
IV	VII	6.0	8	6	2	2	RM-4		-	-	-	-		**22**
IV	VIII	6.0	8	6	2	2	-	-	-	-	-	4		22

Programme Framework (Courses and Credits): B.Sc. Cloud Computing (Major)

Sr. No.	Year	Sem ester	Level	Course Type	Course Code	Title	**Credits**
1.	I	I	4.5	DSC-1	BS-CC111T	Mathematical Foundation for Cloud Computing.	**02**
2.	I	I	4.5	DSC-2	BS- CC 112T	Database Management System –I.	**02**
3.	I	I	4.5	DSC-3	BS- CC 113P	Laboratory Course on Mathematical Computing.	**02**
4.	I	I	4.5	SEC-1	BS- CC 114P	Laboratory Course on Database Managemnet Systems-I.	**02**
5.	I	I	4.5	IKS-1	BS- CC 115T	Science and Technology in Ancient India	**02**
6.	I	II	4.5	DSC-4	BS- CC 121T	Introduction to Cloud Computing.	03
7.	I	II	4.5	DSC-5	BS- CC 122T	Database Management Systems-II	03
8.	I	II	4.5	SEC-2	BS- CC 123P	Laboratory Course on Cloud Computing	**02**
9.	I	II	4.5	VSC-1	BS- CC 124P	Laboratory Course on Database Management Systems-II	**02**
10.	II	III	5.0	DSC-6	BS- CC 231T	Linux Operating System	**03**
11.	II	III	5.0	DSC-7	BS- CC 232T	Object Oriented Concepts Using Java Programming	**03**
12.	II	III	5.0	DSC-8	BS- CC 233P	Laboratory Course on Linux Operating System	**02**
13.	II	III	5.0	SEC-3	BS- CC 234P	Laboratory Course on Object Oriented Concepts Using Java Programming	**02**
14.	II	III	5.0	FP-01	BS- CC 235P	Field Project	**02**
15.	II	IV	5.0	DSC-9	BS-CC242T	Cloud Computing Architecture	**03**
16.	II	IV	5.0	DSC-10	BS- CC 242T	Advance Java Programming	**03**

17.	II	IV	5.0	DSC-11	BS- CC 243P	Laboratory Course on Cloud Computing Architecture	**02**
18.	II	IV	5.0	VSC-2	BS- CC 244P	Laboratory Course on Advance Java Programming	**02**
19.	II	IV	5.0	CEP-01	BS- CC 245P	Community Engagement and Services	**02**
20.	III	V	5.5	DSC-12	BS-CC 351T	Foundation of Data Storage	**04**
21.	III	V	5.5	DSC-13	BS- CC 352T	Advance Cloud Architecture	**04**
22.	III	V	5.5	DSC-14	BS- CC 353P	Laboratory Course on Data Storage	**02**
23.	III	V	5.5	DSE-01	BS- CC 354T (A)	Data Communication and Networking	**02**
24.	III	V	5.5	DSE-02	BS- CC 355P (A)	Laboratory Course on Networking	**02**
25.	III	V	5.5	DSE-01	BS- CC 354T (B)	Software Engineering	**02**
26.	III	V	5.5	DSE-02	BS- CC 355P (B)	Laboratory on Software Engineering	02
27.	III	V	5.5	VSC-3	BS- CC 356P	Laboratory on Advance Cloud Architecture	**02**
28.	III	V	5.5	FP-02	BS- CC 357P	Field Project	**02**
29.	III	VI	5.5	DSC-15	BS-CC361T	Virtualization Techniques	**03**
30.	III	VI	5.5	DSC-16	BS- CC 362T	Big Data Analytics using Hadoop	**03**
31.	III	VI	5.5	DSC-17	BS- CC 363P	Laboratory on Virtualization Techniques	02
32.	III	VI	5.5	DSE-03	BS- CC 364T (A)	Advance Networking Concepts	**02**
33.	III	VI	5.5	DSE-04	BS- CC 365P (A)	Laboratory on Advance Networking Concepts	**02**
34.	III	VI	5.5	DSE-03	BS- CC 364T (B)	Object Oriented Software Engineering	**02**
35.	III	VI	5.5	DSE-04	BS- CC 365P (B)	Laboratory on Object Oriented Software Engineering	**02**
36.	III	VI	5.5	VSC-4	BS- CC 366P	Laboratory on Big Data Analytics using Hadoop	**02**

37.	III	VI	5.5	OJT-01	BS- CC 367P	On –Job Training	**04**

B.Sc. Cloud Computing (Major with Honours)

38.	IV	VII	6.0	DSC-18	BS-CC471T	Containers and micro Services	**03**
39.	IV	VII	6.0	DSC-19	BS-CC472T	Cloud Computing Services	**03**
40.	IV	VII	6.0	DSC-20	BS-CC473T	Fog and Edge Computing	**02**
41.	IV	VII	6.0	DSC-21	BS-CC474P	Laboratory on Containers and micro Services	**02**
42.	IV	VII	6.0	DSC-22	BS-CC475P	Laboratory on Cloud Computing Services	**02**
43.	IV	VII	6.0	DSC-23	BS-CC476P	Laboratory on Fog and Edge Computing	**02**
44.	IV	VII	6.0	DSE-05	BS-CC477T (A)	Management Information System	**02**
45.	IV	VII	6.0	DSE-06	BS-CC478P (A)	Laboratory on Management Information System	**02**
46.	IV	VII	6.0	DSE-05	BS-CC477T (B)	Internet Security	**02**
47.	IV	VII	6.0	DSE-06	BS-CC478P (B)	Laboratory on Internet Security	**02**
48.	IV	VII	6.0	RM-01	BS-CC479T/P	Research Methodology	**04**
49.	IV	VIII	6.0	DSC-24	BS-CC481T	Apex and Visual Force Programming	**03**
50.	IV	VIII	6.0	DSC-25	BS-CC482T	Cloud Computing using Azure	**03**
51.	IV	VIII	6.0	DSC-26	BS-CC483T	PHP	**02**
52.	IV	VIII	6.0	DSC-27	BS-CC484P	Laboratory on Apex and Visual Force Programming	**02**
53.	IV	VIII	6.0	DSC-28	BS-CC485P	Laboratory on Cloud Computing using Azure	**02**
54.	IV	VIII	6.0	DSC-29	BS-CC486P	Laboratory on PHP	**02**

55.	IV	VIII	6.0	DSE-07	BS-CC487T (A)	Artificial Intelligence	**02**
56.	IV	VIII	6.0	DSE-08	BS-CC488P (A)	Laboratory on Artificial Intelligence	**02**
57.	IV	VIII	6.0	DSE-07	BS-CC487T (B)	Data Governance	**02**
58.	IV	VIII	6.0	DSE-08	BS-CC488P (B)	Laboratory on Data Governance	**02**
59.	IV	VIII	6.0	OJT-02	BS-CC489P	On-Job Training	**04**

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

1. Prologue/ Introduction of the programme:

The Bachelor of Science degree in Cloud Computing is a comprehensive program that is designed to provide students with the knowledge and skills needed to become experts in the field of cloud computing. This program is ideal for individuals who are interested in pursuing careers in the rapidly evolving technology industry, particularly in areas such as cloud infrastructure, security, and software development.

The Bachelor of Science degree in Cloud Computing is a comprehensive program that covers a variety of topics related to cloud computing. Major areas of study in this program include introduction to cloud computing, cloud economics, cloud infrastructure, security, software development, networking, virtualization and DevOps.

By the end of this program, graduates will be equipped with the skills and knowledge needed to pursue a variety of careers in cloud computing, including roles such as cloud architects, cloud engineers, cloud developers, cloud security specialists, and more. Whether you are a recent high school graduate or a working professional looking to advance your career in the technology industry, this program offers a comprehensive and practical approach to cloud computing education.

Major areas of study included in the program are –

Introduction to cloud computing: Learning about the fundamentals of cloud computing, its history, types, models, and its benefits to businesses and organizations.

Cloud economics: Learning about the financial aspects of cloud computing, including cost models, pricing structures, and how to analyze the costs and benefits of cloud-based solutions.

Cloud infrastructure: Students learn about the design and deployment of scalable and reliable cloud-based systems and services, including various types of cloud architectures and deployment models.

Security: Understanding the threats to cloud computing and how to implement security measures to protect data and infrastructure, including encryption, access control, and compliance.

Software development: Gaining skills in developing and deploying cloud-based software applications using various programming languages, development platforms, and tools.

Networking: Studying the principles and practices of cloud networking, including virtual private networks, load balancing, and content delivery networks, as well as cloud-based storage and data management.

Virtualization: Understanding how to create and manage virtualized environments using hypervisors such as VMware, Hyper-V, and KVM.

DevOps: Understanding how to integrate development and operations to improve the efficiency and reliability of cloud-based systems and services, using tools such as continuous integration, continuous delivery, and infrastructure as code.

2. Programme Outcomes (POs)

Upon completion of the Bachelor of Science Cloud Computing degree program, students will be able to:

1. Design and implement cloud-based solutions that meet the requirements of modern businesses and organizations.
2. Evaluate and select appropriate cloud technologies and deployment models for specific use cases.
3. Implement and maintain cloud-based infrastructure and services in a secure, reliable, and scalable manner.
4. Develop and deploy cloud-based applications using various programming languages, development platforms, and tools.
5. Analyze the costs and benefits of cloud-based solutions and make informed decisions about cloud adoption and migration.
6. Apply principles of DevOps to manage cloud-based systems and services throughout their lifecycle, including continuous integration and delivery, and infrastructure as code.
7. Understand the ethical and legal considerations associated with cloud computing, including privacy data protection, and compliance.
8. Communicate effectively with stakeholders in the organization about the value and benefits of cloud computing solutions.
9. Work effectively in a team-based environment to design, develop, and deploy cloud-based solutions that meet business needs.
10. Continuously learn and adapt to emerging trends and technologies in the field of cloud computing to stay current and relevant in the industry.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Major)

Title of the Course: Mathematical Foundation for Cloud Computing.								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
DSC-1	BS-CC111T	02	00	02	30	15	35	**50**

Learning Objectives:

1. To introduce the concepts of mathematical logic.
2. To introduce the concepts of sets, relations, and functions to perform the operations associated with it.
3. To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.

Course Outcomes (Cos)

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

1. Relate and apply techniques for constructing mathematical proofs and make use of appropriate set operations, propositional logic to solve problems.
2. Use function or relation models to interpret associated relation.
3. Apply basic counting techniques and use principles of probability.

Detailed Syllabus:

Unit I: Set Theory And Logic (04)

- Sets
- Set Theory
- Need for sets
- Representation of sets
- Set Operations
- Cardinality of Set
- Types of sets-
  bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Power Set.
- Propositional Logic
- Logic
- Propositional Equivalences

- Application of Propositional Logic- Translating English Sentences
- Proof by Mathematical Induction and Strong Mathematical Induction

Unit II: Relations And Functions (06)

- Relations Properties
- n-ary Relations and Applications
- Representing Relations
- Closures of Relations
- Equivalence Relations
- Partial Orderings Partitions
- Hasse Diagram
- Lattices Chains and Anti-Chains
- Transitive Closure
- Warshall's Algorithm
- Functions
- Surjective
- Injective and Bijective Functions
- Inverse Functions and Compositions of Functions

Unit III: Counting (05)

- The Basics of Counting
- Rule of Sum and Product
- Permutations and Combinations
- Binomial Coefficients and Identities
- Generalized Permutations and Combinations
- The pigeonhole principle

Unit IV: Data Presentation And Aggregation (06)

- Data Types Attributes, Variable, Discrete and Continuous Variable
- Data Presentation
- Frequency Distribution
- Histogram
- Ogive
- Box-Plot
- Bar Plots
- Mean, Median, Mode and other Measures of Central Tendency
- Arithmetic Mean (AM)
- Weighted Arithmetic Mean
- Arithmetic Mean Computed from Grouped Data
- Concept of Mean, Median, Mode, Geometric Mean (GM), Harmonic Mean(HM), Quartiles, Deciles and Percentiles.
- Standard Deviation and Other Measures of Dispersion
- Standard Deviation

- Root Measure Square
- Variance
- Absolute and Relative Dispersion

UNIT V: Correlation Theory And Sampling (05)

- Moments, Skewness and Kurtosis
  - Moments
  - Computation of Moments for Group Data
  - Skewness
  - Kurtosis
  - Computation of Skewness and Kurtosis
- Correlation
  - Bivariate data
  - Scatter Plots
  - Linear Correlation
  - Correlation of Attributes
  - Coefficient of Correlation
- Linear Regression
  - Concept
  - Least-Squares Method
  - Regression Lines
- Elementary Sampling Theory
  - Sampling Theory
  - Random Samples and Random Numbers
  - Sampling with and Without Replacement
  - Stratified sampling

UNIT VI: Probability And Hypothesis Testing (04)

- Probability
  - Random Experiment
  - Sample Space
  - Events Types and Operations of events
  - Probability Definition A
  - xioms (The Four Elementary Theorems) of Probability (without Proof)
  - Conditional Probability
  - ‘Bayes’ Theorem (without Proof)
  - Examples
  - Mathematical Expectations
- Standard Deviation
  - Continuous and Discrete
  - PDF/PMF

- Introduction and properties (without proof) for Binomial
- Normal, standard Normal, Chi-square, t, F distributions

Suggested Readings/Material:

1. K. Trivedi, “Probability and Statistics with Reliability, Queuing, and Computer Science Applications”, Wiley, 2016.
2. M. Mitzenmacher and E. Upfal, “Probability and Computing: Randomized Algorithms and Probabilistic Analysis”, Cambridge University Press, 2005.
3. Alan Tucker, “Applied Combinatorics”, 6th Edition, Wiley 2012. Web References

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Cloud Computing (Major)

Title of the Course: Database Management System –I								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
DSC-2	BS-CC112T	02	00	02	30	15	35	**50**

Learning Objectives:

1. To know fundamental concepts of relational database and SQL.
2. Use ER model for Relational model mapping to perform database design effectively

Course Outcomes (Cos)

After completion of this course, student will be able to

1. To understand the different issues involved in the design and implementation of database system.
2. To study the physical and logical database designs and understand, database modelling.
3. To understand and learn Structured Query language and data manipulation language.
4. To develop an understanding of essential DBMS concepts.

Detailed Syllabus:

Unit I: File Organization (05)

- Introduction –Basic concept of File, File system, File operations
- Physical / logical files
- Record organization (fixed, variable length)
- Types of file organization (heap, sorted, indexed, hashed)

Unit II: Introduction Of DBMS (05)

- Overview- Data, information, database, DBMS, field, record

- File system Vs. DBMS
- Component of database system
- Describing & storing data (Data models - relational, hierarchical, network),
- Levels of abstraction
- Data independence
- Structure of DBMS
- Users of DBMS
- Advantages of DBMS

Unit III: Conceptual Database Design (E-R Model) (03)

- Overview of DB design
- ER data model- E-R diagram (entities, attributes, entity sets, relations, relationship sets)
- Additional constraints
- (key constraints, participation constraints, strong entities, weak entities)
- Additional features of database design: aggregation, generalization, specialization
- Case studies

Unit IV: Structure Of Relational Databases (02)

- Concepts of a table, a row, a relation, a tuple and a key in a relational database
- Conversion of ER to Relational model
- Integrity constraints
  (primary key, referential integrity, Null constraint, unique constraint, check constraint)

Unit V: SQL (10)

- Introduction
- Basic structure of SQL query
- DDL commands (create, drop, alter) with examples
- DML commands (insert, update, delete) with example
- DCL commands (grant, revoke)
- DQL commands (select)
- Set operations
- Aggregate functions
- Null values
- Nested Subqueries
- Modifications to Database (with examples)
- SQL mechanisms for joining relations (inner joins, outer joins and their types)
- Examples on SQL (case studies)

Unit VI: Relational Database Design (05)

- Pitfalls in Relational-Database Design
  (undesirable properties of a RDB design like repetition, inability to represent certain information)
- Functional dependencies (Basic concepts, Closure of set of functional dependencies, Closure of an Attribute set)

- Concept of a Super Key and a primary key (Algorithm to derive a Primary Key for a relation)
- Concept of Decomposition, Desirable Properties of Decomposition (Lossless join and Dependency preservation)
- Concept of Normalization - Normal forms (only definitions) 1NF, 2NF, 3NF, BCNF
- Examples on Normalization

Suggested Readings/Material:

1. Henry F. Korth, Abraham Silberschatz, S. Sudarshan Database System Concepts, ISBN: 9780071289597, Tata McGraw-Hill Education
2. Korry Douglas, PostgreSQL, ISBN: 9780672327568
3. John Worsley, Joshua Drake Practical PostgreSQL (B/CD), ISBN: 9788173663925 Shroff/O'reilly
4. Joshua D. Drake, John C Worsley Practical PostgreSQL, O’Reilly

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Major)

Title of the Course: Laboratory Course on Mathematical Computing.								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
DSC-3	BS-CC113P	00	02	02	60	15	35	**50**

Learning Objectives:

1. To introduce the concepts of mathematical logic.
2. To introduce the concepts of sets, relations, and functions to perform the operations associated with it.
3. To relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.

Course Outcomes (Cos):

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

1. Relate and apply techniques for constructing mathematical proofs and make use of appropriate set operations, propositional logic to solve problems.
2. Use function or relation models to interpret associated relation.
3. Apply basic counting techniques and use principles of probability.

Detailed Syllabus:

1. Assignment on Set Theory and Logic .
2. Assignment on Relations and Functions .
3. Assignment on Counting .
4. Assignment on Data presentation and Aggregation .

5. Assignment on Correlation Theory and Sampling .

6. Assignment on Probability and Hypothesis Testing .

Sample Assignments

1) List out the elements of the set "The letters of the word Mississippi"

2)Create a Venn diagram to illustrate each of the following:

(F ∩ E) ∪ D

(D ∪ E) ∪ F

3) Write a verbal description of the set {a, i, e, o, u}

4) Consider the sets below, and indicate if each statement is true or false.

$A = \{1, 2, 3, 4, 5\}$ $B = \{1, 3, 5\}$ $C = \{4, 6\}$ $U = \{$numbers from 0 to 10$\}$

1) $3 \in B$

2) $5 \in C$

3) $B \subset A$

4) $C \subset A$

5) Show that the relation R in set Z given by $R\{(a, b) : 2\ divides\ a - b\}$ is an Equivalence relation.

6) If $R1$ and $R2$ are equivalence relations in set A , show that $R1 \cap R2$is also on equivalence relation.

7) Check whether the relation R in R (real no's) define by $R = (a,b):a \leq b3$is reflexive, symmetric or transitive.

8) Determine whether each of the following relations are reflexive, symmetric and transitive

(i) Relation in set A = {1,2,3,..... 13,14} defined by $R = (x,y):3x-y = 0$.

(ii) Relation in N defined as $R = (x,y):y = x + 5;x < 4$.

(iii) Relation in set A = {1,2,3,4,5,6} defined as $R = (x,y):y$is divisible by x.

(iv) Relation in Z defined as $R = (x,y):x-y$is an integer.

Similar Assignments can be designed on particular topics in syllabus

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Major)

Title of the Course: Laboratory Course on Database Managemnet Systems-I.								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
SEC-1	BS-CC114P	00	02	02	60	15	35	**50**

Learning Objectives:

1. Use typical data definitions and manipulation commands.
2. Design applications to test Nested and Join Queries.

Course Outcomes (Cos)

On completion of the course, student will be able to–

1. Prepare E-R Diagram for the given problem statement
2. Formulate appropriate SQL DDL Queries
3. Formulate appropriate SQL DML Queries

Detailed Syllabus:

ASSIGNMENT 1 Case study – ER diagram
ASSIGNMENT 2 Case study – ER diagram (with generalization).
ASSIGNMENT 3 Case study – ER diagram (with aggregation).
ASSIGNMENT 4 Using PostgreSQL (demo of PostgreSQL).
ASSIGNMENT 5 Data Definition queries (Create)
ASSIGNMENT 6 Data Definition queries (Alter)
ASSIGNMENT 7 Data Definition queries (Drop)
ASSIGNMENT 8 Data Manipulation queries (Insert)

ASSIGNMENT 9 Data Manipulation queries (Delete)
ASSIGNMENT 10 Data Manipulation queries (Update)
ASSIGNMENT 11 SQL DML Select queries
ASSIGNMENT 12 Queries using joins

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Major)

Title of the Course: Science and Technology in Ancient India								
Year: I				Semester: I				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
IKS-1	BS-CC 115T	02	00	02	30	15	35	**50**

Learning Objectives:

Course Outcomes (Cos)

Detailed Syllabus:

Unit- I Importance of the Study of History of Science (15)

Unit- II History of Mathematics in Ancient India (15)

Suggested Readings/Material:

https://ndl.iitkgp.ac.in/ https://doaj.org/

https://www.doabooks.org/

https://nptel.ac.in/ https://shodhganga.inflibnet.ac.in/ https://epgp.inflibnet.ac.in/ https://oatd.org/ https://openknowledge.worldbank.org/ http://liiofindia.org/ http://www.oapen.org/content/

https://www.ncbi.nlm.nih.gov/pmc/?cmd=search&term https://dev.gutenberg.org/ https://www.highwirepress.com/ https://libguides.southernct.edu/openaccess http://agris.fao.org/agris-search/index.do https://www.sciencedirect.com/#open-access https://www.aiddata.org/

https://ilostat.ilo.org/ https://academic.oup.com/journals/pages/open_access https://www.projecteuclid.org/librarians/lib_oa https://www.springeropen.com/journals https://www.tandfonline.com/openaccess/openjournals https://www.cambridge.org/core/what-we-publish/open-access

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Major)

Title of the Course: Introduction to Cloud Computing.								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
DSC-4	BS-CC 121T	03	00	03	45	30	70	**100**

Learning Objectives:

1. Describe the principles of Parallel and Distributed Computing and evolution of cloud computing from existing technologies
2. Implement different types of Virtualization technologies and Service Oriented Architecture systems
3. Choosing among various cloud technologies for implementing applications
4. Install and use current cloud technologies

Course Outcomes (Cos)

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

1. Get acquainted with the term Cloud computing.
2. Understand various types of free and commercial clouds.
3. Understands various types of cloud services like SaaS. PaaS and IaaS.
4. Know how the Cloud Computing is changing software industry

Detailed Syllabus:

Unit I: Understanding Cloud Computing (10)

- Origins and Influences
- A Brief History
- Definitions
- Business Drivers.
- Capacity Planning
- Cost Reduction
- Organizational Agility
- Technology Innovations
- Clustering
- Grid Computing
- Virtualization
- Technology Innovations vs. Enabling Technologies

Unit II: Basic Concepts and Terminology (05)

- Cloud
- IT Resource
- On-Premise
- Cloud Consumers and Cloud Providers
- Scaling
- Horizontal Scaling
- Vertical Scaling
- Cloud Service
- Cloud Service Consumer
- Goals and Benefits
- Reduced Investments and Proportional Costs
- Increased Scalability
- Increased Availability and Reliability
- Risks and Challenges
- Increased Security Vulnerabilities
- Reduced Operational Governance Control
- Limited Portability Between Cloud Providers
- Multi-Regional Compliance and Legal Issues

Unit III: Fundamental Concepts and Models (12)

- Roles and Boundaries
    - Cloud Provider
    - Cloud Consumer
    - Cloud Service Owner
    - Cloud Resource Administrator
    - Additional Roles

- Organizational Boundary
- Trust Boundary

Cloud Characteristics

- On-Demand Usage
- Ubiquitous Access
- Multitenancy (and Resource Pooling)
- Elasticity
- Measured Usage
- Resiliency

Cloud Delivery Models

- Infrastructure-as-a-Service (IaaS)
- Platform-as-a-Service (PaaS)
- Software-as-a-Service (SaaS)
- Comparing Cloud Delivery Models
- Combining Cloud Delivery Models
- IaaS + PaaS
- IaaS + PaaS + SaaS

Cloud Deployment Models

- Public Clouds
- Community Clouds
- Private Clouds
- Hybrid Clouds
- Other Cloud Deployment Models

Unit IV: Cloud-Enabling Technology (18)

Broadband Networks and Internet Architecture

- Internet Service Providers (ISPs)
- Connectionless Packet Switching (Datagram Networks)
- Router-Based Interconnectivity
- Physical Network
- Transport Layer Protocol
- Application Layer Protocol
- Technical and Business Considerations
- Connectivity Issues
- Network Bandwidth and Latency Issues
- Cloud Carrier and Cloud Provider Selection

Data Center Technology

- Virtualization
- Standardization and Modularity
- Automation
- Remote Operation and Management

- High Availability
- Security-Aware Design, Operation, and Management
- Facilities
- Computing Hardware
- Storage Hardware
- Network Hardware
- Carrier and External Networks Interconnection
- Web-Tier Load Balancing and Acceleration
- LAN Fabric
- SAN Fabric
- NAS Gateways
- Other Considerations

Introduction to Virtualization Technology

- Hardware Independence
- Server Consolidation
- Resource Replication
- Operating System-Based Virtualization
- Hardware-Based Virtualization
- Virtualization Management
- Other Considerations

Web Technology

- Basic Web Technology
- Web Applications

Multitenant Technology

Service Technology

- Web Services
- REST Services
- Service Agents
- Service Middleware

Case Study Example

Suggested Readings/Material:

Text Book

1. Ronald L. Krutz, Russell Dean Vines, “Cloud Security A comprehensive Guide to secure Cloud Computing” Wiley.

Reference Books

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini,” Cloud Computing Concepts, Technology & Architecture”

2. John W. itinghouse james F.Ransome, "Cloud Computing Implementation, Managemen and Security" , CRC Press.
3. Borko Furht. Armando Escalante, "Handbook of Cloud Computing", Springer
4. Charles Badcock, "Cloud Revolution" , TMH

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Major)

Title of the Course: Database Management Systems-II								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
DSC-5	BS-CC122T	03	00	03	45	30	70	**100**

Learning Objectives:

1. To Summarize the properties of transactions and concurrency control mechanisms
2. To outline the various storage and optimization techniques
3. To explain the different advanced databases

Course Outcomes (Cos)

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

1. Compare and contrast different concurrency control and recovery techniques.
2. Apply mechanisms for database security.
3. Analyze various database system architectures.

Detailed Syllabus:

Unit I: Relational Database Design (08)

- PL/PostgreSQL: Language Structure
- Controlling the Program Flow, Conditional Statements, Loops

- Views
- Functions
- Handling Errors and Exceptions
- Cursors
- Triggers

Unit II: Transaction Concepts (08)

- Transaction, Properties of Transaction, States of Transactions
- Concurrent Execution of Transactions and Conflicting Operations
- Schedules, Types of Schedules
- Concept of Serializability, Precedence Graph for Serializability

Unit III: Concurrency Control (08)

- Ensuring Serializability by Locks, Different Lock Modes
- 2PL And Its Variations
- Multiple Granularity Locking Protocol
- Basic Timestamp Method for Concurrency, Thomas Write Rule
- Locks with Multiple Granularity, Dynamic Database Concurrency (Phantom Problem)
- Timestamps versus Locking
- Optimistic Concurrency Control Algorithm, Multi Version Concurrency Control
- Deadlock Handling Methods –
    - Detection And Recovery (Wait For Graph).
    - Prevention Algorithms (Wound-Wait, Wait-Die)
    - Deadlock Recovery Techniques (Selection of Victim, Starvation, Rollback)

Unit IV: Crash Recovery (09)

- Transaction Failure Classification
- Recovery Concepts
- Checkpoints
- Recovery with Concurrent Transactions (Rollback, Checkpoints, Commit)
- Log Base Recovery Techniques (Deferred and Immediate Update)
- Buffer Management
- Database Backup and Recovery from Catastrophic Failures
- Shadow Paging

Unit V: Database Security (06)

- Introduction to Database Security Concepts
- Methods for Database Security
- Discretionary Access Control Method
- Mandatory Access Control and Role Based Access Control for Multilevel

Security

- Use of Views in Security Enforcement

Unit VI : Database System Architectures (06)

- Centralized and Client – Server Architectures
- Server System Architectures
- Introduction to Parallel Systems
- Introduction to Distributed Systems
- Introduction to Object Based Databases
- Introduction to Web based databases

Suggested Readings/Material:

1. Fundamentals of Database Systems- Ramez Elmasri, Shamkant B. Navathe, 6th edition– Pearson.
2. Database Management Systems -Raghu Ramakrishnan, Johanne Gehrke, 3rd edition, TataMcGraw Hill
3. Introduction to Database Management System- Bipin Desai, 3rd edition, Galgotia Publication.
4. An Introduction to Database Systems - C.J. Date, 7 th edition, Addison-Wesley
5. Practical PostgreSQL- Joshua D. Drake, John C Worsley, O'Reilly Publications

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Major)

Title of the Course: Laboratory Course on Cloud Computing								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
SEC-2	BS-CC123P	00	02	02	60	15	35	**50**

Learning Objectives:

1. Configure various virtualization tools such as Virtual Box, VMware workstation
2. Design and deploy a web application in a PaaS environment
3. Learn how to simulate a cloud environment to implement new schedulers
4. Install and use a generic cloud environment that can be used as a private cloud.
5. Manipulate large data sets in a parallel environment

Course Outcomes (Cos)

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

1. Design and Implement applications on the Cloud.
2. Design and implement applications on the Grid.
3. Use the grid and cloud tool kits

Detailed Syllabus:

Sample Assignments

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.

2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.

3. Install Google App Engine. Create hello world app and other simple web applications using python/java.

4. Use GAE launcher to launch the web applications.

5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

6. Find a procedure to transfer the files from one virtual machine to another virtual machine.

7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

Programs on SaaS

1. Create an word document of your class time table and store locally and on the cloud with doc,and pdf format . (use www.zoho.com anddocs.google.com)
2. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula

   DA=10% OF BASIC

   HRA=30% OF BASIC

   PF=10% OF BASIC IF BASIC<=3000

   12% OF BASIC IF BASIC>3000

   TAX=10% OF BASIC IF BASIC<=1500

   =11% OF BASIC IF BASIC>1500 AND BASIC<=2500

   =12% OF BASIC IF BASIC>2500

   NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX

   (use www.zoho.com and docs.google.com)

3. Prepare a ppt on cloud computing –introduction , models, services ,andarchitecture Ppt should contain explanations, images and at least 20 pages (use www.zoho.com and docs.google.com)
4. Create your resume in a neat format using google and zoho cloud

Programs on PaaS

1. Write a Google app engine program to generate n even numbers and deploy it to google cloud
2. Google app engine program multiply two matrices
3. Google app engine program to validate user ; create a database login(username, password) in mysql and deploy to cloud
4. Write a Google app engine program to display nth largest no from the given list of numbers and deploy it into google cloud
5. Google app engine program to validate the user Use mysql to store user info and deploy on to the cloud Implement Prog 1-5 using Microsoft Azur

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
B.Sc. Cloud Computing (Major)

Title of the Course: Laboratory Course on Database Management Systems-II								
Year: I				Semester: II				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	**Allotted Marks**		
		Theory	Practical			CIE	ESE	**Total**
VSC-1	BS-CC124P	00	02	02	60	15	35	**50**

Learning Objectives:

1. Implement simple applications that use Views.
2. Critically analyze the use of Tables, Views, Functions and Procedures.

Course Outcomes (Cos)

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

1. Formulate SQL queries using advanced features
2. Write stored procedures, cursors and triggers using PL/PostgreSQL.
3. Design a database using database normalization technique

Detailed Syllabus:

ASSIGNMENT 1: Designing a Database using normalization theory for given application/database design

ASSIGNMENT 2: **Simple and Nested Queries**

ASSIGNMENT 3: Views Creation

ASSIGNMENT 4: **Stored Functions**

- A Simple Stored Function
- A Stored Function that returns
- A Stored Function recursive

ASSIGNMENT 5: **Cursors**

- Simple Cursor
- Parameterize Cursor

ASSIGNMENT 6: Error and Exception handling

- Simple Exception- Raise Debug Level Messages
- Simple Exception- Raise Notice Level Messages
- Simple Exception- Raise Exception Level Messages

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce, and Science College, Ahmednagar (Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

National Education Policy (NEP)
Choice Based Credit System (CBCS)

Programme Skeleton and Syllabus of

Cloud Computing (Minor)

Implemented from

Academic Year 2023-24

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

2. Prologue/ Introduction of the programme:

The Bachelor of Science degree in Cloud Computing is a comprehensive program that is designed to provide students with the knowledge and skills needed to become experts in the field of cloud computing. This program is ideal for individuals who are interested in pursuing careers in the rapidly evolving technology industry, particularly in areas such as cloud infrastructure, security, and software development.

The Bachelor of Science degree in Cloud Computing is a comprehensive program that covers a variety of topics related to cloud computing. Major areas of study in this program include introduction to cloud computing, cloud economics, cloud infrastructure, security, software development, networking, virtualization and DevOps.

By the end of this program, graduates will be equipped with the skills and knowledge needed to pursue a variety of careers in cloud computing, including roles such as cloud architects, cloud engineers, cloud developers, cloud security specialists, and more. Whether you are a recent high school graduate or a working professional looking to advance your career in the technology industry, this program offers a comprehensive and practical approach to cloud computing education.

Major areas of study included in the program are –

Introduction to cloud computing: Learning about the fundamentals of cloud computing, its history, types, models, and its benefits to businesses and organizations.

Cloud economics: Learning about the financial aspects of cloud computing, including cost models, pricing structures, and how to analyze the costs and benefits of cloud-based solutions.

Cloud infrastructure: Students learn about the design and deployment of scalable and reliable cloud-based systems and services, including various types of cloud architectures and deployment models.

Security: Understanding the threats to cloud computing and how to implement security measures to protect data and infrastructure, including encryption, access control, and compliance.

Software development: Gaining skills in developing and deploying cloud-based software applications using various programming languages, development platforms, and tools.

Networking: Studying the principles and practices of cloud networking, including virtual private networks, load balancing, and content delivery networks, as well as cloud-based storage and data management.

Virtualization: Understanding how to create and manage virtualized environments using hypervisors such as VMware, Hyper-V, and KVM.

DevOps: Understanding how to integrate development and operations to improve the efficiency and reliability of cloud-based systems and services, using tools such as continuous integration, continuous delivery, and infrastructure as code.

2. Programme Outcomes (POs)

Upon completion of the Bachelor of Science Cloud Computing degree program, students will be able to:

11. Design and implement cloud-based solutions that meet the requirements of modern businesses and organizations.
12. Evaluate and select appropriate cloud technologies and deployment models for specific use cases.
13. Implement and maintain cloud-based infrastructure and services in a secure, reliable, and scalable manner.
14. Develop and deploy cloud-based applications using various programming languages, development platforms, and tools.
15. Analyze the costs and benefits of cloud-based solutions and make informed decisions about cloud adoption and migration.
16. Apply principles of DevOps to manage cloud-based systems and services throughout their lifecycle, including continuous integration and delivery, and infrastructure as code.
17. Understand the ethical and legal considerations associated with cloud computing, including privacy data protection, and compliance.
18. Communicate effectively with stakeholders in the organization about the value and benefits of cloud computing solutions.
19. Work effectively in a team-based environment to design, develop, and deploy cloud-based solutions that meet business needs.
20. Continuously learn and adapt to emerging trends and technologies in the field of cloud computing to stay current and relevant in the industry.

Credit Distribution: B.Sc.Cloud Computing (Major) including Minor and OE and other courses.

	Type of Courses	III Yr	IV Yrs (Honours)	IV Yrs Research
Major Cloud Computing	Discipline-Specific Courses (DSC)	46	74	66
	Discipline Specific Elective (DSE)	08	16	16
	Skill Enhancement Courses (SEC)	06	06	06
	Vocational Skill Courses (VSC)	08	08	08
	On-Job Training (OJT)	04	08	04
	Field Project (FP)	04	04	04
	Community Engagement and Service (CEP)	02	02	02
	Research project	00	00	12
	Research Methodology	00	04	04
	Total (I, II and III Year)	78	122	122
Minor	Minor	20	20	20
Other Courses	Open Elective (OE)/ Multidisciplinary Courses	12	12	12
	Indian Knowledge System	02	02	02
	Co-Curricular Courses	08	08	08
	Ability Enhancement Courses	08	08	08
	Value Education Courses	04	04	04
	Total	132	176	176

Programme Framework (Courses and Credits): B.Sc. Cloud Computing (Minor)

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	4.5	MNR-1	BS-CC101	Problem Solving Techniques Using C	03
2.	I	II	4.5	MNR-2	BS-CC102	Advance C Programming	03
3.	II	III	5.0	MNR-3	BS-CC103	Python Programming	03
4.	II	IV	5.0	MNR-4	BS-CC104	Data Structure Using Python	03

5.	III	V	5.5	MNR-5	BS-CC105	NOSQL	04
6.	III	VI	5.5	MNR-6	BS-CC106	DevOps	04
							20

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Minor)

Title of the Course: Problem-Solving Techniques Using C								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-1	BS-CC101 T/P	02	01	03	60	30	70	100

Learning Objectives:

1. To impart adequate knowledge on the need of programming languages and problem solving techniques.
2. To develop an in-depth understanding of functional and logical concepts of C programming.
3. To provide exposure to problem-solving through C programming.
4. To familiarize the basic syntax and semantics of C Language.

Course Outcomes (Cos)

1. Develop a source code in C.
2. Control the sequence of the program and give logical outputs.
3. Store different data types in the same memory.
4. Manage I/O operations in your C program.
5. Repeat the sequence of instructions .

Detailed Syllabus:

Unit I : PROGRAMMING PRINCIPLES (07)

- Introduction: Types of Programming languages, History, features and application
- Introduction to Algorithms: Definition & Characteristics of algorithm
- Pseudo code and Flowchart.

- pseudocode statements and flowchart symbols
- Steps in Problem Solving
- Problem Solving Strategies
- Top down design.
- Program development cycle
- Programming Languages
- Types of software's
    - compiler, Interpreter, Loader and Linker
- Fundamentals in C
- History of 'C', Features of C, A Simple C Program, Program execution phases
- Basic Buidong Blocks : Character set, Identifier, Keywords ,Constants, Integer Constants, Real Constants, Character Constants, String Constants, Backslash character constants.
- Variables : Rules for naming Variables Declaration of Variable, Assigning Values to Variables, Initialization
- Assignments: Based on Algorithmd and Flowcharts

Unit II: DATA TYPES, OPERATORS AND EXPRESSIONS (11)

- Data types
    - Basic data types
    - Enumerated types
    - Type casting
    - Declarations and Expressions
    - Expressions, Precedence and Associatively, Expression Evaluation, Type conversions.
    - Modifiers, Const Qualifier
    - Dealing with each data types ,Memory representation of each type
- Types of Operators
    - Arithmetic operators
    - Increment and decrement operators
    - Relational operators
    - Logical operators
    - The bitwise operators
    - The assignment operators
    - The conditional operator
    - The size of operator
    - The comma operator
    - Type casting operator
    - Precedence and order of evaluation

- Assignments : Based on basic data types, problem solving using all operators

UNIT III: INPUT-OUTPUT LIBRARY FUNCTIONS (08)

- Unformatted I-O Functions
    - Single Character Input-Output
    - String Input-Output
- Formatted I-O Functions

- printf() with Width Specifier
- scanf() with Width Specifier

- Assignments: To illustrate the formatted I/O operations

UNIT IV: CONTROL STATEMENTS **(15)**

- Introduction
- Types of Statements
  - Expression Statements.
  - Compound Statements.
  - Selection Statements.
    - if
    - if…else
    - switch-case
- Iterative Statements.
  - for loop
  - while loop
  - do-while loop.
- Jump Statements.
  - Goto
  - Continue
  - Break
  - return
  - Exit()

- Assignments: Based on all types of statements

UNIT V: FUNCTION **(09)**

- Introduction
  - Definition, Why function? Advantages of using functions
- Function Prototype
  - Declaration, Calling a function, Defining a function
- Return statement
- Types of functions
  - Recursion, Nested functions, main() function, Library Function
- Local and global variables
- Assignments : Based on functions

UNIT VI: ARRAY **(10)**

- Introduction
- Definition , Declaration of array, Need, Boundary Checking
- One Dimensional arrays

- Initialization,Accessing element of 1D arrays , Reading and displaying elements
- Two dimensional arrays
- Declaration of 2D arrays , Initialization of 2D arrays , Accessing element of 2D arrays, Reading and displaying elements.
- Memory representation of array [Row Major, Column Major]
- Multidimensional array
- Array and Function
- 1D array and function
- Passing individual array elements to a function , passing individual array
- elements address to a function ,passing whole 1d array to a function
- 2D array and function
- Passing individual array elements to a function ,passing individual array
- elements address to a function ,passing whole 2d array to a function
- Assignment : To illustrate all concepts of arrays

Suggested Readings:

1. R.G.Dromey, “How to Solve it by Computer”, Pearson Education, India, 2008.

2. “C” Programming” Brian W. Kernighan and Denis M. Ritchie.

PHI 2nd Edition

3. Let us C Yashwant P. Kanetkar, BPB publication

4. 21st Century C Ben Klemens OReilly 1st 2012

5. E. Balaguruswamy, “Programming in ANSI C”, ISBN: 9781259004612, Tata Mc-Graw

Hill Publishing Co Ltd.-New Delhi

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Syllabus

B.Sc. Cloud Computing (Minor)

Title of the Course: Advance C Programming								
Year: I				**Semester: II**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
MNR-2	BS-CC102T/P	02	01	03	60	30	70	100

Learning Objectives:

1. Arranging data in arraysand strings .
2. Implementing problem solving skills using pointer concept of the programming languages.
3. Efficiently use data structures for problem solving.
4. Learn the functions of Structures and Unions
5. File management and dynamic memory allocation.

Course Outcomes (Cos)

1. Implement strings in your C program
2. Apply code reusability with functions and pointers
3. Understand the basics of file handling mechanisms
4. Explain the uses of pre-processors and various memory models

Detailed Syllabus:

UNIT I: INTRODUCTION TO C PREPROCESSOR (7)

- Definition of Preprocessor
- Types of Preprocessors
- Macro substitution directives
- Macros versus function
- File inclusion directives
- Conditional compilation processors

- Predefined macros
- Preprocessor Operator
- Assignments : Based on Preprocessor Directives

UNIT II: POINTERS **(15)**

- Introduction
    - Definition and declaration
    - Initialization
- Indirection operator
    - Address of operator
- Types of Pointers
- Pointer arithmetic
- Dynamic memory allocation
- Arrays and pointers
- Pointer to array
- Array of pointers
- Function and pointers
- Call by value and call by refernce
- Passing pointer to function
- Returning pointer from function,
- Function pointer
- Pointers & const- Constant pointer, pointer to a constant
- Assignments Based on Pointers, pointers and arrays, pointers and functions

UNIT III: STRINGS **(15)**

- Introduction
    - Definition
    - Declaration
    - Initialization
- Importance of terminating NULL character
- Strings & pointers
- String and Function
    - User Defined

- Standard library function strlen(), strcpy(), strcat(),strcmp() etc
- Command line arguments – argc and argv
- Assignments: Based on all topics.

UNIT IV: STRUCTURES (10)

- Introduction
    - Definition
    - Declaration
- Variables initialization
- Accessing fields and structure operations
- Nested structures
- Array of structure variables
- Structure and function
- Pointer and structure
    - Declaration
    - Initialization
    - Accessing members using pointer
- Assignments: Based on all topics

UNIT V: UNION (05)

- Introduction
    - Definition
    - Declaration
    - Initialization
- Differentiate between Union and structure
- Accessing fields and structure operations
- Nested structures and unions
- Assignments: Based on all topics

UNIT VI: FILE HANDLING (08)

- Introduction
    - Definition
    - Types of files
- Concept of streams
- Operations on text & binary files, Random access file
- Use of Library functions for file handling – fopen, fclose, fgetc, fputc, fseek, fgets,fputs,fprintf,fscanf, feof,rewind ,ferror.
- Assignments: Based on all topics

Suggested Readings:

1. R.G.Dromey, “How to Solve it by Computer”, Pearson Education, India, 2008.

2. “C” Programming” Brian W. Kernighan and Denis M. Ritchie.

PHI 2nd Edition

3. Let us C Yashwant P. Kanetkar,

BPB publication

4. 21st Century C Ben Klemens OReilly 1st 2012

5. E. Balaguruswamy, “Programming in ANSI C”, ISBN: 9781259004612, Tata Mc-Graw Hill Publishing Co Ltd.-New Delhi