

**FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE**



**DEPARTMENTAL STUDENT'S HAND BOOK
2020 - 2024**

FORWARD

Computer science is a dynamic field of study albeit, with some fundamental and foundational courses which form the basis of the discipline. In light of this, this reviewed curriculum is prepared to ensure consistencies with the Nigeria Universities Commission Benchmark Minimum Academic Standard (NUC BMAS) for undergraduate Programme in Nigerian Universities (2007). Special considerations were given to the naming and content of the courses while at the same time accommodating the creation of new courses in line with the current evolving areas of the discipline globally.

Bearing in mind the importance of security in all aspect of computing, more optional security courses from sister Department of Cyber Security Science were added in addition to the existing compulsory Computer and Network security course. Also, considering the fact that we are in the era of data and digital economy; with the need to make sense of the data being generated on a daily basis, the Data Mining course has been revamped and now offered at 400 level of the programme. Other new optional courses include Mobile Application Development and Game Application Development.

This new 2020-2025 curriculum edition maintains the total instructional hours and the total Units required for graduation as obtained in the previous 2014-2019 edition. Therefore, the new curriculum does not overburden the students but seeks to make them well grounded in all the areas of the discipline.

O.A Abisoye (PhD, MCPN)
Head of Department

VISITOR AND PRINCIPAL OFFICERS OF THE UNIVERSITY

Visitor	His Excellency, Mohammad Buhari, GCFR President and Commander in-Chief of Armed Forces, Federal Republic of Nigeria.
Chancellor	His Royal Majesty Oba Aladetoyinbo Ogunlade Aladelusi
Pro-Chancellor & Chairman, Governing Council	Professor Olu Obafemi B.A (ABU);M.Sc (England); Ph.D.(England)
Vice Chancellor	Professor Abdullahi Bala, FSSN B.Sc. (ABU);M.Sc. (READING); Ph.D (LONDON),
Deputy Vice Chancellor (Academic)	Professor Faruk Kuta B.Sc (SOKOTO);M.Sc (FUTMINNA); Ph.D.(BAUCHI)
Deputy Vice Chancellor (Administration)	Professor Emmanuel Emeka Udensi, FNIP B.Sc. (IFE); M.Sc. (ABU); Ph.D. (ABU)
Registrar	Mr. Amos N. Kolo B.Sc.; (BUK);M.Sc (Ibadan)
Bursar	Mrs. Yunana Hadiza Goje <i>B.Sc., M.Sc (ABU)</i>
University Librarian	Dr. Saka Katamba BLS (ABU); M.Sc. (KANO); Ph.D(UNIMAID),

PRINCIPAL OFFICERS OF THE SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY (SICT)

Prof. Nicholas S. Iwokwagh	-	Dean
Dr. Joseph Ojeniyi	-	Deputy Dean
Mr. Mohammed Aliyu	-	School Secretary

PAST AND PRESENT HEADS OF DEPARTMENT

1. Dr. (Mrs) Francisca N. Ogwueleka - 2010 – 2012
2. Dr. Muhammad Bashir Abdullahi - 2012 - 2019
3. Dr. Sulaimon A. Bashir - 2019 - 2021
4. Dr. (Mrs.) Opeyemi Aderiike Abisoye - 2021- Till date

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CHAPTER ONE

BACKGROUND OF FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

Federal University of Technology, Minna, Niger State is a Federal Government owned university in Nigeria, established on 1st February, 1983. The vision of the university is to become one of Nigeria's leading Universities and a Centre of excellence, recognized nationally, regionally and internationally for its quality, pedagogy, and research, which is supported by visionary leadership, responsible citizenship, internal and external partnership and a unique value system.

As a specialized University, its **mission** is committed to the training of skilled and innovative work force that would harness the forces of nature to transform Nigeria's natural resources into goods and services to be positively affect the economy and thus the quality of life of her people. The University's **objective** is to give effect to the nation's drive for the much-needed self-reliance in Science, Engineering and Technology. The University's **motto** is Technology for Empowerment. The current Vice-Chancellor is Professor M. A. Akanji.

The University has two (2) Campuses: Bosso and Gidan-Kwano. The University runs a School system; an integrated unit of related disciplines with common academic interest in teaching and research. Presently, there are **Ten** (10) Schools namely:

- School of Agriculture and Agricultural Technology (SAAT),
- School of Environmental Technology (SET),
- School of Electrical Engineering and Technology (SEET),
- School of Innovative Technology (SIT),
- School of Information and Communication Technology (SICT),
- School of Life Sciences (SLS),
- School of Physical Sciences (SPS),
- School of Science and Technology Education (SSTE) and
- School of Infrastructure, Process Engineering and Technology (SIPET)
- Postgraduate School (PGS).

A Dean and an Administrative head known as School Secretary, who works with the Dean and coordinates any administrative matter of the School, head each School.

DEPARTMENT OF COMPUTER SCIENCE

INTRODUCTION

The Department of Computer Science was established in 2009. It was created from the defunct Department of Mathematics/Computer Science with the aim that it is the backbone of Information and Communication Technology (ICT). The Department offers a degree programme of Bachelor of Technology (B.Tech.) in Computer Science. The Department of Computer Science is one of the departments in the School of Information and Communication Technology (SICT). The Department offers a unique educational opportunity for students to achieve excellence through vigorous classes, practical and participation in cutting edge ICT research.

PHILOSOPHY

To build national capacity for the country through the provision of sound and well-grounded theoretical and practical computer science leading to advancement in Information and Communication Technology that drives development, and develop high level manpower that will create job and wealth through the use of ICT, and reduce unemployment and poverty.

VISION

To be a leading academic center of excellence in Computer Science providing both software and hardware expertise and solutions that will shape the Information and Communication Technology landscape both nationally and internationally.

MISSION

The Department of Computer Science will build and develop human capacity to high level through comprehensive educational programs, research in collaboration with industry and the government, dissemination through scholarly publications, and services to professional societies, the community, the state, the nation and the world at large.

OBJECTIVES OF THE CURRICULUM

- a. To provide graduates with solid foundation in Computer Science and knowledge that is required for postgraduate studies and research.
- b. To provide and promote sound practical and theoretical training in computer hardware, software, and application areas, that will make our graduates useful in both private and public sectors of the economy.
- c. To develop the students for the purpose of self-employment
- d. To promote the career opportunities offered by Computer Science and to meet with the on-going needs of the industry.

COMPETENCES OF THE GRADUATES

At the end of a successful completion of the B.Tech. Computer Science programme, our graduates should have the following abilities:

- i. An ability to analyse a problem, identify and define the computing requirements appropriate to its solution.
- ii. An ability to analyse the impact of computing on individuals, organizations, and society.
- iii. An ability to design, implement and evaluate a computer-based system, process, component, or program to meet desired needs.
- iv. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modelling and design of computer-based systems in a way that demonstrates comprehension of the trade-offs in design choices.
- v. An ability to live usefully with vision and entrepreneurial skills in this ICT age.

ORGANIZATIONAL CHART OF THE DEPARTMENT

The Department is headed by the Head of Department (HOD) who assigns duty and responsibilities to staff. The Departmental activities are guided by the regulations approved by the University Senate and supervised by the Dean of School. The organisation structure is shown in Figure 1. The department uses committee system with departmental board as its highest decision-making body after the committees. The HOD chairs all the meetings of the Departmental Board while the Secretary who is appointed from the members of academic staff takes the minutes,

prepares and circulates it in readiness for the next meeting. Another staff assists him/her. The department staff are involved in any decision concerning issues affecting the department through participation at departmental meetings where these issues are deliberated on and suggestions made. The meeting considers and approves course allocations to academic staff, examination schedule and procedures, examination results, research areas and other matters concerning the department.

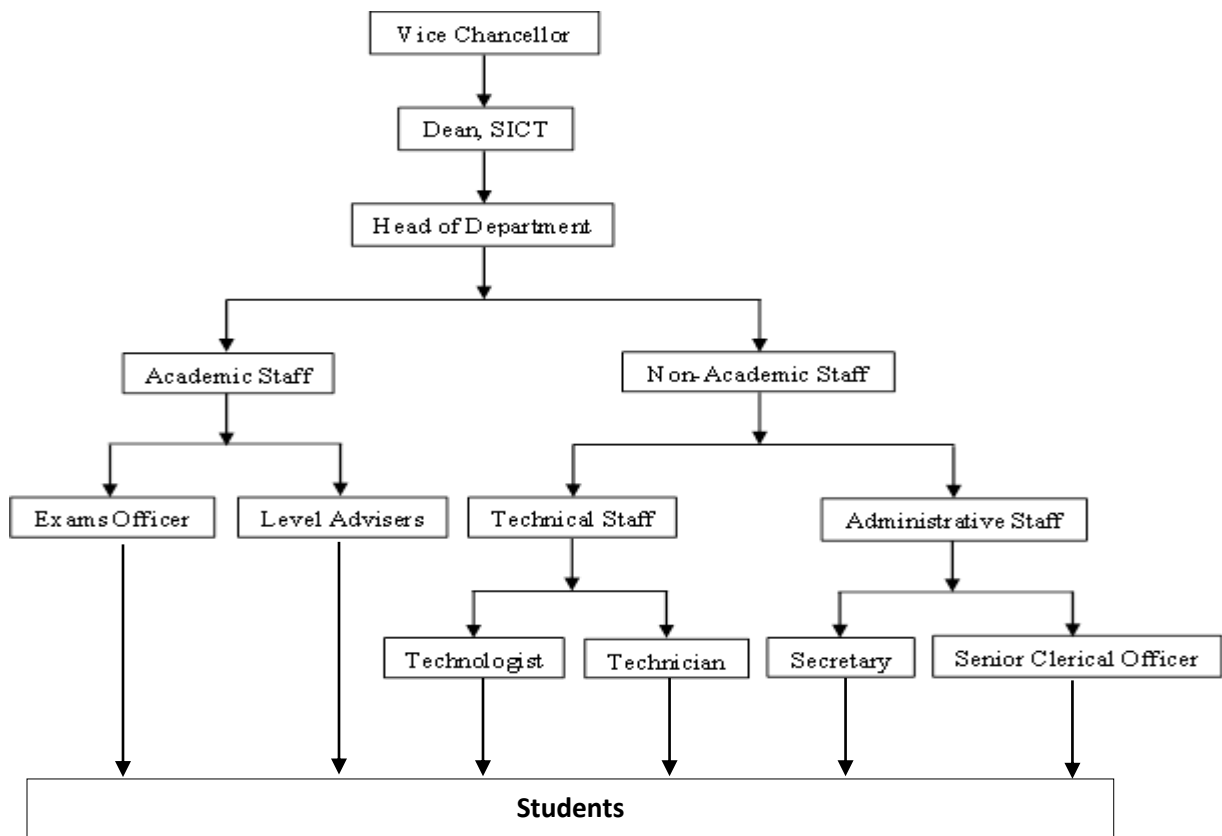


Figure 1: Organizational Chart of Computer Science

Some of the departmental committees are admission committee, research and seminar committee, finance committee, staff appraisal committee, curriculum review committee, welfare committee, strategic planning committee, etc.

CHAPTER TWO

REGULATION GOVERNING ADMISSION INTO THE PROGRAMME

ADMISSION REQUIREMENTS

(a) UTME ENTRY REQUIREMENTS

Candidates are required to obtain five (5) O' Level Units in English Language, Mathematics, Physics, Chemistry, and either Biology or Geography in NECO, WAEC or NABTEB in not more than two (2) sittings. In addition, candidates must obtain a high aggregate score from the University Post-UTME Screening Exercise greater than or equal to the cut-off point as might be stipulated from time to time by the University.

(b) DIRECT ENTRY (DE)

- (i) Holders of National Diploma (ND) in Computer Science/Engineering with a minimum of Lower Unit may qualify for admission into 200 Level.
- (ii) Holders of HSC/GCE-A Level/IJMB with Unit passes in Mathematics, Physics and Chemistry also qualify for 200 Level.

NB: (i) These DE requirements are in addition to the O'Level grades stipulated in (a) above. Also, DE students must take and pass the General Studies courses offered in 100 and 200 Levels.

- (ii) All candidates for admission must pass the University Post-UTME Screening Exercise.

DURATION OF THE PROGRAMME

The Bachelor of Technology degree in Computer Science is designed to last for a minimum of five (5) years and maximum of 7 ½ years for a UTME candidate. Minimum of four (4) years and maximum of six (6) years for a DE (200 level) candidate.

EXAMINATION REGULATIONS

The Senate of the Federal University of Technology, Minna, approves the following Code of Conduct. Members of the Academic staff and student are expected to abide by the rules and regulations enunciated in the code of conduct. Only the Senate of the University shall amend the Code from time to time as the need arises. Any exception to the regulations shall be accepted only under extenuating circumstances and must be sanctioned by the Senate.

ATTENDANCE

1. Attendance in lectures, practical classes, fieldwork and SIWES shall be regarded as part of the requirements for a successful completion of a course. A student shall record a 75 percent attendance in lectures and 100 percent participation in practical, laboratory exercises, class assignments, SIWES and fieldwork in order to qualify to sit a semester's examination.

2. Therefore, each lecturer shall be required to keep attendance for each course. The student shall be made aware of this and shall be informed on an on-going basis during the course how he or she is doing in the course with respect to attendance. The mode employed in keeping the attendance shall be the prerogative of each lecturer and /or the respective departments.
3. Exemption from the above rules on attendance shall be on medical ground and shall be granted on submission of a certificate from the Director of the University Health Services. For reasons other than medical, Heads of Departments concerned in consultation with their teaching staff and ratified by the Dean must endorse student applications. Any student who fails to meet the above requirements in anyone course shall carryover that course.

STUDENT'S WELFARE

(a) Handling of academic grievances

The Students' academic grievances are normally channelled through the class representative and the respective level adviser to the Head of Department. The issue will then be discussed at the Departmental meeting, and where necessary, an ad-hoc committee may be constituted to look into the grievances. Issues that cannot be resolved at the Departmental level may be referred to the School Academic Board, where, with the permission of members, the Dean might set up a committee to look into the issue.

(b) Students' academic advising

The Head of Department appoints one academic staff as an adviser to each level. Moreover, there is an intimate interaction between the students and the staff of the Department through the students' advisers. Consequently, the students have direct access to the staff and the Head of Department always ready to come to the assistance of the students, where and when necessary.

LATENESS TO CLASS

Lecturers are expected to start on the exact time they are scheduled. Any student who is not in the class 15 minutes after the lecturer has started his/her lecture shall be deemed to be absent from that class. Also, the students shall wait for the lecturer for up to 15minutes; starting from the time the lecture is scheduled to commence. If a lecturer fails to turn up for lectures or is fond of lateness in attending to his lectures the class representative should intimate the HOD Computer Science or the Dean SICT.

MODE OF EXAMINATION

The following three types of assessment may be used to examine a course in Computer Science:

1. Practical examination
2. Oral examination
3. Written examination/E-examination

The particular mode of examination or combinations chosen shall be dictated by the type of course and shall be the prerogative of the lecturer and the department.

EXTERNAL EXAMINATION AND ASSESSMENT

The examination questions are set and marked by the Course lecturer(s). The Department internally moderates the questions. Course lecturer(s) evaluate(s) and grade(s) the students' answers scripts using marking schemes and model answers, while the Head of Department carries out double-checking of the results submitted by the course lecturers. On request, the Department issues students their results after examinations having been approved by the Senate.

In the case of the final year degree examinations, the questions with solutions shall be sent out to the University appointed External Examiner for external moderation. Qualified External examiners (the proposed and the alternate) shall be nominated by the Head of Department and submitted to the University Senate for approval through the SICT school board. The approved External examiner shall be appointed for one academic session and may be reappointed for a maximum of three terms. Only when qualified and appointable external examiner is not available from within Nigeria shall such appointment be extended to examiners from outside the Country.

CONDUCT OF EXAMINATIONS

1. Examination shall be conducted by the school. Invigilators shall be chosen by the School Examination Officer from among the academic and senior technical members of staff of the various Departments. For each examination, there is a Chief Invigilator, who is a senior academic staff among the invigilators. There shall be at least two invigilators for each examination and for examination involving more than 50 candidates, one extra invigilator shall be required for each additional 25 candidates. No lecturer shall be allowed to be the Chief Invigilator for his course.
2. The functions of the various officers charged with the responsibility of conducting the examinations are defined as follows:

SCHOOL EXAMINATION OFFICER

The School Examination Officer shall not below the rank of Lecturer I, and shall be appointed by the Senate on the recommendation of the School (SICT) Board. It is his/her responsibility to:

- (i) Prepare the Examination timetable and assign Chief invigilator/invigilators to each examination.
- (ii) Prepare attendance slips, attendance registers and receipts for all examinations
- (iii) Notify the Academic Officer in advance of all the materials that would be needed for each semester examination, e.g. answer booklets, answer sheets, graph papers etc. and to collect all these materials one week to the commencement of the semester examination.
- (iv) Handover the envelope(s) containing the question papers to the Chief invigilator about 30 minutes before the commencement of any examination scheduled for the period.
- (v) Collect all the answer scripts, the attendance slips and attendance register from the Chief invigilator after making sure that the total number of answer scripts tally with the number of students present at the end of the examination. A receipt must be issued for all items collected from him/her.

- (vi) Handover the answer scripts to the Departmental Examination Officer concerned with the examination after he/she has signed for them.

CARRYOVER COURSE

No student is allowed to carry over any course in which he/she scored an “E” grade or above. Both the old and new grades in a carryover course shall be retained in the student’s transcript and they will also be used in computing his/her CGPA.

DEAN’S LIST, PROBATION AND WITHDRAWAL

1. Within any one semester, any student that registers a CGPA of 4.0 and above shall qualify to be on the Dean’s list of exceptional students. A letter shall be issued from the Dean’s Office to inform the student.
2. If a student recorded a CGPA below 2.0 at the end of 100Level, he/she shall be withdrawn from the Department. While if such a student is in 200level and above; he/she shall be placed on probation at the first instance (SP1) and if recorded consecutively for the second time; he/she shall be withdrawn from the University.

COURSE REGISTRATION

The level adviser for each level is also the registration officer for that level. Every course is assigned a Unit load that corresponds with the number of lecture hours per week required to complete the course during the semester. A course that requires two hours of lectures per week shall be assigned two Unit units and vice versa.

Students are expected to register the courses they are to offer in a particular semester/session. Carry over courses are registered first before the fresh courses for that semester.

The maximum unit a student is allowed to register for in a semester is 24 Unit units and a minimum of 16 Unit units would be allowed in any semester. This means that the total number of Unit units for all courses registered for by any student during a semester will not exceed 24 or be below 16 units.

AWARD OF DEGREE

BREAKDOWN OF SPECIFIED MINIMUM CREDIT UNITS PER SEMESTER

	BASIC SCIENCES	CORE ICT	GENERAL STUDIES	TOTAL /SEMESTER
100L	15	3	3	21
	14	5	4	23
200L	8	9	4	21
	5	17	-	22
300L	-	18	3	21
	-	18	-	18
400L	-	20	-	20
500L	-	18	-	18
	-	17	-	17

REQUIREMENTS FOR GRADUATION

		<u>UTME</u>	<u>DE (200L)</u>	<u>DE (300L)</u>
Basic Sciences	-	42	13	-
Core ICT courses	-	125	117	91
General Studies	-	14	07	03
SIWES	-	06	06	06
Total	=	187	143	100

To be eligible for the award of B.Tech. (Computer Science), a student must have:

- Passed all core (compulsory) courses and electives recommended for the programme;
- Accumulated at least 187 credit units for UTME, 143 credit units for DE (200L) and 100 for DE (300L)
- Completed successfully all class works, industrial attachments, seminars and projects.

Furthermore, a student must be found worthy in character throughout the period of his/her studentship in the University and must have accumulated the total units prescribed by the School from Core, Electives, General Studies courses, Industrial Attachment (SIWES) and Project. A student must be in good standing in order to go for Industrial Attachment. A student shall not exceed more than 15 semesters.

DEGREE AWARDED

The nomenclature of the first degree awarded by the Department is Bachelor of Technology (Computer Science).

CLASS OF DEGREE

The class of degree obtained at the end of the undergraduate programme is classified as shown in Table 1:

Table 1: Class of degree

CLASS OF DEGREE	CGPA
First Class	4.50 – 5.00
2 nd Class Upper	3.50 – 4.49
2 nd Class Lower	2.40 – 3.49
Third Class	1.50 – 2.39
Pass	1.00 – 1.49
Fail	0.00 – 0.99

WEIGHTING COURSES

The assessment of a student's performance in all courses shall be as follows:

- | | | |
|---------------------------|---|-------------|
| (a) Continuous Assessment | = | 40% |
| (b) Examination | = | <u>60%</u> |
| | | <u>100%</u> |

GRADING SYSTEM

The Federal University of Technology, Minna operates a 5-point grading system. Table 2 shows the letter grades as in use under the grading system.

Table 2: Grading system

LETTER	GRADE	SCORE (MARKS)	GRADE POINTS
A	Excellent	70 – 100	5
B	Very Good	60 – 69	4
C	Good	50 – 59	3
D	Intermediate	45 – 49	2
E	Fair	40 – 44	1
F	Failure	0 – 39	0

CALCULATION OF SEMESTERIAL GRADE POINT AVERAGE (SGPA)

Table 3: Student's First Semester Results

COURSE	GRADE OBTAINED	UNIT UNIT (X1)	POINT OBTAINED (Y1)	GRADE POINT (X1*Y1)
CPT 311	B	3	4	12
CPT 312	A	2	5	10
CPT 313	D	2	2	2
CPT 314	C	3	3	9
TOTAL		10		33

$$SGP = \sum (X1 * Y1) = 33$$

$$SGPA = \frac{SGP}{\sum X1} = \frac{33}{10} = 3.3$$

CALCULATION OF CUMULATIVE GRADE POINT AVERAGE (CGPA)

Table 4: Student's Second Semester Results

COURSE	GRADE OBTAINED	UNIT UNITS (X2)	POINT OBTAINED (Y2)	GRADE POINT (X2*Y2)
CPT 321	A	3	5	15
CPT 322	C	3	3	9
CPT 323	B	2	4	8
CPT 324	E	3	1	3
TOTAL		11		35

$$CGP = \sum (SGP(\text{First semester}) + SGP(\text{Second semester})) = 33 + 35 = 68$$

$$CGPA = \frac{CGP}{\sum X1 + \sum X2} = \frac{68}{10 + 11} = \frac{68}{21} = 3.24$$

ADDING/DROPPING OF COURSES

Since a student is required to attain a minimum of 75% class attendance in order to qualify for the semester examination, subject/course combinations can only be changed within the first four weeks of the semester in the first year as the case may be, in line with the University current regulations.

INTRA AND INTER UNIVERSITY TRANSFERS

All candidates seeking transfer (whether intra or inter University) must have spent a minimum of one academic session in the programme of first admission with full Sessional result attached to the application for transfer.

- (a) All intra University candidates seeking transfers to the Department of Computer Science from other Departments, must
 - (i) Have a minimum CGPA of 3.00.
 - (ii) Not have more than six (6) units deficiencies in the previous courses taken.
 - (iii) Not scored less than a C grade in CPT111 (Introduction to Computer Science) and CPT121 (Introduction to Programming).
 - (iv) Have fulfilled O' Level requirements stipulated for the UTME candidates.
- (b) All inter University candidates seeking transfers to the Department of Computer Science of the Federal University of Technology, Minna must:
 - (i) Have fulfilled O' Level requirements stipulated for UTME candidates.
 - (ii) Be studying an Engineering/Science programme in their current university.
 - (iii) Have passed all courses registered in their current university before seeking the transfer.
 - (iv) Have a minimum CGPA of 4.00 out of 5.00 or 3.00 on a scale of 4.00.
 - (v) Transfer cases can only be entertained up to and not beyond 200L.

Notice: In all cases, admission is purely based on:

- (a) Available vacancies.
- (b) The number of candidates applying for admission.

CONDITIONS FOR PROGRESSION

Continuing students: The case of screening and weeding is not limited to new students only. The following criteria were approved for the continuing students:

- (a) Students crossing from 100L to 200L must have passed 6 out of 8 unit loads for each of Mathematics and Physics and 3 out of 6 unit loads of Chemistry.
- (b) For a student to proceed to 200L he/she must have a CGPA of not less than 1.00. Else, he/she will be asked to withdraw from the department.

- (c) A student is not allowed to carry over more than 16 units or eight (8) courses per session otherwise; such a student would be advised to repeat the session.
- (d) A student with a CGPA of less than 1.00 for a semester or a session in the first instance; is placed on semesterial probation (P) or sessional probation (SP1), respectively. Consequently, if the student is still on probation for two consecutive sessions, he/she will be asked to withdraw from the university.

REGULATIONS GUIDING PROFESSIONAL EXAMINATIONS

In line with the Computer Professionals (Registration Council of Nigeria) (CPN) regulation and the Nigerian Computer Society (NCS) all graduates of the Department of Computer Science are statutorily obligated to register with the Council and/or the Society before practicing.

CHAPTER THREE

PROGRAMME STRUCTURE

The program structure for Computer Science from 100 Level to 500 Level is as follows:

100 Level – Students are expected to take relevant courses in basic science such as Mathematics, Physics, Chemistry, and General Studies, which will serve as foundation upon which the courses at subsequent levels are to be based. In addition, introductory courses in Computer, Environmental Science and Biology are included.

200 Level – Students at this level take Computer Science courses as well as courses in Mathematics, Statistics and Physics.

300 Level – Students at this level take more Computer Science courses with a General Studies course.

400 Level – Students at this level take Detailed and specific courses in Computer Science together with practical. In the second semester, the students undertake Industrial Work Experience Scheme (SIWES) for six months.

500 Level – At this level, the students take more detailed and specific courses in Computer Science, with seminar presentation and research project. The students are equally passed through oral defense and examination by the Department’s external examiner.

COURSE CONTENT SPECIFICATION

L= Lecture, P = Practical, T = Tutorial Course Structure

100 Level First Semester

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT111	Introduction to Computer Science	3	2	-	1	
MAT111	Elementary Mathematics I (Algebra and Trigonometry)	3	2	-	1	
MAT112	Elementary Mathematics III (Vectors, Geometry, and Dynamics)	3	2	-	1	
PHY113	General Physics I (Mechanics, Thermal Physics and Waves)	3	2	-	1	
*PHY100	General Physics Laboratory	2	-	2	-	
CHM111	General Chemistry I	3	3	-	-	
BIO111	General Biology I (Cell Biology)	3	2	-	1	
GST110	Use of English I and Library	3	3	-	-	
	Total	21	16	-	5	

*these courses begin in first semester, but examined in the second semester; therefore the credit units are not used in 1st semester.

100 Level Second Semester

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT121	Introduction to Problem Solving	3	2	-	1	
MAT 121	Elementary Mathematics (Calculus)	3	2	-	1	-
PHY123	General Physics II (Electricity, Magnetism and Modern Physics)	3	2	-	1	
PHY100	General Physics Laboratory	2	2	2	-	
GST121	Use of English II	2	2	-	-	
GST103	Nigerian Peoples and Culture	2	2	-	-	
STA127	Probability I	2	3	-	1-	
CSS121	Fundamentals of Cyber Security I	2	2	-	-	
STA121	Statistical Computing I	2	-	2		
	Total	21	17	2	4	

200 Level First Semester

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT211	Computer Programming I	3	2	1	-	CPT121
CPT212	Structured Programming	3	2	1	-	CPT121
CPT213	Operating Systems I	3	2	1	-	CPT111
MAT212	Linear Algebra I	2	2	-	-	MAT111,
MAT216	Mathematical Methods I	3	2	-	1	
PHY216	Electric Circuits and Electronics	3	2	-	1	PHY123
GST211	Communication Skills (Logic and Philosophy)	2	2	-	-	
GST208	Entrepreneurship I	2	2			
	Sub-Total	21	16	3	2	
Elective (Optional)						
CSS216	Cryptography Theory 1	3	2	1	-	
STA217	Probability II	4	3	-	-	STA127
	Total	21	16	3	2	

200 Level Second Semester

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT221	Computer Programming II	3	2	1	-	CPT121
CPT222	Fundamentals of Data Structures	3	2	1	-	CPT121
CPT224	Web Application Development	2	1	1	-	CPT111
CPT226	Computer Hardware	3	2	1	-	CPT111
CPT227	Foundation of Sequential Program	3	2	-	1	CPT121
MAT222	Linear Algebra II	2	2		-	MAT 212
MAT225	Introduction to Numerical Analysis	3	2	1		
CIT224	Discrete Structure	3	2	-	1	MAT111
	Total	22	15	5	2	
	ELECTIVES (Optional)					
CSS222	Fundamental of Information Security and Criminal Justice	3	3	-	-	
STA222	Statistical Computing II	3	2	1	-	STA 121
	TOTAL	22	15	5	2	

300 Level First Semester

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT311	Object Oriented Programming	3	2	1	-	CPT211, CPT221
CPT313	Operating Systems II	3	2	1	-	CPT213
CPT314	Architecture and Organization I	3	2	-	1	CPT226
CPT315	Algorithms and Complexity Analysis	3	2	-	1	CPT211, CPT221, CIT224
CPT316	Systems Analysis and Design	3	2	1		CPT221
CPT319	Data Management I	3	2	1		CPT222
GST308	Entrepreneurship II	3	1	2		
	Sub-Total	21	13	6	2	
	Electives (Optional)					
CSS311	Cybercrime and Countermeasures	3	2		1	
CSS314	Web Hacking	3	2	-	1	
CSS312	Cryptography Theory II	3	2		1	
	Total	21	13	6	2	

300 Level Second Semester

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT321	Computational Science & Numerical Methods	3	2	-	1	
CPT322	Architecture and Organization II	3	2	1	-	CPT226
CPT323	Theory of Computing	3	2		1	
CPT324	Compiler Construction I	3	2	-	1	CPT211, CPT221
CPT325	Survey of Programming Languages	4	3	1	-	CPT211, CPT221
CPT326	Computer and Network Security	2	2	-	-	
	SUB-TOTAL	18	13	2	3	
ELECTIVES (Optional)						
STA326	Operations Research I	3	1	1	1	
CSS324	Operating System Security	3	2		1	
CSS327	Development in the.net Environment	3	2		1	
	TOTAL	18	13	2	3	

400 LEVEL FIRST SEMESTER

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT419	Software Engineering	4	3	1		
CPT411	Mobile Application Development	3	2	-	1	
CPT412	Human Computer Interface	2	2	-	-	CPT329
CPT413	Computer Network and Communications	3	2	1	-	
CPT414	Data Management II	3	2	1	-	CPT319
CPT416	Formal Methods and Software Development	3	2	1	1	CPT329
CPT417	Advanced Visual Basic Programming	2	1	1		
	SUB-TOTAL	20	14	4	2	
ELECTIVES (Optional)						CPT318
CPT415	Compiler Construction II	3	2	-	1	CIT224, CPT222
CPT431	Queuing Systems Performance Evaluation	3	3			
	TOTAL	20	14	4	2	

400 LEVEL SECOND SEMESTER

COURSE CODE	COURSE TITLE	UNIT
SIW400	SIWES	2

500 LEVEL FIRST SEMESTER

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT510	Data Mining	3	2	1	-	CPT319
CPT511	Net Centric-Computing	3	2		1	CPT323
CPT512	Research Methodology in Computer Science	2	2	-	-	
CPT514	Big Data Analytics	2	2	-	-	CPT321, CPT415
CPT515	Artificial Intelligence	3	2	1	-	
CPT518	Introduction to Neural Networks & Deep Learning	3	2	1		
CPT519	Information Technology Law	2	2	-	-	
	SUB-TOTAL	18	14	3	1	
ELECTIVES (2Units Optional)						
CPT517	Games Application Design and Development	2	2			
CPT 516	Computer Graphics and Visualization	2	2			
CPT513	Modeling and Simulation	2	2	-	-	MAT225
	SUB-TOTAL	2	2			
	Total	18	14	3	1	

500 LEVEL SECOND SEMESTER

COURSE CODE	COURSE TITLE	UNIT	STRUCTURE			PRE-REQUISITE
			L	P	T	
CPT521	Organization of Programming Languages	3	2	1	-	
CPT522	Special Topics in Computer Science	3	3	-	-	
CPT525	Computer System Performance Evaluation	3	2	-	1	CPT223, CPT313
CPT526	Introduction to Mobile Computing	2	1	-	1	CPT418
CPT529	Project	6	-	6	-	
	SUB-TOTAL	17	8	7	2	
ELECTIVES (3 Units Optional)						
CPT 523	Fault Tolerant Computing	3	2	-	1	CPT312, CPT322

CPT 524	User Centered Design	3	2	-	1	CPT412
CPT 525	Social Network Analysis	3	2	1		
	SUB-TOTAL	3	2	-	1	
	TOTAL	17	8	7	2	

COURSE SYNOPSIS

CPT111: INTRODUCTION TO COMPUTER SCIENCE

3 UNITS

Survey of computers and information processing and their roles in society. This course introduces a historical perspective of computing, hardware, software, information systems, and human resources and explores their integration and application in business and other segments of society. Students will be required to complete lab assignments using the PC` operating system, and several commonly used applications, such as word processors, spreadsheets, presentations, graphics and other applications. Internet and online resources, browsers and search engines.

MAT111: ELEMENTARY MATHEMATICS I

3 UNITS

(Algebra and Trigonometry)

Elementary set theory, subsets, union, intersection, complements, and Venn diagrams. Number systems, real number system, complex number system, real line, inequality, surds, indices and logarithms, mathematical induction, sequence and series, partial fraction. Equations, polynomials, remainder theorem, completing the square, change of variable, reciprocal equation, method of rationalization, simultaneous equation, theory of quadratic equations, Binomial theorem, Matrices and Determinants, circular measure, trigonometric functions of angles of any magnitude, addition and factor formulae.

MAT112: ELEMENTARY MATHEMATICS III

3 UNITS

(Vectors, Geometry, and Dynamics)

Geometric representation of vector in 1-3 dimensions components direction cosines, scalars and vector with respect to a scalar variable. Coordinate geometry, distance between two points, equation of straight line, equation of a line in normal form, equation of tangent, equation of ellipse, equation of parabola, equation of hyperbola, equation of conic section, and equation of a circle. Tangents, normal, kinematics of a particle. Component of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles, resisted vertical motion, elastic string, simple pendulum impulse impact of two smooth spheres, and of a sphere on a sphere.

PHY113: GENERAL PHYSICS I

3 UNITS

(Mechanics, Thermal Physics, and Waves)

Space and Time; UNITS and Dimensions: Fundamental and Derived UNITS in S. I. Unit; Dimensional Analysis of Equations. **Scalars and Vectors:** definitions of scalars and vectors; vector addition and subtraction, components of vectors and resultants, product of vectors. **Motion and Forces:** Displacement, time, average and instantaneous velocity, average and instantaneous

acceleration, motion with constant acceleration, freely fallen bodies, and relative velocity, Projectile motion, forces and interactions, Newton first and second law of motion, mass and weight, work, energy and power, simple harmonic motion, motion of simple systems, **Circular motion:** centripetal force, banking of tracks, motion along horizontal and vertical circles. **Rotation of rigid bodies:** Moment of inertia; theorems of moment of inertia. Conservation of angular momentum, rolling bodies. Newton third law of motion, Conservation of energy and momentum, elastic collisions. **Statics:** Composition and resolution of forces, concurrent and parallel forces, conditions for equilibrium, center of gravity for component bodies and bodies from which part is removed. **Gravitational force:** Inverse square law, gravitational constant, gravitational potential and field, velocity-synchronous orbit; escape velocity, weightlessness. **Elasticity:** Hooke's law, Young's shear and bulk moduli. **Hydrostatics:** Pressure, buoyancy, Archimedes' principles. Surface tension: cohesion, capillarity, drops and bubbles. **Temperature:** heat, gas laws; Laws of thermodynamics; kinetic theory of gases. **Sound:** types and properties of waves as applied to sound and light energies, superposition of waves, propagation of sound in gases, solids and liquids and their properties. The unified spectra analysis of waves and applications.

PHY100 GENERAL PHYSICS PRACTICAL I & II

2 UNITS

Introduction to quantitative measurement techniques, the treatment of errors, and graphical analysis. Students will carry out laboratory experiments covering the main aspects of PHY113 and PHY100. The experiments include studies of meters, the oscilloscope, mechanical systems, electrical and mechanical resonant systems, light, heat, viscosity, etc. however, emphasis should be placed on the basic techniques for observation, measurements, data collection, analysis and deduction..

CHM111 GENERAL CHEMISTRY I

3 UNITS

Atoms, molecules and chemical reactions: Modern electronic theory of atoms. Electronic configuration, periodicity and building up of the periodic table. Hybridisation and shapes of simple molecules Valence Forces; Structure of solids. Chemical equations and stoichiometry; Chemical bonding and intermolecular forces, kinetic theory of matter. Elementary thermochemistry; rates of reaction, equilibrium and thermodynamics. Acids, bases and salts. Properties of gases. Redox reactions and introduction to electrochemistry Radioactivity.

BIO111: GENERAL BIOLOGY 1

2 UNITS

Origin of life and influence of living things on the chemistry of the Earth. Essentials of life, including sources and use of energy, responsiveness to natural selection and cellularity. Cell structure and organization, functions of cellular organelles, diversity, characteristics and classification of living things, general reproduction, interrelationships of organisms; heredity and evolution, elements of ecology and types of habitat.

GST110: USE OF ENGLISH I AND LIBRARY

3 UNITS

General Introduction to Effective Communication and Writing English: Definition of Communication; The elements and process of Communication. **Writing Effectively:** Writing of essays, including answers to examination questions; Academic sources of information; Key areas in answering Examination questions; Vocabulary of questions; Explanations of question terminologies; sample questions and analyses. **Definition of Reports/Technical Report;** Purpose

of writing technical report; Skills in Technical report writing e.g. Exposition, Narration, Description and Argumentation. Attributes of a Technical Report. Characteristics of Technical and Non-technical writing. Aspects that make for effective technical report writing. Categories of Technical reports – Formal and informal. Examples of Formal Technical report. Basic outline/structure. Research Report Writing as a variety Technical Report: Definition of Research. Objectives of writing a research Report. The Research process. Varieties/Types of researches e.g. experimental, empirical, observation, case study, surveys. Sections of a research report and their functions e.g. Title, Abstract, Review of Literature, etc. Data collection methods in Research Writing. **Use of Library:** Nature and Concept of Library: Introduction. The library users. The five fundamental laws of librarianship. The importance of the course “Use of Library” /Aims and objectives of user education. Types of Libraries. The charging system. Functions of a University Library.

CPT121: INTRODUCTION TO PROBLEM SOLVING **3UNITS**

Role of Algorithms in problem solving process, concepts and properties of Algorithms Implementation strategies, Development of Flow Charts, Pseudo Codes. Program objects. Implementation of Algorithms in a programming Language Python/Visual BASIC/JAVA /C/C ++.

MAT121: ELEMENTARY MATHEMATICS II (CALCULUS) **3 UNITS**

Function of a real variable, graphs, limits and idea of continuity. The derivative as limit of change, techniques of differentiation. Extreme curve sketching; Integration as an inverse of differentiation, method of integration, definite integrals, application to area, volume.

PHY123: General Physics II (Electricity and Magnetism) **3 UNITS**

Electrostatics: electric charge, conductors, insulators and induced charges, Electrostatic force and Coulomb’s law, Electric field intensity and electric field lines, electric potential energy, electric potential, equipotential surface and potential gradient; Gauss theorem: electric flux, Gauss law, application of Gauss law, charges on conductors. **Capacitance and Dielectrics:** Dielectrics, capacitance, parallel plate and practical forms of capacitors, capacitors in series and parallel, energy storage in capacitors and electric field energy, charging and discharging a capacitor. **Current electricity:** electric current, resistance and resistivity, resistance in series and in parallel, ohm’s law, electromotive force and DC circuits, energy and power in electric circuits, Kirchhoff’s rules, R-C circuits. **Magnetism:** magnetic materials, magnetic field, magnetic field lines and magnetic flux, motion of charged particles in a magnetic field, magnetic force on a current carrying conductor, force and torque on a current loop, Ampere’s law and application, AC voltages applied to inductors, capacitors, and resistors.

GST121: USE OF ENGLISH II (Logic Philosophy & Human existence) **2 UNITS**

Reading Techniques and Study Skills and Reading Comprehension: Definition/Concept of Reading .Reading purposes. Reading strategies. Reading techniques, skimming, scanning SQ3R, main ideas in a passage and others. Summary writing. Vocabulary development - How to enrich your vocabulary, Registers/Lexis, American and British vocabulary differences. Oracy skills.

GST103: NIGERIAN PEOPLES AND CULTURE **2 UNITS**

Study of Nigerian history; Culture and arts in pre-colonial times; Nigerian's perception of his world; Culture areas of Nigeria and their characteristics; Evolution of Nigeria as a political Unit; Indigene/settler phenomenon; Concepts of trade; Economic self-reliance; Social justice; Individual and national development; Norms and values; Negative attitudes and conducts (cultism and related vices); Re-orientation of moral and national values; Moral obligations of citizens; Environmental problems.

STA127: PROBABILITY I

4 UNITS

Generation of statistical events from set theory and combinatorial methods; elementary principle of probability: addition, multiplication and conditional probability, Bayes' rule, one dimensional random variable (discrete and continuous); Types and distribution of random variables (discrete and continuous), their expectations and moments, Application to the Bernoulli, binomial, poisson, geometric, hypergeometric.

CSS121 INTRODUCTION TO CYBER-CRIME AND PREVENTION 2 UNITS

General introduction to cyber-crime, different types of cyber-crime including: cyber terrorism, pornography, credit card frauds etc. and possible ways of curbing them.

words; binary representation of integers; representation of character data; representation of records and arrays. **Assembly level machine organization:** Basic organization of the von Neumann machine; instruction fetch, decode, and execution; assembly language programming for a simulated machine. **Software development methodology:** Fundamental design concepts and principles; structured design; testing and debugging strategies; test-case design; programming environments; testing and debugging tools. **Introduction to language translation:** Comparison of interpreters and compilers; language translation phases (lexical analysis, parsing, code generation, optimization); machine-dependent and machine-independent aspects of translation.

STA121 STATISTICAL COMPUTING I

2 CREDIT UNITS

Introduction to and use of calculators. Computations (using calculators), involving topics in STA 117 and 127. Introduction to computer: structure, involving, type, uses and applications.

CPT211: COMPUTER PROGRAMMING I

3 UNITS

Introduction to problem solving methods and algorithm development, designing, coding, debugging and documenting programs using techniques of a good programming language style, programming language and programming algorithm development. A widely used programming language should be used in teaching the above

CPT212 STRUCTURED PROGRAMMING

3 UNITS

Structured Programming elements, structured design principles, abstraction modularity, stepwise refinement, structured design techniques. Teaching of a structured programming language etc.

CPT213: OPERATING SYSTEM I

3 UNITS

Overview of O/S: Role & Purpose, Functionality Mechanisms to Support Client-server models, hand-held devices, Design Issues, influences of Security, networking, multimedia, Windows. O/S Principles: Structuring methods, Abstraction, processes of resources, Concept of APIS Device organization interrupts. Concurrency: States & State diagrams Structures, Dispatching and Context Switching; interrupts; Concurrent execution, Mutual exclusion problem and some solutions deadlock; Models and mechanisms (Semaphores, monitors etc) Producer – Consumer Problems & Synchronization. Multiprocessor issues, Scheduling & Dispatching Memory Management: Overlays, Swapping and Partitions, Paging & Segmentations Placement & replacement policies, working sets and Trashing, Caching.

MAT212: LINEAR ALGEBRA I

3 UNITS

Vector space over the real field, subspaces, linear independence, basis and dimension, linear transformation and their representation, matrices, range, null space rank, singular and non-singular transformation and matrices, algebra of matrices.

MAT216: MATHEMATICAL METHODS

2 UNITS

Taylor's series, real valued function of two or three variables, partial derivatives, chain rule, extremes, LaGrange multipliers, increments, differentials and linear approximations, evaluation of line integrals, multiple integrals.

PHY216: ELECTRIC CIRCUITS AND ELECTRONICS

3 UNITS

D.C Circuits: circuit analysis; Kirchhoff's laws; Potentiometer circuit; the venin's r.m.s and peak-to-peak values, reactance, transient currents. Fourier analysis of complex waveforms, series RLC circuit, Q factor, resonance. **Review of semiconductors:** Qualitative treatment of band theory, doping, intrinsic and extrinsic semiconductors, p-type and n-type semiconductors, minority and majority carries. **Diode circuits:** ideal rectifiers, rectifiers, filters, detectors.

GST211 LOGIC AND PHILOSOPHY

2 UNITS

This course covers Philosophical foundations of human existence; main branches of philosophical problems; philosophy and human institutions; science, technology, politics, religions and morality; types and sources of knowledge; facts; Truth, Belief and Opinion; theories of knowledge and philosophy; social and political philosophy; Man-origin, nature and environment; and implication of science, Technology and Education to life.

GST208: ENTREPRENEURSHIP I

2 UNITS

Introduction to entrepreneurship and new venture creation; Entrepreneurship in theory and practice, The opportunity, Forms of business, Staffing, Marketing and the new venture; Determining capital requirements; Raising capital; Financial planning and management; Starting a new business, Feasibility studies, **Introduction to business plan**, innovation; Legal issues; Insurance and Environmental consideration; Possible business opportunities in Nigeria; **Profiles of selected Entrepreneurial Giants.**

CSS216

CRYPTOGRAPHY THEORY I

3 UNITS

Introduction to simple Cryptosystems: Shift Cipher, Substitution Cipher, Affine Cipher, Vigenere Cipher, Hill Cipher, Permutation Cipher, Streams Cipher. **Cryptanalysis:** Cryptanalysis of Affine, Cryptanalysis of Substitution Cipher, Cryptanalysis of Vigenere Cipher, Cryptanalysis of Hill Cipher, Cryptanalysis of substitution Cipher, Cryptanalysis of streams Ciphers. **Shannon's Theory:** Introduction, Elementary probability theory, Perfect Secrecy; **Entropy:** Huffman Encoding, Properties of Entropy, Spurious Keys and Unicity distance, product cryptography.

STA217: PROBABILITY II

3 UNITS

Statistical estimation, estimation by methods of moments and maximum likelihood. Some properties of point estimators: unbiasedness, mean square error, sufficiency, efficiency, consistency, Completeness, UMVU, Best asymptotic normal. Cramer-Rao inequalities (lower bound). Interval estimation for means, proportion and their difference. Test of hypothesis, contingency tables and test of independence.

CPT221: COMPUTER PROGRAMMING II

3 UNITS

Principles of good programming, structured programming concepts, Debugging and testing, string processing, internal searching and sorting, recursion. Use a programming language different from that in CPT211 e.g C-Language.

CPT222: FUNDAMENTALS OF DATA STRUCTURES AND ALGORITHMS 3UNITS

Primitive types, Arrays, Records Strings and String processing, Data representation in memory, stack and Heap allocation, Queues, Implementation Strategies for stack, queues, trees. Run time Storage management; Pointers and References, linked structures. Non-linear data structures (hash tables, binary trees, search trees, balanced trees, heaps), searching and sorting algorithms and graph algorithms. This will also include substantial programming assignments and projects. Introduction to algorithm for parallel & distributed computing

CPT224: WEB APPLICATION DEVELOPMENT

2 UNITS

Introduction to the internet and web servers: Fundamental of HTTP Protocol, request and response message formats. **Introduction to HTML** overview, structural HTML tags, formatting text, creating links, adding images and other page elements, tables, frames, forms, specifying colour in HTML, server side include; graphics GIF, JPEG, PNG formats, designing graphics with palette, animated GIFs. **Cascading Style Sheets:** CSS basics, Inheritance and Cascade, Text styling with CSS, The CSS layout model - boxes, borders, margins, padding, css layout, css frameworks i.e bootstrap **Introduction to JavaScript:** multimedia and interactivity, sound and audio, image and graphics, animation and video tools to support multimedia development. **Software Tools and Environments for Web Design:** web—page development tools i.e Joomla, Dreamweaver. Review of HTML and CSS and Client-Side Scripting Language: JavaScript. **Introduction to Server-side programming Languages:** ASP.Net, JSP, PHP. **Introduction to PHP:** PHP Language; Using PHP; Variables; Program control; Built-in functions; code organization and reuse; Object-oriented programming, moving beyond libraries and Object-Oriented programming, extending objects, working with arrays, strings and characters. Character

set and Unicode, interacting with server, redirecting the user; Database basics using MySQL, data access, PHP and data access, planning and implementing web applications: cookies and sessions, user authentication **Introduction to Web application frameworks:** jQuery ,Django, Flask, SQLAlchemy, Node.js etc

CPT226: COMPUTER HARDWARE 3 UNIT

Introduction to computer systems: Computer systems parts. Computer circuits; diode arrays etc, Integrated circuits fabrication process. Use of MSI, LSI and VLSI IC` hardware Design. Primary and Secondary memories; core memory, etc. Magnetic devices; disks, tapes, video disks etc. Peripheral devices printers, CRT`s , keyboards, character recognition. Operational **amplifiers; Analog-to-digital and Digital-to-analog converter.** Description of a typical integrated circuit. Fundamental Logic Gates: overview of logic circuits and truth tables; the AND gate; the OR gate; the NOT gate. Logic circuit design: addition of logic expressions; truth table representation; diagrammatic representation of logic circuits. Further logic gates: NAND gate, NOR gate; XOR gate. Boolean algebra: switching algebra; basic laws of Boolean algebra; simplifying Boolean expressions, use of truth tables. Karnaugh maps: use of Karnaugh maps; how to use Karnaugh maps; rules of symmetry for Karnaugh maps; three and two variable Karnaugh maps. Further electronic logic: decoders and encoders. Further computer arithmetic: the full adder; parallel addition of binary numbers; serial addition of binary numbers. Flip flop circuits: the S-R flip-flop; the J-K flip-flop; shift registers. Binary counters.

CPT227 FOUNDATION OF SEQUENTIAL PROGRAM 3 UNITS

The relationships between H/L languages and the Computer Architecture that underlies their implementation: basic machine architecture, specification and translation of P/L Block Structured Languages, parameter passing mechanisms.

MAT222 LINEAR ALGEBRA II 2 UNITS

System of linear equations, change of basis, equivalence and similarity, Eigen values and Eigen vectors, minimum and characteristic polynomials of a linear transformation (matrix) Caley-Hamilton theorems, bilinear and quadratic forms, orthogonal diagonalisation, canonical forms.

MAT225 INTRODUCTION TO NUMERICAL ANALYSIS 3 UNITS

Solution of algebraic and transcendental equations, curve fitting. Error analysis. Interpolation and approximation. Zeros or non-linear equations `in one variable`. Systems of linear equations. Numerical differentiation and integration. Initial value problems for ordinary differential equation.

CIT 224: DISCRETE MATHEMATICAL STRUCTURES 3 UNITS

Logic: Propositions and truth values, logical connectives and truth tables, tautologies and contradictions, logical equivalence and logical implication, the algebra of propositions, arguments, predicate logic, arguments in predicate logic; **Mathematical Proof:** the nature of proof, axioms and axiom systems, methods of proof, mathematical induction; **Sets:** sets and membership, operations on sets, counting techniques, the algebra of sets, families of sets, the Cartesian product, types and typed set theory, **Relations:** relations and their representations, properties of relations,

intersections and unions of relations, equivalence relations and partitions, order relations, Hasse diagrams, relational; databases. **Functions:** definitions and example, composite functions, injections and surjections, bijections and inverse functions, cardinality, functional dependence and normal forms; **Algebraic Structures:** binary operations and their properties, algebraic structures, groups, substructures, morphisms, group codes; **Boolean algebra:** introduction, properties of Boolean algebras, Boolean functions, switching circuits, logic networks, minimization of Boolean expressions; **Graph Theory:** definitions and examples, paths and cycles, isomorphism of graphs, tree, planar graphs, directed graphs; **Applications of graph Theory:** rooted trees, sorting, searching strategies, weighted graphs, the shortest path and travelling salesman problems, networks and flows.

CSS222 FUNDAMENTALS OF INFORMATION SECURITY & CRIMINAL JUSTICE 3 UNITS

The Information Assurance and Security is added to the body of knowledge. Information Assurance and Security as a domain is the set of controls and processes for both technical and policy intended to protect and defend information and information systems by ensuring their confidentiality, integrity; and availability. The topics include: CIA (confidentiality, integrity, availability), concept of risk, threats, vulnerabilities, and attack vectors, authentication and authorization, access control (mandatory vs discretionary), concept of trust and trustworthiness, ethics (Responsible disclosure), principles of secure design: threats and attacks: Attack goals, capabilities, and motivations (such as underground economy, digital espionage, cyberwarfare, insider threats, hacktivism, advanced persistent threats) examples of malware (e.g. viruses, worms, spyware, bonnets, trojan horses or rootkits), denial of services (DOS) and distributed denial of service (DDOS), social engineering (e.g. phishing) (cross-reference social context network security. Discuss of network security relies on previous understanding on fundamental concepts of networking, including protocols, such as TCP/IP, and network architecture/organization. Topics include: network specific threats and attack types (e.g. denial of service, sniffing and traffic redirection, man –in- the –middle, message integrity attacks, routing attacks, routing attacks, and traffic analysis); use of cryptography for data and network security; Architecture for secure networks (e.g. secure channels, secure routing protocols, secure Dots, VPNs, anonymous communication protocol, isolation; defense mechanisms and countermeasures (e.g. network monitoring, intrusion detection, farewells, spoofing and DoS protection, honey pots, tracebacks , security for wireless, cellular networks (other non-wired networks (e.g. ad hoc, sensor, and vehicular networks, censorship resistance, operational networks security management (e.g. configure network access control). History, theory, and structure of the criminal justice system emphasizing substantive and procedural criminal law; police, prosecution, defense, courts, institutional and community corrections; juvenile justice subsystem

STA222 STATISTICAL COMPUTING II 3 UNITS

Uses of computers in statistical computing. Introduction to package. Word Star, WordPerfect, Spread Sheets, SYSTAT, D-Base, C-stat, MINITAB, SPSS. Use of BASIC and FORTRAN programmes in solving problems in STA 215 and STA 217.

CPT311: OBJECT-ORIENTED PROGRAMMING**3 UNITS**

Basic OOP Concepts: Classes, Objects, inheritance, polymorphism, Data Abstraction, Tools for developing, Compiling, interpreting and debugging, Java Programs, Java Syntax and data objects, operators. Central flow constructs, objects and classes programming, Arrays, methods. Applets and the Abstract, OLE, Persistence, Window Toolkit, Laboratory exercises in an OOP Language.

CPT313: OPERATING SYSTEMS II**3 UNITS**

Device Management- Characteristics of serial and parallel devices, Abstracting device differences, Buffering strategies, Direct memory access, Recovery from failures.

File Systems- Files: data, metadata, operations, organization, buffering, sequential, non-sequential, Directories: contents and structure • File systems: partitioning, mount/unmount, virtual file systems, Standard implementation techniques, Memory-mapped files, Special-purpose file systems, Naming, searching, access, backups, Journaling and log-structured file systems.

Virtual Machines- Types of virtualization (including Hardware/Software, OS, Server, Service, Network), Paging and virtual memory, Virtual file systems, Hypervisors, Portable virtualization; emulation vs. isolation. Cost of virtualization. Security and Protection-Overview of system security, Policy/mechanism separation, Security methods and devices, Protection, access control, and authentication, Backups. **Real Time and Embedded Operating Systems-** Process and task scheduling, Memory/disk management requirements in a real-time environment, Failures, risks, and recovery, Special concerns in real-time systems

CPT314 ARCHITECTURE AND ORGANIZATION I 3UNITS

Overview of computer organization: Register transfer sequences; micro-operations, instruction codes, control units and timing; microprogramming; bus organization. **Memory systems:** Storage systems and their technology; coding, data compression, and data integrity; memory hierarchy; main memory organization and operations; latency, cycle time, bandwidth, and interleaving; cache memories (address mapping, block size, replacement and store policy); virtual memory (page table, TLB); fault handling and reliability. **Interfacing and communication:** I/O fundamentals; handshaking, buffering, programmed I/O, interrupt-driven I/O; interrupt structures; vectored and prioritized interrupt acknowledgement; external storage, physical organizations, and drives. **Buses:** bus protocols, arbitration, direct-memory access (DMA); introduction to networks, multimedia support raid architectures.

CPT315: ALGORITHMS AND COMPLEXITY ANALYSIS**3 UNITS**

Basic algorithmic analysis: Asymptotic analysis of Upper and average complexity bounds; standard Complexity Classes Time and space tradeoffs in algorithms analysis recursive algorithms. Algorithmic strategies: Fundamental computing algorithms: Numerical algorithms, sequential and binary search algorithms; sorting algorithms, Binary Search trees, Hash tables, graphs & its representation.

CPT316: SYSTEMS ANALYSIS AND DESIGN**3 UNITS**

System Concept; System development Life Cycle, Analysis: Fact gathering Techniques, data flow diagrams, Process description data modeling. System Design: Structure Charts, form designs, security automated tools for design.

CPT319: DATA MANAGEMENT I**3 UNITS**

Information storage & retrieval, Information management applications, Information capture and representation, analysis & indexing, search, retrieval, information privacy; integrity, security; scalability, efficiency and effectiveness. **Information models and systems:** history and motivation for information systems; information storage and retrieval; information management applications; information capture and representation; analysis and indexing; search, retrieval, linking, navigation; information privacy, integrity, security and preservation; scalability, efficiency and effectiveness. **Database systems:** history and motivation for database systems; components of database systems; DBMS functions; database architecture and data independence. **Physical database design:** storage and file structure; indexed files; hashed files; signature files; b-trees; files with dense index; files with variable length records; database efficiency and tuning.

GST308: ENTREPRENEURSHIP II**2 UNITS**

PART 1: 4 weeks of e-lectures in modules. General lectures to be taken by all students. Electronic lectures, CA and exams

PART 2: 2 weeks for business plan development relevant to the student's programme. Students are to develop business plans on a chosen business related to their programme. This must be submitted to the departmental staff.

PART 3: 8 weeks skill acquisition. This will be achieved at the Entrepreneurship Centre or with an SME if the Entrepreneurship Centre is not yet equipped with the facility for such training. In case there's the need to undertake the skill acquisition with SME, this will be coordinated by the departmental staff. Daily activities log book to be filled by the student, signed by the field expert and also the departmental staff.

CSS312 CRYPTOGRAPHY THEORY II**3 UNITS**

Public-key Cryptography and Discrete Algorithms: ELGamal Cryptography. Algorithms for the Discrete Logarithm Problem: Shank's algorithm, Pollard Rho Discrete Algorithm, Pohlig-Hellman Algorithm, Index Calculus Method, Lower Bounds on Complexity of Generic Algorithms, finite fields. EllipticCurves: Curves over the real, Elliptic curves modulo a prime, Properties of Elliptic curves, Point compression and ECIES, Computing point multiples on Elliptic curves. Security of ELGamal: Bit Security of Discrete Logarithms, Semantic Security of ELGamal Systems, Diffie-Hallman problems.

CSS314 WEB HACKING**3 UNITS**

Security foundations; security principles; Ethics and legality; Internet foot printing; Scanning/Landscape discovery; Windows security overview; Attacking windows systems; securing windows systems; Unix security overview; attacking/securing UNIX systems; Web security essentials; Network security essentials; Incident response, cryptography and encryption best practice, Malware.

CPT321 COMPUTATIONAL SCIENCE AND NUMERICAL METHODS 3 UNITS

Operations research, Numerical Computation, Graphical computation, Modeling and simulation, High performance computation.

Algorithms for numerically fitting data (e.g., Newton's method), Define error, stability, machine precision concepts and the inexactness of computational approximations- Error, stability, convergence, including truncation and round-off • Implement algorithms for Function approximation including Taylor's series, interpolation, extrapolation, and regression • Implements algorithms for Numerical differentiation and integration (Simpson's Rule, explicit and implicit methods) • Differential equations (Euler's Method, finite differences).

CPT322: ARCHITECTURE AND ORGANIZATION II 3 UNITS

Memory systems, general; characteristics of memory operation. (Technology-magnetic recording semi-conductor memory, coupled devices, magnetic bubble). Memory addressing, memory hierarchy, virtual memory control systems. Hardware control, micro programmed control, Asynchronous control, i/c control. Introduction to the methodology of faulty tolerant computing

CPT323 THEORY OF COMPUTING 2 UNITS

Automata theory: Roles of models in computation. Finite state Automata, Push-down Automata, Formal Grammars, Parsing, Relative powers of formal models. Basic computability: Turning machines, Universal Turing Machines, Church's thesis, solvability and Decidability.

CPT324: COMPILER CONSTRUCTION I 3UNITS

Review of compilers assemblers and interpreters, structure and functional aspects of a typical compiler, syntax semantics and functional relationship between lexical analysis, expression, analysis and code generation. Internal form of course programme. Use of a standard compiler (FORTRAN<COBOL/PL) as a working vehicle. Error detection and recovery. Grammars and Languages: the parsing problem. The scanner.

CPT325 SURVEY OF PROGRAMMING LANGUAGES 3 UNITS

Overview of programming languages: History of programming languages, Brief survey of programming paradigms (Procedural languages, Object-oriented languages, Functional languages, Declarative – non-algorithmic languages, Scripting languages), the effects of scale on programming methodology; Language Description: Syntactic Structure (Expression notations, abstract Syntax Tree, Lexical Syntax, Grammars for Expressions, Variants of Grammars), Language Semantics (informal semantics, Overview of formal semantics, Denotation semantics, Axiomatic semantic, Operational Semantics). Declarations and types: The concept of types, Declaration models (binding; visibility, scope, and lifetime), Overview of type-checking, Garbage collection; Abstraction mechanisms: Procedures, function; and iterations as abstraction mechanisms, Parameterization mechanisms (reference vs value), Activation records and storage management, Type parameters and parameterized types, modules in programming languages; Object oriented language paradigm; Functional and logic language paradigms

CPT326: COMPUTER AND NETWORK SECURITY**2 UNITS**

Introduction, threats, risks and vulnerabilities, data security, policies/administration, security procedural control, security models, designing secure systems, effects of hardware on security, operating systems security, network security, database security, programming language security, cryptography, distributed systems security and information systems security.

STA326 OPERATIONS RESEARCH I**3 CREDIT UNITS**

Nature and scope of operations research. Linear programming and graphical, simplex (including big M and two-phase) methods. Sensitivity analysis. Duality theory. Transportation and assignment problems. Network analysis: CPM and PERT. Inventory theory and applications. Sequencing and scheduling.

CSS324 OPERATING SYSTEM SECURITY**3 UNITS**

This course presents an introduction to the history and fundamentals of the Unix/Linux Operating system. Topics include the history of Linux and open source code, files and directories, shell commands; K Desktop Environment; and the GNU Network Object Model Environment. **Memory Management:** Review of physical memory and memory management hardware, working sets and thrashing, caching (10083-reference AR/memory system organization and Architecture). **Security and Protection:** Overview of system security, policy/mechanism separation, security methods and devices, protection, access control, and authentication. **Virtual Machines:** Types of virtualization (including Hardware/software, OS server, service, network), paging and virtual memory, virtual file systems, Hypervisors, fortake virtualization; emulation vs. isolation, cost virtualization. Device management; characteristic of serial and parallel devices, Abstracting Buffering strategies, Direct memory access recovering from failures.

CSS327 DEVELOPMENT IN THE .NET ENVIRONMENT**3 UNITS**

This course introduces students to various concepts in the .NET environment and programming standards within that environment. Topics may include Windows desktop application development, multi-user application development using ASP.NET, ADO.NET, XML, -NET, and Web Server.

CPT411 MOBILE APPLICATION DEVELOPMENT**3 UNITS**

Introduction- Mobile programming languages and Operating Systems: -Types mobile devices: Phone, Watch, Cars etc. Programming on the Android Platform: Android OS Architecture, Android Application Components: Activity, Service, Broadcast receivers and Content Providers Layouts and resources for the UI, Text and scrolling views Activities and intents, Activities and intents, Activity lifecycle and state, Implicit intents, Testing, debugging, and using support libraries, The Android Studio debugger, App testing, The Android Support Library, – User experience ; User interaction, Buttons and clickable images; Input controls, Menus and pickers, User navigation, Recycler View, Delightful user experience: Draw Tables, styles, and themes, Material Design Resources for adaptive layouts, UI testing, – Working in the background: Background tasks, Async Task and Async Task Loader, Internet connection , Broadcast receivers, Services, Alarms and schedulers, Notifications, Alarms, Efficient data transfer, – Saving user

data, Preferences and settings, Data storage, Shared preferences, App settings , Storing data with Room, SQLite primer, Room, Live Data, and View Model.

CPT 412 HUMAN COMPUTER INTERACTION 2 UNITS

Foundations of human-computer interaction: human-centered development and evaluation; principles of good design (GUI) and good designers; GUI (Graphical user interface) toolkits, engineering trade-offs. Introduction to usability testing: tools; processes; requirements; design for reuse. Software engineering issues: risks and liabilities of computer-based systems.

CPT413 COMPUTER AND NETWORK/ COMMUNICATIONS 3UNITS

Introduction, waves, Fourier analysis, measure of communication, channel characteristics, transmission media, noise and distortion, modulation and demodulation, multiplexing, TDM FDM and FCM Parallel and serial transmission (Synchronous vs asynchronous). But structures and loop systems, computer network, Examples and design consideration data switching principles broadcast techniques, network structure for packet switching, protocols, description of network e.g ARPANET, etc.

CPT414 DATA MANAGEMENT II 3UNITS

Data modeling: data modeling; conceptual models; object-oriented model; relational data model. **Relational databases:** mapping conceptual schema to a relational schema; entity and referential integrity; relational algebra and relational calculus. **Database query languages:** overview of database languages; SQL; query optimization; 4th generation environments; embedding non-procedural queries in a procedural language; introduction to Object Query Language. **Relational database design:** database design; functional dependency; normal forms; multivalued dependency; joint dependency; representation theory. **Transaction processing:** transactions; failure and recovery; concurrency control. **Distributed databases:** distributed data storage; distributed query storage; distributed query processing; distributed transaction model; concurrency control homogeneous and heterogeneous solutions; client-server.

CPT415: COMPILER CONSTRUCTION II 3 UNITS

Grammars and languages, recognizers, Top-down and bottom-up language, Run-time storage Organization, The use of display in run-time storage Organization. The use of display in run time storage. allocation LR grammars and analyzers. Construction of LR table. Organization of symbol tablets. Allocation of storage to run-time variables. Code generation. Optimization/Translator with systems.

CPT416 FORMAL METHODS AND SOFTWARE DEVELOPMENT 2 UNITS

Project management- Risk management, managing people, Teamwork. **Project planning-** Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques, COCOMO cost modeling. **Quality management-** Software quality, Software standards, Reviews and inspections, Quality management and agile development, Software measurement. **Configuration management-** Version management, System building, Change management, Release management.

Software reuse- The reuse landscape, Application frameworks, Software product lines, Application system reuse. **Component-based software engineering-** Components and component models, CBSE processes, Component composition.

Distributed software engineering- Distributed systems, Client–server, Architectural patterns for distributed systems, Software as a service. **Service-oriented software engineering-** Service-oriented architecture, RESTful services, Service engineering, Service composition. **Real-time software engineering-** Embedded system design, Architectural patterns for real-time software, Timing analysis, Real-time operating systems

CPT417 ADVANCED VISUAL BASIC PROGRAMMING 2 UNITS

Developing multiplier applications: dividing logical layers into multiple components; implementing components with Visual Basic 2010; reusing components with different UIs; persisting component data into databases. **The .NET framework:** common language runtime (CLR); framework class library (FCL). **Visual Basic 2010 Productivity features:** user interface design; VB 2010 enhancements. **Object-oriented programming:** encapsulation, inheritance; polymorphism. **Exceptions and Events:** designing and consuming events; structured exception handling. **Data manipulation with ADO.NET:** the ADO.NET model; programming ADO.NET objects; programming Data Sets and Table Adapters. Deploying Visual Basic. **Applications:** preparing the release build; comparing X Copy and setup projects; publishing Windows applications with Click Once; harnessing Visual Studio support for Web application deployment. **Suggested Lab work:** Programming assignments leading to extensive practice in implementing various components of GUI and database application covered in this course.

CPT419 SOFTWARE ENGINEERING 4 UNITS

Software processes- Software process models, Process activities, Process improvement. **Agile software development-** Agile methods, Agile development techniques, Agile project management, Scaling agile methods. **Requirements engineering-**Functional and non-functional requirements, Requirements engineering processes, Requirements elicitation, Requirements specification, Requirements validation, Requirements change **System Modeling-** Context models, Interaction models, Structural models, Behavioral models, model-driven architecture. **Architectural design-** Architectural design decisions, Architectural views, Architectural patterns, Application architectures. **Design and implementation-** Object-oriented design using the UML, Design patterns, Implementation issues, Open-source development. **Software testing-** Development testing, Test-driven development, Release testing, User testing. **Software evolution-** Evolution processes, Legacy systems, Software maintenance.

CPT419 OPTIMIZATION TECHNIQUES 2 UNITS

INTRODUCTION: Concept of optimization – classification of optimization – problems; Mathematical preliminaries, Linear algebra and matrices, Vector space, eigen analysis, Elements of probability theory • Elementary multivariable calculus **.LINEAR PROGRAMMING:** Introduction to linear programming model, Examples of linear programming problems –

formulation simplex methods variable with upper bounds, Karmarkar's method – principle duality -dual simplex method - sensitivity analysis – revised simplex procedure – solution of the transportation problem – assignment – network minimization – shortest route problem – maximal two problem – L.P. representation of networks. QUEUING THEORY Queuing Model, poisson and exponential distributions -Queues with combined arrivals and departures-random and series queues. UNCONSTRAINED OPTIMIZATION: One-dimensional search methods, Gradient-based methods, Conjugate direction and quasi-Newton methods Maximization and minimization of convex functions. Necessary and sufficient conditions for local minima – speed and order of convergence – univariate search – steepest and descent methods- Fletcher reeves method -conjugate gradient method. CONSTRAINED OPTIMIZATION: Necessary and sufficient condition – equality constraints, inequality constraints -kuhn – tucker conditions – gradient projection method – penalty function methods – cutting plane methods of subgradients, Lagrange theorem, FONC, SONC, and SOSC conditions. NON-LINEAR PROBLEMS: Non-linear constrained optimization models, KKT conditions, Projection methods

CPT431 QUEUING SYSTEMS PERFORMANCE EVALUATION 3 UNITS

Introduction; Birth-death queuing systems; Markovian queues, the queue M/GI bounds, inequalities and approximations

SIW 400 SIWES 6 UNITS

CPT510 DATA MINING 3 UNITS

Data Mining; Data Mining Functionalities; Classification of Data Mining Systems; Data Mining Task Primitives; Integration of a Data Mining System with a Database or Data Warehouse System; Major Issues in Data Mining; Data Preprocessing; Descriptive Data Summarization; Data Cleaning; Data Integration and Transformation; Data Reduction; Data Discretization and Concept Hierarchy Generation. Data Preparation- Overview, cleaning the data, Removing variables, Data transformation, segmentation; Table and Graphs- Tables, Data tables, Contingency tables; Graphs- frequency polygons and histograms, scatter plots, box plots, multiple graphs, prediction-classification, Regression, Building a prediction model, applying a prediction model, simple regression models -simple linear regression, simple nonlinear regression, K-nearest neighbours-learning, prediction, classification and regression trees- predicting using decision trees, neural net; Naive Bayes estimation and Bayesian networks, -Bayesian Approach, Maximum a posterior classification. Posterior odds ratio, Balancing the data, Naive Bayes classification- numeric predictors analysis using Naive Bayes; Bayesian belief networks, Cloth purchase example, using the Bayesian Network to find probabilities, Genetic Algorithm Introduction, Basic framework of a GA, simple example of a genetic Algorithm, cross over, multipoint crossover, uniform crossover, Analysis using Genetic algorithm. ASSOCIATION RULES AND CLUSTER ANALYSIS: Basic Concepts; Efficient and Scalable Frequent Item-set Mining Methods; Mining; Various Kinds of Association Rules; Cluster Analysis; Types Of Data In Cluster Analysis; A Categorization Of Major Clustering Methods; Different Clustering Methods. CLASSIFICATION AND PREDICTION: Classification; Issues Regarding Classification and Prediction; Different Classifications; Classification by Decision Tree Induction; Bayesian Classification; Rule Based

Classification; Classification by Back propagation; Prediction; Accuracy and Error Measures; Evaluating the Accuracy of a Classifier or Predictor-Ensemble Methods; Model Selection. VARIOUS MININGS: Mining Data Streams; Mining Time; Series Data; Mining Sequence Patterns in Transactional Databases; Mining Sequence Patterns in Biological Data Graph Mining-

CPT511 NET- CENTRIC COMPUTING

3 UNITS

Distributed Computing, Mobile & Wireless computing, Network Security; Client/Server Computing (using the web), Building Web Applications

CPT512 RESEARCH METHODOLOGY IN COMPUTER SCIENCE 2UNITS

NB

Introduction to Research Methods; criteria for good scientific practice, Literature review, critical use of existing knowledge, generalize and define limits of new findings, scientific publishing, creating document in Latex format, classification of conferences and journals, judging what material is publishable, publishing, referencing process. **Theory of science:** theory of science and computational science, viz. innovation, systemizing and classifying, hypothesis development and testing, establishing laws and models, criticizing own and others works. **Ethics:** computer ethics in research. Ethical and plagiarism, development of research plan.

CPT513 MODELING AND SIMULATION

3 UNITS

Basic Definitions and Uses, Simulation Process, Some basic statistic Distributions Theory, Model and Simulation. Queues; Basic components, Kendal notation, Queuing rules, Little`s Law, Queuing networks, Special/types of queues. Stochastic Processes; Discrete state and continuous state processes, Markov processes, Birth-death Processes, Poisson Processes. Random Numbers; types of Random Number Exercises.

CPT514 BIG DATA ANALYTICS

2 UNITS

The concept of noSQL movement; the theory and techniques for data acquisition, cleansing, and aggregation; the principles and functionalities of big data programming models and tools; acquiring, processing, and managing large heterogeneous data collections; algorithms and systems for information and knowledge extraction from large data collections

CPT515 ARTIFICIAL INTELLIGENCE

3 UNITS

Fundamental issues in intelligent systems: history of artificial intelligence; philosophical questions; fundamental brute-force search; best-first search; two-layer games; constraint satisfaction. **Knowledge representation and reasoning:** review of propositional and predicate logic; resolution and theorem proving; non-monotonic inference; probabilistic reasoning; Bayes theorem. **Advanced search:** genetic algorithms; simulated annealing; local search. **Advanced knowledge representation and reasoning:** structured representation; nonmonotonic reasoning; reasoning on action and change; temporal and spatial reasoning; uncertainty; knowledge representation for diagnosis; qualitative representation. **Agents:** definition of agents; successful application and state-of-the-art agent-based systems; software agents, personal assistants, and

information access; multi-agent systems. **Machine learning and neural networks:** definition and examples of machine learning; supervised learning; unsupervised learning; reinforcement learning; introduction to neural networks. **AI planning systems:** definition and examples of planning systems; planning as search; operator-based planning; propositional planning.

CPT516 COMPUTER GRAPHICS AND VISUALIZATION

2 UNITS

Graphic systems: Raster and vector graphics systems; video display devices; physical and logical input devices; issues facing the developer of graphical systems. Fundamental techniques in graphics: hierarchy of graphics software; using a graphics API; simple colour models; homogeneous coordinates; affine transformations; viewing transformation; clipping. Graphical algorithms: line generation algorithms; structure and use of fonts; parametric polynomial curves and surfaces; polygonal representation of 3D objects; parametric polynomial curves and surfaces; introduction to ray tracing; image synthesis, sampling techniques, and anti-aliasing; image enhancement. Graphical user-interface design: choosing interaction styles and interaction techniques; HCI aspects of interface design; dynamics of colour; structuring a view for effective understanding. Graphical user-interface programming: graphical widgets; event management and user interaction; GUI builders and programming environments. Computer animation: key-frame animation, camera animation; scripting system; animation of articulated structures; motion capture; procedural animation; deformation. Multimedia techniques: sound, video, and graphics; design of multimedia systems; tools for multimedia development; virtual reality.

Suggested Lab work: Programming assignments leading to extensive practice in generation of various algorithms and animations covered in this course.

CPT518 INTRODUCTION TO NEURAL NETWORKS & DEEP LEARNING 3UNITS

Learning neural networks for Classification and Regression, Backpropagation Algorithm, Gradient Descent Optimization Techniques and Its variations **Deep Neural Network,** Convolutional Neural Network, Recurrent Neural Network. Generative Models: Auto encoders , Generative Adversarial Network (GAN) , Restricted Boltzmann Machine RBM Deep Reinforcement Learning. Practical: Deep Learning Libraries such Keras and Tensorflow can be used for practical implementation and testing of the various algorithms

CPT519 INFORMATION TECHNOLOGY LAW

2 UNITS

Social context of computing: introduction to the social implications of computing; social implications of networked communication; growth of, control of, and access to the Internet; gender-related issues; international issues. **Methods and tools of analysis:** making and evaluating ethical arguments; identifying and evaluating ethical choices; understanding the social context of design; identifying assumptions and values. **Professional and ethical responsibilities:** community values and the laws by which we live; the nature of professionalism; various forms of professional credentialing and the advantages and disadvantages; the role of the professional in public policy; maintaining awareness of consequences; ethical dissent and whistle-blowing; codes of ethics, conduct and practice; dealing with harassment and discrimination; “acceptable use” policies for computing in the workplace. **Risks and liabilities of computer-based systems:** historical examples of software risks; implications of software complexity; risk assessment and management.

Overview of Nigeria IT Laws and Policies. Roles of Government IT Agency such as NITDA and Ministry of Telecommunications and Digital Economy. Excursion to IT Firms and Agency.

CPT517 GAME APPLICATION DESIGN AND DEVELOPMENT 2UNITS

The course covers game development history, Platforms, goals and genres, player elements, story and character development, gameplay, levels, interface, audio, development team roles, game development process, and marketing and maintenance. Students will play games, analyse them, and complete portions of game design with appropriate documentation. Types of game platforms (e.g. XBox, Wii, PlayStation), - Game platform languages (e.g., C++, Java, Lua, Python) - Game platform constraints. The course should include Design and implement a simple application on a game platform. Describe the constraints that game platforms impose on developers. 3. Compare and contrast game programming with general purpose programming

CPT521: ORGANIZATION OF PROGRAMMING LANGUAGES 3 UNITS

Language definition structure. Data types and structure, Review of basic data types, including lists and trees, control structure and data flow, Run-time consideration, interpretative languages, lexical analysis and parsing.

CPT522 SPECIAL TOPICS IN COMPUTER SCIENCE 2UNITS

Special topics from any area of computer science considered relevant at given time. Topics are expected to change from year to year. Apart from seminars to be given by lecturers and guests lecturers, students are expected to do substantial readings on their own.

CPT524: USER CENTRED DESIGN 3 UNITS

Overview of User Experience (UX), its importance, meaning of User centered design, UX design process, design challenges, fundamentals of user interface design; models on human computer interaction, software psychology, input devices, usability, cognitive and perceptual aspects of human-computer interaction, advance interface. Approaches to and characteristics of the design process. Functionality and usability requirements (cross reference to SE requirement engineering). Techniques for gathering requirements e.g. interviews, surveys, ethnographic and contextual enquiry. Techniques and tools for the analysis and presentation of requirements e.g. reports, personas. Prototyping techniques and tools e.g. sketching, storyboards, low-fidelity prototyping, wireframes. Evaluation without users e.g using both qualitative and quantitative techniques e.g walkthroughs, GOMS, expert based analysis, heuristics, guideline and standards. Evaluation with users e.g. observation, think aloud, interviews, survey, experiments. Challenges to effective evaluation e.g. sampling, generalization. Reporting the result of evaluation internalization designing for users from other cultures, cross-cultural. Representing information to users (navigation representation, manipulation). Approaches to design: Touch and multi-touch interfaces, speech recognition, natural language processing

CPT525 COMPUTER SYSTEM PERFORMANCE EVALUATION 3 UNITS

Measurement techniques, simulation techniques, techniques, workload characterization, performance evaluation in selection problems, performance evaluation in design problems, evaluation of programme performance.

on-chip performance monitoring, off-chip hardware monitoring, software monitoring, micro-coded instruction. Aggregating performance metrics over a benchmark suite, statistical techniques for computer performance analysis, statistical for processor and cache simulation, statistical simulation,

benchmark simulation.

CPT526: INTRODUCTION TO MOBILE COMPUTING

2 UNITS

Overview of the history, evolution, and compatibility of wireless standards; the special problems of wireless and mobile computing; wireless local area networks and satellite-based networks; wireless local loops; mobile Internet protocol; mobile aware adaptation; extending the client-server model to accommodate mobility; mobile data access; the software packages to support mobile and wireless computing; the role of middleware and support tools; performance issues; emerging technologies

CPT523 FAULT TOLERANT COMPUTING

3UNITS

Introduction and overview of fault tolerant schemes; fault and error modeling; test generation and fault simulation; concepts in fault-tolerance; reliability/availability modeling; system level diagnosis; low level fault-tolerance coding techniques (basic principles, parity bit codes, hamming codes, error detection and retransmission codes, burst error correction codes, Reed-Solomon codes, etc.); high-level fault tolerant techniques in systems; rollback, check pointing ,reconfiguration; software fault-tolerance; fault-tolerant routing; integrated hardware/software fault-tolerance; redundancy, spares and repairs apportionment, system versus component redundancy, parallel redundancy, RAID system reliability, N-modular redundancy; software reliability and recovery techniques, network system reliability, reliability optimization.

CPT527 SOCIAL NETWORK ANALYSIS

Social Network Analysis; Multi-Relational Data Mining. MULTIMEDIA MINING AND APPLICATIONS: Multidimensional Analysis and Descriptive Mining of Complex Data Objects; Spatial Data Mining; Multimedia Data Mining; Text Mining; Mining the WWW-Applications and Trends in Data Mining. **Overview of neural networks:** basic Architecture of neural networks and Neural Computing; central Nervous System: Anatomy and physiology of the brain-Sensation, perception and cognition: learning and memory: Information content of neural signals; spike generation Processes: Stochastically in Neural Codes: Principal components analysis: neural Operators that encode, analyze and represent image structure: Face recognition: Invariants and object representation.

CPT529: PROJECT

6 Units

Project carries 100 Marks. A project is carried out individually or by a group with a maximum number of 3 students in one group. The project can be an in-house project. (Project done within one's institution) or it can be done in the industry. If the project is to be done in an industry, the

group will be guided by an External Project guide (from the industry) and an Internal Project Guide (from the institution). If the project is to be done in-house, the group will be guided by the Internal Project guide only.

DISTRIBUTION OF MARKS

ITEM	MARKS	HOW TO CONDUCT EXAM
Project report	50	Assessed jointly by Internal and External examiners.
Oral Presentation	50	Assessed jointly by Internal and External examiners.

INDUSTRIAL TRAINING (SIWES)

At the end of first semester, 400 level students in the programme are expected to proceed on twenty-four (24) weeks of students' industrial work experience scheme (SIWES), which is to be done in an establishment that can provide relevant industrial experience to the students.

CHAPTER FOUR

FACILITIES AVAILABLE:

University Library: The University library has large collections of required, current and quality books, journals and other relevant literature for students and the department.

Departmental Library: Apart from the resources available at the main library, the department also operates its own Library with specialized collection to cater for the research and teaching needs of our lecturers and students. This is presently located in the school's faculty library in the School of Information and Communication Technology (SICT) complex. In addition to this, there is also an e-library with current and up to date books in the field of computer science and allied fields. There is provision for Local Area Network with Internet connectivity.

Computer Laboratory: The Department has three (3) standard, well equipped and functional computer laboratories for students' practical as well as for teaching. Apart from this, there are other general laboratories for the faculty with necessary and adequate software and hardware.

STAFFING

The Department has human resources group under academic staff (core staff on the ground for the programme and staff available for the programme from other sources such as Engineering and Science); non-academic staff (made up of secretary, clerical staff, and cleaners), and technical staff (system analyst, programmer, technicians, and technologist).

ACADEMIC STAFF LIST

S/N	Name of Staff	Discipline	Area of Specialization	Qualification	Rank /Date of Appointment	Employment Status	Mode of Appointment
1.	ABISOYE, Opeyemi Aderike	Computer Science	Artificial Intelligence, Bioinformatics, High Performance Computing.	PhD Computer Science (2018) M.Sc. Computer Science (2010) B. Sc. Computer Science (2004)	Senior Lecturer	Tenure	Fresh Appointment
2.	WAZIRI Victor Onomza	Cyber Security	Digital Forensic, Computational Optimization, Computational Intelligence	Ph.D Applied Mathematics(Computational Optimization) (2004), M. Tech. Applied Mathematics (Computational Optimization) (1999) BSc. Ed/Mathematics/ (1990)	Professor	Tenure	
3.	MOHAMMED, Adamu Alhaji	Mathematics	Web Application Development, Operation Research	Ph.D. Applied Mathematics (2012) M.Tech Mathematics (2004) B.Sc. Mathematics (2000)	Professor	Tenure	Fresh Appointment
4.	OLAYIWOLA, Rasaq Oyeyemi	Mathematics	Mathematical Modeling and Simulation, Fluid Dynamics and Combustion Theory	Ph.D. Applied Mathematics (2011) M.Tech Pure and Applied Mathematics (2005) B.Tech Pure and Applied Mathematics (1998)	Professor	Tenure	Transfer of Service
5.	ALHASSAN, John Kolo	Computer Science	Human Computer Interaction, Software Engineering, Artificial Intelligence.	Ph.D. Computer Science, (2014) M.Sc. Computer Science, (2006) B.Tech. Maths/Computer Science (2000)	Associate Professor	Tenure	Fresh Appointment

6.	OYEFOLAHAN, O. Ishaq	Computer Science	Applied Information System	Ph.D. Information Technology (2012) MSc. Information Technology, (2009) BSc. Information Technology (2005) HND Statistics (2000)	Associate Professor	Tenure	Transfer of Appointment
7.	IDRIS, Ismaila	Computer Science	Digital Forensics, Data Mining, Computational Intelligence	Ph.D Computer Science (2014) M.Sc. Computer Science (2009) B.Tech. Maths/Computer Science (Malware Detection) (2002).	Senior Lecturer	Tenure	Fresh Appointment
8.	OJENIYI, Joseph Adebayo	Cyber Security Science	Digital Forensics, Data Mining, Computational Intelligence	Ph.D. Cyber Security Science (2017) M.Sc. Computer Science (<i>Internet Security</i> 2009), B.Tech. (Maths/Computer 2004) N.C.E (Maths/Computer 1999)	Senior Lecturer	Tenure	Fresh Appointment
9.	OLALERE, Morufu	Cyber Security Science	Security in Computing, Access Control, Application of machine Learning to Malware Detection, Biometric Security Technology	PhD Security in Computing (2017)	Senior Lecturer	Tenure	Fresh Appointment
10	BASHIR, Sulaimon Adebayo	Computer Science	Machine Learning, Mobile Data Learning	PhD Computer Science (2017) M.Sc. Computer Science (2008) B.Tech. Computer Science (2003)	Senior Lecturer	Tenure	Fresh Appointment
11	ADEPOJU, Solomon Adelowo	Computer Science	Human Computer Interaction, Web Mining, ICT 4D	PhD. Computer Science (2021) M.Sc. Computer Science (2006) B.Tech.	Senior Lecturer	Tenure	Fresh Appointment

				Maths/Computer Science (2002)			
12	OJERINDE Oluwaseun A.	Computer Science	Telecommunication Systems, Software Engineering, Health Care System & Blockchain Technology	Ph.D Electrical Engineering – Mobile Communication System(2014) M.Sc. Mobile Communication System(2008), Postgraduate Diploma in Electronic and Electrical Engineering(2018) B.Sc(Hons) Computer Science(Technology)(2006),	Senior Lecturer	Tenure	Fresh Appointment
13	ADEBAYO, Surajudeen Olawale	Cyber Security Science	Computer & Information Security, Cryptography, Data Mining, Malware Detection	Ph.D. Cyber Security Science (2017) M.Sc. Computer Science (<i>Internet Security</i> 2009), B.Tech. (Maths /Computer 2004),	Senior Lecturer	Tenure	Fresh Appointment
14	IBRAHIM, Aku Godwin	Physics	Geophysics, Electro-dynamics	Ph.D. (Physics) (2015) M.Sc. (Engineering Physics), 2007 B.Sc. (Physics) 2002	Senior Lecturer	Tenure	Fresh Appointment
15	MOHAMMED, Danlami Abdulmalik	Computer Science	Image Processing, Computer Vision & Machine Learning	Ph.D. Computer Science (2017) M.Sc. Computer Science (2010) B.Sc. Computer Science (2003)	Lecturer I	Tenure	Fresh Appointment
16	ALABI, Oludare Ishaq	Information Technology	Information System & Mobile Computing	Ph.D. Computer Science (2018) M.IT. Information Technology	Lecturer I	Tenure	Fresh Appointment

				(2010) B.Sc. Computer Science (1988)			
17	AMINU Enesi Femi	Computer Science	Semantic Web	M.Sc. Computer Science (2014) B.Sc. Computer Science (2008)	Lecturer I	Tenure	Fresh Appointment
18	SALIU, Adam Muhammad	Computer Science	Data Mining	M.Sc Mathematics/Computer Science. (2010) B.Tech Maths/Computer Science. (1998)	Lecturer I	Tenure	Fresh Appointment
19	UGWOKE, Cosmas Uchenna	Computer Science	Information System & Mobile Computing	M.Sc. Computer Science (2010) B.Tech. Maths/Computer Science (2007)	Lecturer I	Tenure	Fresh Appointment
20	MOHAMMED, Idris Kolo	Computer Science	Biometric Intrusion Detection System	M.Tech Computer Science (2015) B.Tech. Mathematics/Computer Science (2007)	Lecturer I	Tenure	Fresh Appointment
21	HAMZA, Aliyu Olarewaju	Information Technology	Software Engineering	PhD. Computer Science B.Tech. Computer Science (2016) B.Tech. Electrical Engineering (2008)	Lecturer II	Tenure	Fresh Appointment
22	ADAMA, Victor Ndako	Computer Science	Human Computer Interaction, Usable Security	M.Tech. Computer Science (2016) B.Tech. Computer Science (2008)	Lecturer II	Tenure	Fresh Appointment
23	EKUNDAYO, Ayobami	Computer Science	Data Mining	M.Sc. Computer Science (2016)	Lecturer II	Tenure	Fresh Appointment

				B.Sc. Computer Science (2012)			
24	SIKIRU, Olarewaju Zuberu	CyberSecurity	Computer & Information Security, Cryptography	M.Sc. Computer Science (2016) B.Sc. Computer Science (2012)	Lecturer II	Tenure	Fresh Appointment

NON-ACADEMIC STAFF LIST

S/N	Name	Rank/	Qualifications
1	ABUBAKAR, Yahaya	Asst. Chief System Analyst/Programmer	BTech. Math/ Computer Science, (2000) MSc.2010
2	OSAGIE, Cynthia Ibhande	Principal Technologist	ND Computer Science, (2005). HND Computer Science. (2008). PGD Computer Science. (2019- Till Date).
3	MUHAMMAD, Isah Baba	Technologist II	HND Computer Science (2019)
4	ANAGO, Emily Ojone.	Confidential Secretary III	N.C.E, 2011, WASSCE, 2014
5	SANTALI, Ibrahim	Clerical Officer	SSCE O'level (2018).