Ahmadu Bello University, Zaria

Faculty of Science,
Department of Mathematics

STUDENTS' HANDBOOK

Undergraduate Computer Science Programme

2013 – 2017

Printed by
Ahmadu Bello University Press Limited, Zaria,
Kaduna State, Nigeria.
Tel.: 08065949711.
E-mail: abupresslimited2005@yahoo.co.uk;
abupress2013@gmail.com
Website: www.abupress.org

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Introduction

Department of Mathematics, Ahmadu Bello University, Zaria, was established in October 1962. In its early years the Department was mainly offering combined honours degrees such as B.Sc. (Hons) Mathematics with Physics. The B.Sc. single (honours) programmes in Mathematics, Mathematics with Computer Science and Mathematics with Statistics started in the early 1970's. By the end of the 1970's and early 1980's, the Department had graduated Masters and Ph.Ds. in Computer Science, Mathematics and Statistics. However, Statistics and Computer Science programmes got discontinued due to lack of manpower. B.Sc. (Hons) in Mathematics with Computer Science was resuscitated in 2001 with eight students selected from the B.Sc. (Hons) Mathematics at 300 level. Also, B.Sc. (Hons) Statistics programme was resuscitated during the 2001/2002 academic session. M.Sc. and Ph.D. programmes in Statistics and Computer Science were also revived during the same session. Presently, the Department offers the following courses:

i. B.Sc. (Hons) Mathematics
ii. B.Sc. (Hons) Computer Science
iii. B.Sc. (Hons) Statistics
iv. Postgraduate Diploma in Computer Science
v. Postgraduate Diploma in Statistics
vi. M.Sc. Mathematics
vii. M.Sc. Computer Science
viii. M.Sc. Statistics
ix. Ph.D. Mathematics
x. Ph.D. Computer Science
xi. Ph.D. Statistics

This handbook will provide students with basic information about B.Sc. (Hons) Computer Science, guidelines and general matters for proper studentship. It provides the students with information relating to career opportunities in Computer Science. It also provides students with information about Departmental staff and opportunity to interact with the staff for effective learning in order to successfully graduate and live a meaningful life and become useful citizens. Our mission is to produce best graduates who would contribute selflessly

towards nation building. It is mandatory that every student should have a copy of this book.

Applications of Computer Science

Nowadays with the fast growing technology, Computers have become indispensible in almost all activities. They offer a wide range of functions and services. Few of such areas where Computer Science is applicable include the following:

- Education
- Medicine
- Business
- Banking
- Government
- Defense
- Communication

Departmental Staff
Full-Time Academic Staff

S/N	Name	Qualifications	Field of Research	Present Rank
1.	Dr. Babangida Sani (Head of Department)	B.Sc., M.Sc., Ph.D.	Operational Research	Reader
2.	Prof. Dasharath Singh	B.Sc., M.Sc., Ph.D.	Set Theory and Logic	Professor
3.	Prof. Goje Uba Garba	B.Sc., M.Sc., Ph.D.	Semigroup Theory	Professor
4.	Prof. Sahalu Balarabe Junaidu	B.Sc., M.Sc., Ph.D.	Parallel Computing & Web Application Engineering	Professor
5.	Prof. Basant Kumar Jha	B.Sc., M.A., Ph.D.	Computational Fluid Dynamics	Professor
6.	Prof. Jagadish Singh	B.Sc., M.Sc., Ph.D., D.Sc.	Space Dynamics	Professor
7.	Prof. Abba Ali Tijjani	B.Sc., M.Sc., Ph.D.	Functional Analysis	Professor
8.	Dr. Abiodun Olusegun Ajibade	B.Sc., M.Sc., Ph.D.	Computational Fluid Dynamics	Reader
9.	Dr. Afolayan Ayodele Obiniyi	B.Sc., M.Sc., Ph.D.	Computer Networking & Cyber Security	Senior Lecturer
10.	Dr. Adeku Musa Ibrahim	B.Sc., M.Sc., Ph.D.	Multisets Theory	Senior Lecturer
11.	Dr. Abdul Mohammed	B.Sc., M.Sc., Ph.D.	Algebra, Rhotrix Theory	Senior Lecturer
12.	Dr. Hussaini Garba Dikko	B.Sc., M.Sc., Ph.D.	Time Series Analysis	Senior Lecturer
13.	Dr. Haruna Mohammed Jibril	B.Sc., M.Sc., Ph.D.	Computational fluid Dynamics Partial Diff. Equations,	Senior Lecturer
14.	Mal. Yakubu Mamman Baraya	B.Sc., M.Sc.	Operational Research	Lecturer I
15.	Mal. Alhaji Jibril Alkali	B.Sc., M.Sc.	Fuzzy Set Theory	Lecturer I
16.	Dr. AbubakarYahaya	B.Sc., M.Sc., Ph.D.	Operational Research & Statistical Inference	Lecturer I
17.	Mal. Ibrahim Aliyu Fulatan	B.Sc., M.Sc.	Algebra/Analysis	Lecturer I
18.	Mrs. Mariyat Isah Yakubu	B.Sc., M.Sc.	Operational Research	Lecturer II
19.	Mr. Armand Florentin-Donfack Kana	B.Sc., M.Sc.	Knowledge Representation satisfaction and reasoning	Lecturer II
20.	Mrs. Aishetu Umar	B.Sc., M.Sc.	Space Dynamics	Lecturer II
21.	Mr. Chibuike Ngene Nnamani	B.Sc., M.Sc.	Multivariate Analysis	Lecturer II
22.	Mrs. Safinatu OzohuYisah	B.Sc., M.Sc.	Computer Networking	Lecturer II

S/N	Name	Qualifications	Field of Research	Present Rank
23.	Mal. Ibrahim Muhammad Kalil	B.Sc., M.Sc.	Data Mining and NLP	Lecturer II
24.	Mal. Muhammad Abdullahi	B.Sc., M.Sc.	Computer Algorithms	Lecturer II
25.	Mal. Umar Shehu	B.Sc., M.Sc.	Computational Mathematics	Lecturer II
26.	Mrs. Fatima Binta Abdullahi	B.Sc., M.Sc.	Data Mining	Lecturer II
27.	Mal. Salihu Idi Dishing	B.Sc., M.Sc.	Soft Computing & Machine learning	Lecturer II
28.	Mal. Umar Isyaku Abdullahi	B.Sc., M.Sc.	Computational Mathematics	Lecturer II
29.	Mal. Ma'aruf Mohammed Lawal	B.Sc., M.Sc.	Cloud Computing	Lecturer II
30.	Mrs. Amina Hassan Abubakar	B.Sc., M.Sc.	Cloud Computing	Assistant Lecturer
31.	Mal. Shehu Bala	B.Sc., M.Sc.	Design and Analysis of Experiment	Assistant Lecturer
32.	Mal. Isma'il Barroon Ahmad	B.Sc., M.Sc.	Moderate Applications	Assistant Lecturer
33.	Mal. Aminu Mustapha Bagiwa	B.Sc., M.Sc.	Semantic Web Applications Databases	Assistant Lecturer
34.	Mal. Jamilu Garba Yayari	B.Sc., M.Sc.	Design and Analysis of Experiments	Assistant Lecturer
35.	Mal. Aliyu Salisu	B.Sc., M.Sc.	Semantic Web Simulation Registry	Assistant Lecturer
36.	Mal. Abdussamad Tanko Imam	B.Sc., M.Sc.	Semigroup Theory	Assistant Lecturer
37.	Mal. Sahabi Yusuf Ali	B.Sc., M.Sc.	E-learning System	Assistant Lecturer
38.	Mal. Abba Muktar Junaid	B.Sc.	Computational Mathematics	Graduate Assistant
39.	Mal. Abdulnasir Isah	B.Sc.	Functional Analysis	Graduate Assistant
40.	Mal. Usman Ahmed Danbaba	B.Sc.	Biomathematics	Graduate Assistant
41.	Mal. Abdullahi Abubakar Imam	B.Sc.	Computer Science	Graduate Assistant
42.	Mal. Aminu Onimisi Abdulsalami	B.Sc.	Computer Science	Graduate Assistant
43.	Mal. Muhammad Aliyu Kufena	B.Sc.	Computer Science	Graduate Assistant
44.	Mal. Nura Abdullahi	B.Sc.	Computer Science	Graduate Assistant
45.	Mal. AliyuYakubu	B.Sc.	Statistics	Graduate Assistant
46.	Mr. Rueben Oluwabukunmi David	B.Sc.	Statistics	Graduate Assistant
47.	Mr. Michael Oluwakayode Oni	B.Sc.	Mathematics	Graduate Assistant
48.	Mr. Yusuf Samuel Taiwo	B.Sc.	Mathematics	Graduate Assistant
49.	Mal. Mohammed YahayaTanko	B.Sc.	Computer Science	Graduate Assistant
50.	Mal. Muhammad Lawal	B.Sc.	Computer Science	Graduate Assistant

Visiting Academic Staff

S/N	Name	Qualifications	Field of Research	Present Rank
1	Prof. Ninuola I. Akinwande	B.Sc., M.Sc., Ph.D.	Mathematical Modeling on Disease Dynamics	Professor
2	Prof. Shehu Usman Gulumbe	B.Sc., M.Sc., Ph.D.	Multivariate Analysis	Professor
3	Prof. Sunday Olumide. Adewale	B.Sc., M.Sc., Ph.D.	Computer Networking & Cyber Security	Professor
4	Prof. Osebekwin Ebenezer Asiribo	B.Sc., M.Sc., Ph.D.	Biostatistics	Professor
5	Prof. Moharram A. Khan	B.Sc., M.Sc., Ph.D.	Ring Theory	Professor
6	Prof. Haruna Yusuf	B.Sc., M.Sc., Ph.D.	Differential Equations	Professor
7	Dr. Bashir Maifada Yakasai	B.Sc., M.Sc., Ph.D.	Operational Research	Reader
8	Dr. Isa Audu	B.Sc., M.Sc., Ph.D.	Geo statistics	Reader
9	Dr. Yusuf Usman Abubakar	B.Sc., M.Sc., Ph.D.	Operational Research	Reader
10	Dr. Saleh E. Abdullahi	B.Sc., M.Sc., Ph.D.	Programming Languages Operating System	Senior Lecturer
11	Dr. Mohammed Baba Hammawa	B.Sc., M.Sc., Ph.D.	Information Security	Senior Lecturer
12	Dr. Mohammad Mustapha Yakut	B.Sc., M.Sc., Ph.D.	Fuzzy Topology	Senior Lecturer
13	Dr. Aliya Mohammed Khalil Khattab	B.Sc., M.Sc., Ph.D.	Numerical Analysis	Senior Lecturer
14	Dr. Bashir Ali	B.Sc., M.Sc., Ph.D.	Functional Analysis	Senior Lecturer
15	Dr. Abdulhadi Aminu	B.Sc., M.Sc., Ph.D.	Max-algebra and Optimization	Senior Lecturer
16	Dr. Baba Ibrahim Mundi	B.Sc., M.Sc., Ph.D.	Fluid Dynamics	Lecturer I
17	Dr. Ibrahim Abdullahi	B.Sc., M.Sc., Ph.D.	Response Surface Methodology	Lecturer I

Senior Non Teaching Staff

S/N	Name	Qualification	Remarks
1	Mrs. U.M.N. Agbo	B. Ed.	Departmental Secretary
2	Mrs. B. A. Ibiteye	50 WPM	Chief Typist
3	Mal. M. Y. Nadabo	50 WPM	Senior Typist I
4	Mal. Shehu Umar	Diploma (Lib. Sci)	Departmental Librarian
5	Mal. Yunusa Nuhu	Diploma (Comp. Sci)	Senior Computer Opp.
6	Mal. Abdullahi Magaji	N.C.E. (Comp. Math.)	Senior Computer Opp.
7	Mal. Jamilu M. Sahabi	B.Eng.	Network Engineer
8	Mal. Jafaru Musa	National Diploma (Computer Science)	Senior Computer Operator
9	Mal. Adamu Yusuf	Diploma Lib. & Inf. Sci.	Library Officer
10	Habiba Bala	Diploma Lib. & Inf. Sci.	Library Officer

Junior Non Teaching Staff

S/N	Name	Qualification	Remarks
1	Junaidu Mohammed	N.C.E. (Math. Comp.)	Chief House keeper
2	Kabir M. Bala	Diploma in Islamic Studies	Senior Office Assistant
3	Abu-Safiyan Suleiman	Sec. School Cert.	Senior Office Assistant
4	Masa'udu Abdullahi	Secondary School Cert. NECO, Drivers Liceince, Trade Test I. II, III	Driver/Mechanic
5	Yakubu Mahmud	Diploma in English Language	Office Assistant
6	Lawal Usman	Secondary School Cert. NECO	Office Assistant

Entry Requirements

The Department admits students into 100 level as well as 200 level for the B.Sc (Hons.) Computer Science based on their qualifications. In rare cases they may be admitted into upper levels.

I. **For 100 level:** Candidates must satisfy the general University and Faculty of Science requirements of five O'Level credits which must include: Mathematics, English, Physics and any two relevant science subjects from the following: Chemistry, Biology, Geography, etc at Senior Secondary School Certificate level or equivalence examination in at most two sittings.

II. **For 200 level:** Candidates must in addition to (I) above have an Advanced level (A'Level) or its equivalence in Computer Science and any other science subject.

Registration Guidelines

1. Fresh students are to come with the original copies of their relevant credentials to the Faculty/Department to collect admission letter and to be screened. Successful candidates would be informed of the procedure of registration with the Academic Office, the Faculty and the Department.
2. Students must be aware of time schedule for registration and have to be in possession of proper identification at all times.
3. Students have to consult their Level Coordinators before filling the Course Registration Forms.
4. Pre-requisites must be satisfied for courses that require such.
5. All courses are registered officially at designated places, except otherwise stated.
6. Unrestricted electives chosen outside those listed must be approved by the Department.
7. The minimum and maximum credit units registerable for regular students are 12 and 24 units respectively.
8. At the point of registration, a student is required to pay the National Association of Mathematics Students (NAMS) dues, purchase the Students' Handbook and settle other charges as may be required from time to time.
9. Late registration attracts payment of penalty due; however, it cannot last beyond a quarter of the semester.
10. De-registration of undergraduate project is not allowed in the second semester.
11. Registration problems associated with ill-health may be entertained (if supported with medical report authenticated by the University Health Services).
12. Application for deferment of a session or a semester must be channeled through the Head of Department on time, for such requests to be tendered for consideration by the appropriate body(ies.).
13. A student is regarded as bona-fide only when the necessary registration forms have been duly submitted to the Departmental Registration Officer. Students are therefore advised to strictly adhere to registration guidelines in their own interest.

Examination Guidelines

Examinations are normally held at the end of each Semester. Examinations may take the form of written papers, oral examinations, practicals, submission of projects, any combination of these or any other form approved by the Senate. Continuous Assessment (C.A.) of course work is normally included in determining examination results.

Eligibility

In order to be eligible for admission into any examination, a student must have been registered for the course unit to be examined and must have fulfilled the University requirements concerning residence, fees or other related matters. At least 75% attendance is required in all classes, tutorials, laboratories, etc. to qualify to sit for examinations. The student must also fulfill other Departmental requirements regarding satisfactory completion of any course- work, practicals, assignments, projects or other matters.

Conducts

1. Candidates should be in the vicinity of the examination venue at least ten (10) minutes before the time of the examination. A candidate may be admitted up to forty five (45) minutes after the commencement of the examination but shall not be allowed extra time. On no accounts shall a student be allowed to leave the venue during the first hour or the last fifteen (15) minutes of the examination. A student must handover his/her scripts to the invigilator before leaving the examination room.
2. A student who leaves the examination room shall not be admitted back unless during the period of absence, he/she has been continually under the surveillance of an Invigilator/Assistant Invigilator.
3. A student shall come along with his/her I.D. Card and Examination Card to each examination and display them conspicuously on his/her desk. Each student shall complete an Attendance Form bearing his/her number, name and signature, which shall be collected by the Invigilator during each examination. No student is allowed to make any noise,

disturbance or to speak to any other student except as essential to the Invigilator.

4. No book, printed paper, written document, hand-set or any unauthorized materials shall be allowed into an examination room by any student, except as stated in the rules of the examination paper. A student must not during an examination directly or indirectly give assistance to any other student or permit any other student to copy from or otherwise use his/her papers. Similarly, a student must not directly or indirectly accept assistance from any other student or use any other student's papers.
5. If any student is suspected to have infringed on any of the above provisions or in any way to have cheated or disturbed the conduct of the examinations, a report shall be made as soon as possible to the Faculty Examination Officer and the Dean. The Dean will cause the circumstances to the investigated and reported to the Board of Examiners. The student concerned shall be allowed to continue with the examinations, provided he/she does not cause any disturbance. However, the Board of Examiners shall subsequently recommend to the Faculty Board and Senate whether his/her paper should be accepted and as to any other action that shall be taken in the matter.
6. A student shall write his examination number and not his name distinctly in the space provided at the top of the cover of every answer booklet or separate sheets of paper. The use of scrap paper is strictly prohibited as all rough work must be done in the answer booklet and crossed neatly or in supplementary answer booklets which must be submitted to the Invigilator. Except for the printed question paper, student may not remove from the examination room or mutilate any paper or other materials supplied. At the end of the time allotted for the examination, each student shall cease from writing when instructed to do so and shall gather his /her scripts together for collection by the Invigilator.

RESULTS

Several terms are frequently used on an examination result chart. The most outstanding and salient ones are the following:

i. Registered Credit Units(RCU)
This is the sum of the credit units of the various courses registered by the student during the entire semester.

ii. Earned Credit Units(ECU)
This is the sum of the credit units of all the courses passed by the student during the entire semester.

iii. Total Registered Credit Units (TRCU)
This is the sum of the credit units of all the courses registered by the student from the first year of study to the particular semester under consideration.

iv. Grade Point (GP)
This is a point system replacing 'A, B, C, D and F ' classification as in the Table below.

TABLE 1

Mark of Average	**Letter Grade**	**Grade Point**
70- 100	A	5
60-69	B	4
50-59	C	3
45-49	D	2
0-44	F	0

v. Weighted Grade Point (WGP)
This is the product of the Grade Point and the number of credit units.

WGP = GP * Number of credit units.

vi. Grade Point Average (GPA)
This is the sum of the weighted Grade Point for a semester divided by the Registered Credit Unit for that semester i.e.

$$GPA = \frac{\text{Sum of Weighted Grade Points for the semester}}{\text{Registered Credit Unit}} = \frac{\sum WGP}{RCU}$$

vii. Cumulative Grade Point Average (CGPA)

This is the sum of the weighted grade point of a student from the first semester of study to the particular semester under consideration divided by total credit units registered.

$$CGPA = \frac{Total\ Weighted\ Grade\ Point}{Total\ Registered\ Credit\ Unit} = \frac{TWGP}{TRCU}$$

The CGPA provides a measure of the students' academic standing.

Calculation of GPA and CGPA

Suppose a 100 level student of B.Sc. (Hons.) Computer Science has the following scores in the first semester examination.

TABLE 2: AN ILLUSTRATION FOR CALCULATING CGPA

Course	Credit Units	Score %	Grade	GP	WGP
MATH 101	2	60	B	4	8
MATH 103	2	60	B	4	8
MATH 105	2	70	A	5	10
COSC101	2	50	C	3	06
GENS 101	1	49	D	2	02
GENS 103	2	43	F	0	00
GENS 107	1	35	F	0	00
CHEM 161	1	61	B	4	04
PHYS 121	2	45	D	2	04
GEOL 101	1	55	C	3	03

Taking into consideration the GP ratings in Table 1 above, and the definitions for WGP and GPA in (v) and (vi), GPA = $\frac{\sum WGP}{RCU} = \frac{8+8+...+03}{2+2+...1} = \frac{45}{16} = 2.8125 \approx 2.81$

Assuming that this particular candidate registered 20 credit units in the second semester and earned (passed) 18 credit units with a WGP total of 72 then GPA(2nd Semester) = $\frac{72}{20}$ **= 3.60**

CGPA = $\frac{45+72}{16+20}$ **= 3.25.**

Also for this candidate:

RCU (1st Semester)	=	16
ECU (1st Semester)	=	13
RCU (2nd Semester)	=	20
ECU (2nd Semester)	=	18
TRCU	=	36
TECU	=	31

Failure in any course shall be recorded as such and can only be redeemed by re-taking the course as carry-over and passing the examination, but both the initial GP and the ”carry-over" GP shall count towards the CGPA. Subject to the conditions for withdrawal and probations, a student may continue to re-take the failed course unit(s) at the next available opportunity, provided the total number of credit units registered during that semester does not exceed 24. The number and titles of the core and elective course units to be examined shall be specified in the syllabus approved by the Senate of the University. The Faculty may determine from time to time, on the recommendation of the Department, and shall make any change known to the affected student by the commencement of the relevant teaching.

The method of determining continuous assessment marks:
The weight given to continuous assessment mark is 40% for each course.

B.Sc. Computer Science degree is classified according to the students final CGPA as follows:

CGPA	Classification of Degree
4.50 - 5.00	First Class
3.50 - 4.49	Second Class (Upper Division)
2.40 - 3.49	Second Class (Lower Division)
1.50 - 2.39	Third Class
< 1.5	Fail.

Students Industrial Work Experience (SIWES)

SIWES is an integral part of the undergraduate training in Computer Science programme and an essential requirement for graduation. It is usually undertaken at the end the first semester of 300 level. It is a six months programme at the end of which the student has to write, present and defend a technical report on what he/she learnt in the industry

Deferment of SIWES

If a student wants to defer SIWES for a good course at the time it is due, he/she must forward a formal application to the Head of Department for consideration and possible approval. Only cases of deferments approved by the Department (HOD) would be processed and tendered for consideration.

Undergraduate Project

Every final year student in B.Sc. Computer Science programme shall undertake a research project in any field of interest besides the usual prescribed courses, to be supervised by a qualified lecturer. The report shall be prepared and submitted to the Departmental project coordinator in the appropriate format of four (4) bound copies. The report will also be orally examined on an appropriate date.

Graduation Requirements

For a student to graduate, he/she must pass all his/her core courses, earn at least 120 credit units (i.e. TECU $\geq$ 120) and have a Cumulative Grade Point Average of at least 1.50 (i.e. CGPA $\geq$ 1.50)

Course Structure

Structure and Duration

The duration of B.Sc. (Hons.) Computer Science programme is four years. There are two semesters of formal University Studies in each academic session. At 300 Level, a student is expected to go for at least 6 months Students Industrial Work Experience Scheme (SIWES) after completion of the first semester courses, at the end of which he/she has to write, present and defend a report on what he/she learnt in the industry. At 400 Level, each student undertakes a one year project in any field of interest besides the usual prescribed courses. A report on the project is also to be presented and defended.

Summary: B.Sc. Computer Science

	100 Level	200 Level	300 Level	400 Level	TOTAL
Core Courses (Departmental)	22	27	20	31	100
Cognate Courses (GENS)	3	2	2	0	7
Restricted Electives	2	3	6	6	17
Unrestricted Electives	8	9	2	6	25
TOTAL	35	41	30	43	149

The above summary table shows that *for a student to graduate he/she needs to register a total of at least 149 credit units of which 100 credits must be core.*

The following gives a detailed breakdown of the courses in the curriculum on a semester-by-semester basis.

100 LEVEL – A MINIMUM OF 35 CREDIT UNITS.

- Core courses (Departmental) : 22
- Core courses (General Studies) : 03
- Restricted Elective : 02
- Unrestricted Electives : 08
- Total : 35

Core Courses (Departmental)

1ST Semester

Code	Course Title	Credit Units	Prerequisite
MATH101	Sets and Number System	2	O/L Maths
MATH103	Trigonometry and Co-ordinate Geometry	2	"
MATH105	Differential and Integral Calculus	2	"
COSC101	Introduction to Computing	2	"
PHYS111	Mechanics	2	O/L Physics
PHYS131	Heat and properties of matter	2	"

2ND Semester

Code	Course Title	Credit Units	Prerequisite
MATH102	Algebra	2	O/L Maths.
MATH104	Conic Sections and Application of Calculus	2	"
MATH106	Vectors and Dynamics	2	"
STAT102	Introductory Statistics	2	"
PHYS124	Geometric and Wave Optics	2	"

Restricted Elective

PHYS122	Electricity, Magnetism and Modern Physics	2	O/L Physics.

Cognate Courses (General Studies)

Code	Course Title	Credit Units	Prerequisite
GENS101	Nationalism	1	
GENS103	English and Communication Skills	2	

Electives at 100 Level

1st/2nd Semester

A minimum of eight (8)-credit units chosen from the following subject areas: Biology, Chemistry, STAT101, GENS102 and GENS107

200 Level – A Minimum of 41 Credit Units

- Core courses (Departmental) : 27
- Core courses (General Studies) : 02
- Restricted Electives : 03
- Unrestricted Electives : 09
- Total : 41

Core Courses (Departmental)

1st Semester

Code	Course Title	Credit Units	Prerequisite
MATH201	Mathematical Methods I	3	MATH105 or equiv.
MATH207	Linear Algebra I	3	MATH102 or equiv.
COSC211	Object-Oriented Programming I	3	COSC101 or equiv.
COSC203	Discrete Structures	3	MATH101 or equiv.
COSC205	Digital Logic Design	3	COSC101 or equiv.

2nd Semester

Code	Course Title	Credit Units	Prerequisite
COSC212	Object-Oriented Programming II	3	COSC101 or equiv.
COSC204	Computer Organization and Assembly Language	3	COSC101 or equiv.
STAT202	Continuous Probability Distributions and Distribution Techniques	3	STAT101 or equiv.
COSC208	Introduction to Artificial Intelligence	3	COSC101

Cognate Course (General Studies)

GENS202	Entrepreneurship and Innovation	2	

Restricted Departmental Electives

MATH209	Numerical Analysis I	3	MATH104 or equiv.

Unrestricted Electives

COSC206	Human Computer Interaction	2	COSC101 or equiv.
MATH208	Linear Algebra II	3	MATH102 or equiv.

A minimum of nine (9) credit units chosen from any of the following subject areas: Biology, Chemistry, Mathematics, Statistics and Physics.

300 Level – A Minimum of 30 Credit Units

- Core courses (Departmental) : 20
- Core courses (General Studies) : 02
- Restricted Electives (Departmental) : 06
- Unrestricted Electives (minimum) : 02
- Total : 30

Core Courses

1st Semester

Code	Course Title	Credit Units	Prerequisite
COSC301	Data Structures and Algorithm	3	COSC211
COSC303	Computer Architecture	3	COSC205
COSC305	Systems Analysis and Design	2	COSC101
COSC309	Database Management systems	3	COSC203
COSC311	Organization of Programming Languages	3	COSC211

2nd Semester

COSC300	SIWES	6	

Cognate Course (General Studies)

GENS302	Business Creation and Growth	2	

Restricted Electives

COSC307	Web Application Engineering I	3	COSC101
MATH311	Mathematical Modeling	3	MATH201

Unrestricted Electives

A minimum of two (2) credit units chosen from any of the following: Any relevant 300 level course in the Faculty of Science, Department of Electrical Engineering, Department of Economics, and Department of Business Education.

400 LEVEL – A MINIMUM OF 43 CREDIT UNITS

- Core courses (Departmental) : 31
- Restricted Electives : 06
- Unrestricted Electives (minimum) : 06
- Total : 43

Core Courses

1st Semester

Code	Course Title	Credit Units	Prerequisite
COSC400	Project	3	COSC300
COSC401	Algorithms and Complexity Analysis	3	COSC301
COSC403	Software Engineering	3	COSC305
COSC405	Web Application Engineering II	2	COSC307
COSC407	Data Communications and Networks	3	COSC205
COSC411	Operating Systems	3	COSC204

2nd Semester

Code	Course Title	Credit Units	Prerequisite
COSC400	Project	3	COSC300
COSC402	Formal Methods and Software Development	3	MATH201
COSC404	Network Design and Management	3	COSC307
COSC406	Advanced Database Systems	2	COSC309
COSC408	Compiler Construction	3	COSC311

Restricted Electives

COSC409	Professional and Social Aspects of Computing	3	COSC206
COSC416	Simulation Methodology	3	STAT202

Unrestricted Electives

A minimum of 6 credit units, chosen from any of the following 400 level subject areas: Computer Science (COSC415,COSC413,COSC414,COSC412), Electrical Engineering, Physics, Electronics, Economics, Business Administration, Mathematics, Statistics or other relevant sciences depending upon the availability of facilities and resources.

Undergraduate Syllabus for B.Sc. (Hons.) Computer Science

100-Level First Semester Courses

COSC101 Introduction to Computing

Prerequisite: **O/Level Mathematics**

Introduction to computer systems. Components of computer systems and their functons. Windows operating systems and its utilities. Hands-on explosure to Office application software (MS Office or Open Office): Word processing, spreadsheets, presentation graphics and databases. Introduction to and use of Internet tools and technologies.

Suggested Lab work

Lecturers should develop laboratory exercises and assignments targeted at providing hands-on practical experience on all topics in the syllabus. The exercises should cover the typical tasks that students do with computers throughout their studies.

Textbooks

1. S.B. Junaidu, A.F. Donfack-kana and A. Salisu, Fundamentals of information technology ABU press (2013)
2. J.J. Parsons and D. Oja, *Practical Computer Literacy*, Thompson Learning, 2005
3. Curt Simmons, *How to Do Everything with Windows XP*, 2nd Edition McGraw-Hill/Osborne, 2003, ISBN 0-07-223080-0
4. Peter Norton's, *Introduction to Computers*, 5th Edition McGraw-Hill/Glencoe, 2003, ISBN 0-07-826421-9

MATH101 – Sets and Number System (2 Credit Units)

Prerequisite – O/Level Mathematics

Sets: Definition of a set, finite and infinite sets, equality of sets, subsets, union, intersection, universal set, complements, empty set, Venn diagram. Symmetric difference, power sets and De-Morgan theorems. Inclusion-Exclusion principle. Elements of relations and functions.

Some Properties of number systems: Natural numbers, integers, rationals, irrationals and reals. Order relations in the set of real numbers. Open and closed intervals on the number line.

Complex Numbers: Definition of a complex number, addition, multiplication and division. Geometric interpretation modulus and conjugation. Polar representation, De- Moivre's theorem, n^{th} roots of a complex number, n^{th} roots of unity.

Text books

1. Mathematics for Fresh Undergraduates Vol. I, D. Singh, A. Mohammed, A.M. Ibrahim and I.A. Fulatan ABU press (2013)
2. Set Theory and Related Topics, S. Lipschutz, (Schaum's Outline Series), McGraw-Hill (1964).

MATH103 – Trigonometry and Coordinate Geometry (2 Credit Units)

Prerequisite – O/Level Mathematics

Circular Measures: Trigonometric ratios of angles of any magnitude, inverse trigonometric functions.

Addition formulae: Sin (A+B), cos(A+B), tan(A+B) and their proofs. Multiple and half angles, solutions of simple trigonometric equations. Factor formulae. Solution of triangles, heights and distances (including three-dimensional problems)

Plane Polar Coordinates: Relation between polar and Cartesian coordinates, plotting and sketching of simple curves whose polar equations are known.

Coordinate Geometry of lines and Circles: Pair of straight lines and system of circles. (Emphasis on concepts rather than formulae).

Text books

1. Mathematics for Fresh Undergraduates Vol. II, B.K. Jha, A.O. Ajibade, M.I. Yakubu and A.T. Imam, ABU press (2013)
2. Pure Mathematics Books I & II, J.K. Backhouse *et al*, Longman (1980)
2. Calculus and Analytical Geometry, G.B. Thomas and R.L.Finney, Addison- Wesley, (1979).
3. Theory and Problems of Trigonometry, Frank Ayres, (Schaum's Outline Series). (1954).

MATH105 – Differential and Integral Calculus (2 Credit Units)

Prerequisite – O/Level Mathematics.

Functions of a real variable: Odd, even, periodic functions and their symmetries, graphs, limits and continuity (Intuitive treatment only)

Differentiation: First principle, techniques of differentiation in general. Higher derivatives.

Integration: Integration as the inverse of differentiation, techniques of integration in general, definite integral (Evaluation only).

Text books

1. Mathematics for Fresh Undergraduates Vol. III, J. Singh, H.M. Jibril, A.J. Alkali, Y.M. Baraya and A. Umar, ABU press (2013)
2. Pure Mathematics Books I & II, J.K. Backhouse, *et al* Longman (1980).
3. Calculus and Analytic Geometry, G.B. Thomas and R. L. Finney, Addison –Wesley (1979).

PHYS111 Mechanics

Prerequisite – O/Level Physics.

Units and dimensions; Dimension methods for checking correctness of equations and for deriving simple relations. Additions and subtraction of vectors, projectiles, Newton laws, conservation laws, Elastic collisions, work, energy and power. Circular motion, simple harmonic motion, motion of rigid bodies, statics Gravitational potential, circular orbit, escape velocity.

PHYS131 Heat and Properties of Heat

Prerequisite – O/Level Physics.

Structure of solids, liquids and gases. Kinetic theory of gases, Elasticity, surface tension, solid friction. Fluid in motion, Bernuillis's law, Aerofoil; thermodynamics; thermal expansion. Heat transfer. EM radiation, prevost thery of heat exchange. Thermal radiation detectors; Optical pyrometer.

100-Level Second Semester Courses

MATH102 – Algebra (2 Credit Units)

Prerequisite – O/Level Mathematics

Quadratic and other polynomial functions: Elementary properties of quadratic expressions, roots of quadratic equations, application to symmetric functions, polynomial functions of third and fourth degrees, remainder theorem, location of roots.

Permutation and combination: Notion of Factorials, ${}^{n}P_{r}$, ${}^{n}C_{r}$, and simple applications, mathematical induction principle and applications.

Binomial Theorem: Expansion of all rational index, interval of convergence, approximations and errors.

Text books

1. Mathematics for Fresh Undergraduates Vol. I, D. Singh, A. Mohammed, A.M. Ibrahim and I.A. Fulatan ABU press (2013)
2. Pure Mathematics Book I and II, J.K. Backhouse, *et al*, Longman (1980)

MATH104 – Conic Sections and Application of Calculus (2 Credit Units)

Prerequisite – O/Level Mathematics.

Conics: Properties of parabola, ellipse, hyperbola, rectangular hyperbola, their Cartesian and parametric equations, problems involving elimination of parameters, tangents and normals. Rate of Change: Velocity, acceleration and other rates.

Curve Sketching: Asymptotes, maxima and minima. Small increments, approximations and errors. Newton's approximation, simple application of integration to areas and volumes.

Differential equations: First order differential equations only.

Text books

1. Mathematics for Fresh Undergraduates Vol. II, B.K. Jha, A.O. Ajibade, M.I. Yakubu and A.T. Imam, ABU press (2013)
2. Mathematics for Fresh Undergraduates Vol. III, J. Singh, H.M. Jibril, A.J. Alkali, Y.M. Baraya and A. Umar, ABU press (2013)
3. Pure Mathematics Books I & II , J.K. Backhouse, *et al*, Longman (1980)
4. Calculus and Analytic Geometry , G.B. Thomas and R.L. Finney, Addison-Wesley (1979).

MATH106 – Vectors and Dynamics (2 Credit Units)

Prerequisite – O/Level Mathematics

Vectors: Geometric representation of vectors in 1-3 dimensions, components, direction cosines. Addition, scalar multiplication, linear

independence and dependence of vectors. Scalar and vector products of vectors. Differentiation and integration of vectors w.r.t a scalar variable.

Dynamics: Kinematics of a particle. Components of velocity and acceleration of a particle moving in a plane. Force, momentum, laws of motion under gravity, projectiles, restricted vertical motion, elastic strings, simple pendulum, impulse. Impact of two smooth spheres, and of a restricted sphere and a smooth sphere.

Text books

1. Mathematics for Fresh Undergraduates Vol. III, J. Singh, H.M. Jibril, A.J. Alkali, Y.M. Baraya and A. Umar, ABU press (2013)
2. Textbook of Dynamics, F. Charlton, Ellis Horwood, 1977.
3. Vector Analysis, Murray R. Spiegel, Schaum's Outline Series (1974)

STAT102 INTRODUCTORY STATISTICS II (2 CREDIT UNITS)

Prerequisite – O/Level Mathematics.

Random experiment, Sample space, event space, definitions of probability, conditional probability, addition and multiplication theorems, definition of random variable (discrete and continuous), mathematical expectations of a random variable, addition and multiplication theorems of expectation, definition of moment, relationship between raw moments and central moments, the bi-variate frequency distribution, fitting of curves by method of least squares, concepts of correlation and regression and their coefficients, the rank correlation coefficient.

Text Books

1. Statistics for Fresh Undergraduates, Yahaya A. and Nnamani C.N., ABU press (2013), Zaria.
2. Mathematical Statistics, Ray, M., Sharma, H.S. and Choudhary, S., Ram Prakash and Sons Agra - 3, India.
3. Fundamentals of Mathematical Statistics, Gupta S.C. and Kapoor, V.K., Sultan Chand and Sons, New Delhi, India.

PHYS122 Electricity, Magnetism and Modern Physics

Prerequisite – O/Level Physics.

Electric force; Field and potential, Electric flux and Gauss's therem. Capacitancies, current electricity, magnetic force, magnetic effects of currents, magnetic materials, electro magnetic induction, Alternating current, Planck's constant quanta of lightenergy, photo electric effect, Radioactivity, Nuclear composition, binding energy, Nuclear fission and fussion. Thermionic emission, rectification by diodes, transistor.

PHYS124 Geometric Wave and Optics

Prerequisite – O/Level Physics.

Reflection, refractive index, smells law measurement of refractive index, total internal reflection, air cell. Refraction through prism, minimum deviation. Tens formula, Lenses in contact, Newton formula. Spherical and chromatic aberrations, power of lenses, Dispersive Powers. Classification of spectra, Optical instruments, interference phenomenon, Newton rings, Polarization, Molu's law, polaroids

200-Level Fisrt Semester Courses

COSC211 Object-Oriented Programming I

Prerequisite: ***COSC101 or Equivalence***

Overview of computers and computing; Introduction to object-orientation as a technique for modeling computation. Introduction of a typical object-oriented language, such as Java; Basic data types and operators; Basic object-oriented concepts; Introduction to Strings; Simple I/O; Logical expressions, control structures, algorithms and problem solving; Arrays; Simple recursive algorithms; inheritance; polymorphism.

Suggested Lab work

Programming assignments involving hands-on practice in the design and implementation of simple algorithms such as finding the average, standard deviation, searching and sorting. Practice in developing and tracing simple recursive algorithms. Developing programs involving inheritance and polymorphism.

Textbooks

1. Nell Dale and Chip Weems, *Programming and Problem Solving with Java,* Second Edition, Jones and Barrlett Publishers, 2008. (Lab Manual Available)
2. J. Lewis and W. Loftus, *Java Software Solutions*, 5th Edition, Addison Wesley, 2006. (Lab Manual Available)
3. G. Bronson, *Program Development Using Java: A Class-Centered Approach*, Enhanced Edition, Thompson Learning, 2006.
4. D.J. Barnes and M.K. Kolling, *Objects First with Java: A practical introduction using Blue J*, Pearson Education, 2006

COSC203 Discrete Structures

Prerequisite:MATH101 or Equivqlence

Functions and relations. Basics of counting: inclusion-exclusion principle, pigeon-hole principle, permutations, recurrence relations, generating functions. Graphs and trees: definitions, properties and applications. Discrete probability: computing probabilities, dependent and independent events, applications.

Textbooks

1. K. Rosen, *Discrete Mathematics and Its Applications*, McGraw-Hill Higher Education, 6th Edition, 2007.
2. F. Giannasi and R. Low, *Maths for Computing and Information Technology*, Longman, 1996.
3. J. Truss, *Discrete Mathematics for Computer Scientists*, Addison-Wesley, 1999.

COSC205 Digital Logic Design

Prerequisite: COSC101 or Equivalence.

Introduction to information representation and number systems. Boolean algebra and switching theory. Manipulation and minimization of completely and incompletely specified Boolean functions. Physical properties of gates: fan-in, fan-out, propagation delay, timing diagrams and tri-state drivers. Combinational circuits design using multiplexers, decoders, comparators and adders. Sequential circuit analysis and design, basic flip-flops, clocking and

timing diagrams. Registers, counters, RAMs, ROMs, PLAs, PLDs, and FPGA.s.

Textbooks

1. M. M. Mano and C. R. Kime, *Logic and Computer Design Fundamentals & XILINX 6.3 Student Edition*, Prentice Hall, 3rd Edition, 2004.
2. Englander, The Architecture of Computer Hardware and Systems Software, 3rd Edition, Wiley, 2003.

MATH201 – Mathematical Methods - I (3 Credit Units)

Prerequisite – MATH105 or equivalence

Applications of Calculus: Revision of different techniques of differentiation, successive differentiation, Leibniz's theorem, Taylor and Maclaurin series. Tangents and normals to plane curves, curvature, Definite integrals. Methods of integration, reduction formulae, lengths of arc of a plane curve. Area enclosed by a plane curve.

Differential Equations: Concept of differential equations. First order ordinary differential equations of the forms; variable separable, homogeneous, exact and linear. Second order ordinary linear differential equations with constant coefficients, auxiliary equation, and cases of auxiliary equations having distinct, equal, and complex roots, complementary functions and particular integrals in connection with non-homogeneous equations. Uses of the operator D = d/dx and the method of undetermined coefficients for calculating particular integrals. Differential equations of Euler's type of second order. Solutions of systems of two linear differential equations. Second order Ordinary Linear Differential Equations with variable coefficients; reduction of order, variation of parameters.

Partial Differentiation: Real valued functions of two and three variables. Partial derivatives, chain rule, Jacobian. Extrema, Lagrange's mltipliers,increments, differentials and linear approximations.

Text books

1. Mathematical Methods, J. Heading, University Press, (1963).
2. Advanced Engineering Mathematics, E. Kreyszig, Wiley, (1987).

MATH207 – Linear Algebra I (3 Credit Units)

Prerequisite – MATH102 or equivalence

Matrices: Definition, types of matrices, algebra of matrices, matrix as a sum of symmetric and skew symmetric matrices. Elementary operations of matrices and echelon form, equivalence matrices. Inverse of a matrix.

Systems of linear equations and matrices: Systems of m linear equations in n unknowns and their solutions. Gaussian elimination by pivot method and matrix representation. Solution of the system using Gaussian elimination and Gauss-Jordan reduction.

Determinants: Definition, evaluation of determinants. Cofactor expansion, inverse of a non-singular matrix. Solution of systems of linear equations using Cramer's rule.

Text books

1. Linear Algebra, S. lipschutz (Schaum's Outline Series) Mc Graw-Hill (1987)
2. Linear Algebra and Matrix Theory, E.D. Nerring, John Wiley, (1967).

MATH209 – Numerical Analysis I (3 Credit Units)

Prerequisite – MATH105

Accuracy in numerical calculations: errors and their sources, error accumulation in different operations.
Finite differences: difference operators and difference table.
Evaluation of functions: using series approximation, solution of polynomial, algebraic and transcendental equations, curve fitting.
Interpolation: Newton's difference formulae, central difference formulae, Lagrange's formula. Numerical differentiation. Numerical Integration

Text books

1. Introduction to Numerical Analysis, Carl-Eric Froberg, Addison-Wesley publication, (1981).
2. Theory and Problems of Numerical Analysis, Francis Scheid, Schaum's Series (1968).
3. Numerical Analysis: An Introduction, S.A. Bhatti, Mathematics Departmental Library, (Lecture Notes, 1980's).
4. Calculus of Finite differences and Numerical Analysis, P.P. Gupta & G.S. Malik.

200 - Level Second Semester Courses

COSC212 Object-Oriented Programming II

Prerequisite: COSC102 or Equivalence

Advanced object-oriented programming - polymorphism, abstract classes and interfaces: Program organization using packages/namespaces; Use of API – use of iterators/enumerators, List, Stack, Queue from API; Recursion; Event-driven programming.

Suggested Lab work

Programming assignments leading to extensive practice in problem solving and program development with emphasis on object-orientation. Solving basic problems using static and dynamic data structures. Solving various searching and sorting algorithms using iterative and recursive approaches. GUI programming.

Textbooks

1. Nell Dale and Chip Weems, *Programming and Problem Solving with Java*, Second Edition, Jones and Barrlett Publishers, 2008. (Lab Manual Available)
2. J. Lewis and W. Loftus, *Java Software Solutions*, 5th Edition, Addison Wesley, 2006. (Lab Manual Available)
3. G. Bronson, *Program Development Using Java: A Class-Centered Approach*, Enhanced Edition, Thompson Learning, 2006.
4. D.J. Barnes and M.K. Kolling, *Objects First with Java: A practical introduction using Blue J*, Pearson Education, 2006

COSC204 Organization and Assembly Language

Prerequisite: COSC101 or Equivalence

Introduction to computer organization. Signed and unsigned number representation, character representation, ASCII codes. Assembly language programming, instruction format and types, memory and I/O instructions, dataflow, arithmetic, and flow control instructions, addressing modes, stack operations, and interrupts. Datapath and control unit design. RTL, microprogramming, and hardwired control. Practice of assembly language programming.

Suggested Lab work

Programming assignments to practice MS-DOS batch programming, Assembly Process, Debugging, Procedures, Keyboard input, Video Output, File and Disk I/O and Data Structure.

Textbooks

1. Vincent P. Heuring, Harry F. Jordan, *Computer System Design & Architecture*, Prentice Hall, 2004.
2. Dandamudi *et al*, Introduction to Assembly Language Programming: From 8086 to Pentium, Springer, New York, 1998.

COSC206 Human Computer Interaction

Prerequisite: COSC101 or Equivalence

Foundation of HCI, principles of GUI, GUI toolkits. Human-centered software evaluation and development; GUI design and programming.

Textbooks:

1. Dix, Finlay, Aboud & Beale, *Human-Computer Interaction.* Pearson Prentice-Hall, Third ed, 2004.
2. Preece, J., Rogers, Y. & Sharp, H., *Interaction Design: Beyond Human-Computer Interaction*. New York, NY: John Wiley & Sons, 2002.

COSC208 Introduction to Artificial Intelligence

Prerequisite: COSC101 or Equivalence

Introduction to the types of problems and techniques in Artificial Intelligence. Problem-Solving methods. Major structures used in Artificial Intelligence programs. Study of knowledge representation techniques such as predicate logic, non-monotonic logic, and probabilistic reasoning. Examples of expert systems. Introduction to natural language understanding and various syntactic and semantic structures. Expert systems. Introduction to computer image recognition.

Textbooks

1. Stuart Russell and Peter Norvig, *AI: A Modern Approach*, 2nd Edition, Prentice Hall, 2003.
2. G.F. Luga, *Artificial Intelligence: structures and strategies for complex problem solving*, 5th Edition, Addison Wesley, 2005.

MATH208 – Linear Algebra II (3 Credit Units)

Prerequisite – MATH102

Vector Spaces: Review of basic definitions and examples of vector spaces. Subspaces, linear dependence and independence. Bases, dimension of a vector space. Homomorphism and quotient space. Direct sum, Dual spaces.

Linear Mappings and Matrices: General linear transformation of n-dimensional into m-dimensional space, matrix representation of a linear map, similar matrices and change of basis. Eigenvalues and eigenvectors. Characteristic polynomial and characteristic equation. Caley-Hamilton theorem. Orthogonal diagonalisation.

Canonical Forms: Primary decomposition theorem, Triangular Jordan and Rational forms for linear operator (square matrices). Quadratic and bilinear forms.

Text books

1. Linear Algebra, S. lipschutz (Schaum's Outline Series) Mc Graw-Hill (1987)
2. Linear Algebra and Matrix Theory, E.D. Nerring, John Wiley, (1967).

STAT202 - Continuous Probability Distributions and Distribution Techniques (3 Credit Units)

Prerequisite – STAT102

Univariate continuous probability distributions such as Normal, Uniform, exponential, type I and type II beta and gamma distributions, various properties of these distributions, fitting of normal distribution. Concept of Bi-variate probability distribution, joint, marginal, conditional probability distribution, covariance and correlation of bi-variate r.v. sampling distribution and standard errors of statistics, distribution of functions of random variables using the techniques such as cumulative distribution function technique, moment generating function technique and transformation technique.

Text Books

1. Introduction to the theory of Statistics, Mood, A.M., Graybill, F.A. and Boes, D.C. Mc-Graw-Hill, New York, USA.
2. Fundamentals of Mathematical Statistics, Gupta S.C. and Kapoor, V.K., Sultan Chand and Sons, New Delhi, India.

300-Level First Semester Courses

COSC301 Data Structures and Algorithm

Prerequisite: COSC212 or Competence in Programming

Review of object-oriented concepts; Basic algorithm analysis - the big-O notation; Fundamental data structures – implementation strategies for stacks, queues and lists; Recursion; Implementation strategies for tree and graph algorithms; Hash tables; Application of data structures.

Suggested Lab work
Programming assignments leading to extensive practice in problem solving and program development involving the use of the various data structures implemented in the course.

Textbooks

1. Adam Drozdek, *Data Structures and Algorithms in Java*, 2nd Edition, Thomson Course Technology, 2005.
2. J Lewis & J Chase, *Java Software Structures*, 2nd Edition, Addison-Wesley, 2005.
3. D.S. Malik, J*ava Programming: Program Design Including Data Structures*, Thomson Course Technology, 2005.

COSC303 Computer Architecture

Prerequisite: COSC205
Memory hierarchy and cache memory. Integer and floating point arithmetic. Instruction and arithmetic pipelining, superscalar architecture. Reduced instruction set computers. Parallel architectures and interconnection networks.

Textbooks

1. David Patterson & John Hennessy, *Computer Architecture: A Quantitative Approach*, 4th Edition, Kaufmann, 2006, ISBN 0-12-370490-1.
2. Linda Null and Julia Lobur, *The Essentials of Computer Organization and Architecture*, 2nd Edition, Jones & Bartlett, 2006. ISBN 0-7637-3769-0

COSC305 Systems Analysis and Design

Prerequisite: COSC211 or Competence in Programming
The software development life cycle: conception, business case, business context, system requirements, requirements analysis, systems analysis, design, implementation, testing, deployment, maintenance. The Unified Modeling Language (UML): models, use case diagrams, activity diagrams and state chart diagrams, sequence and collaboration diagrams, class diagrams, component diagrams. Managing the process: customers, organization types, project

management, teams and team dynamics, computer assisted software engineering (CASE) tools, documentation.

Suggested Lab Work
Analysis and design assignments leading to extensive practice in the use of UML and CASE tools.

Textbooks

1. Dennis, Wixom, Roth, *Systems Analysis and Design,* 3rd Edition, John Wiley, 2006.
2. Farmer, McRobb & Bennett: *Object Oriented Systems Analysis and Design Using UML,* 3rd Edition, Mc-Graw Hill 2006.
3. Roger S. Pressman, *Software Engineering: A Practitioner's Approach,* 6th Edition Mc-Graw Hill, 2005.
4. Ken Lunn, *Software Development with UML,* Palgrave Macmillan Limited, 2003.

COSC307 Web Applications Engineering I

Prerequisite: COSC211 or Competence in Programming
The Internet (brief history, Internet protocols and Internet services) ; The Web architecture (Client-server architecture, multi-tier architecture, URL) ; XHTML; DHTML (Cascaded Style Sheet, JavaScript, DOM) ; Web interface and interactivity design principles and practice. Incorporating multimedia content into Web pages (using Photoshop, Flash or similar tools).

Textbooks

1. Dietel, H. M., Dietel, P. J., Goldberg, A. B. *Internet & World Wide Web How to Program,* 4th Edition, Prentice-Hall, 2008.
2. R. W. Sebesta, *Programming the World Wide Web,* 3rd Edition, Addison Wesley, 2006
3. Flanagan: *JavaScript: The Definitive Guide*, 5th Edition, O'Reilly, 2006

COSC309 Database Management Systems

Prerequisite: COSC211

Basic database concepts. Conceptual modeling. Relational data model. Relational theory and languages. Database Design. Database security and integrity. Introduction to query processing and optimization. Introduction to concurrency and recovery.

Suggested Lab work

Programming assignments to learn database design using CASE tools. Introduction to back-end/Server-based Relational DataBase Management System (RDBMS). Learning Standard SQL (interactive/embedded). Introduction and programming assignments on Front-End tools. Programming team projects to design and develop real life database systems using the learned tools.

Textbooks

1. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 5th Edition, Addison-Wesley, 2007.
2. Carolyn Begg and Thomas Connolly, Database Systems: A Practical Approach to Design, Implementation and Management, 4th Edition, Prentice Hall, 2004.

COSC311 Organization of Programming Languages

Prerequisite: COSC211 or Competence in Programming

Concepts of Programming languages: Syntax and semantics. Data types. Control structures. Sub-Programs. Exception handling. Run-time Storage Management. Programming Paradigms: Imperative, functional, logic, object-oriented and concurrent.

Textbooks

1. Robert W. Sebesta, *Concepts of Programming Languages*, 7th Edition, Addison-Wesley, 2006.
2. Kenneth Louden, *Programming Languages: Principles and Practice*, Second Edition, Course Technology, 2003.
3. Allen Tucker and Robert Noonan, *Programming Languages: Principles and Paradigms*, Mc-Graw Hill, 2002.

MATH311 – Mathematical Modeling (3 Credit Units)

Prerequisite – MATH201

Methodology of Model building: Identification, formulation and solution of problems. Cause-effect diagrams. Modeling using graphs and proportionality: modeling by interpolation using polynomials. Modeling using Least squares and Linear programming. Modeling deterministic behavior and probabilistic processes. Modeling using derivatives: applications using differential equations.

Text books

1. A first course in Mathematical Modeling, F.R Giordano & M.D. Weir, Woodsworth, Inc. (1985).
2. Mathematical Modeling for Industrial Processes, Lassi Hyvaarinen, Springer-verlag (1970).
3. Mathematical Methods of Operations Research, T.L. Saaty, Dover Publications, Inc. (1988).

400-Level First Semester Courses

COSC400 Project

Prerequisite: COSC300

The project aims to provide experience with planning, executing and formally reporting on a substantial computing task within a set time. Students will develop their understanding of relevant areas of computing and their capabilities in the practical engineering and writing activities involved, and demonstrate their competence as candidate computing professionals.

Textbooks

1. CW Dawson, Projects in Computing and Information Systems, Addison-Wesley, 2005

COSC401 Algorithm and Complexity Analysis

Prerequisite: COSC301

Introduction to algorithms and review of data structures; fundamentals of algorithm analysis; Analysing recursive and non-recursive algorithms; Algorithm design techniques: brute-force, divide-and-conquer, greedy algorithms, dynamic programming,

search techniques; NP-complete problems and approximation algorithms.

Textbooks:

1. Anany Levitin, *Introduction to the Design and Analysis of Algorithms*, Addison Wesley, 2003. ISBN 0-201-74395-7
2. M. Al-Suwaiyel, *Algorithms: Design Techniques & Analysis*, World Scientific Publishing Company, 1999.
3. Useful Resources: http://www.cs.ucsd.edu/classes/wi05/cse101/

COSC403 Software Engineering

Prerequisite: COSC305

Fundamental design concepts, design notations, and architectural design methods for large-scale software systems. Several design: examples of their use, comparisons among them. Concepts of information hiding, data abstraction, concurrency, and object-oriented software construction.

Textbooks

1. Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, 6th Edition Mc-Graw Hill, 2005.
2. Ian Sommerville: *Software Engineering*, 8th Edition, Addison Wesley, 2006.
3. Dennis, Wixom, Roth, *Systems Analysis and Design*, 3rd Edition, John Wiley, 2006.

COSC405 Web Application Engineering II

Prerequisite: COSC307

Review of client-side application development. Server-side application development. Adding content to Web applications dynamically. Input validation and use of regular expressions. Defining and managing sessions. Cookies. Working with databases. Web application security.

Assignments and projects should be given to enable students design and implement non-trivial data-driven Web applications.

Textbooks

1. Dietel, H. M., Dietel, P. J., Goldberg, A. B. *Internet & World Wide Web How to Program*, 4th Edition, Prentice-Hall, 2007.
2. Jeffrey C. Jackson***, Web Technologies: A Computer Science Perspective***, Prentice hall, 2007.
3. Shepherd, G, *Microsoft ASP.NET 2.0 Step by Step*, Microsoft Corporation, 2006.

COSC407 Data Communications and Network

Prerequisite: COSC205

Introduction to computer networks and layered architectures: connectivity, topology, circuit and packet switching, TCP/IP and ISO models; Application layer: C/S model, DNS, SMTP, FTP, WWW, socket programming and network security; Transport layer: TCP and UDP, congestion control; Network layer: internetworking, addressing and routing algorithms and protocols; Data link layer: framing, flow and error control protocols, PPP, MAC and LANs; Physical layer: principles of data communications, circuit switching, coding, multiplexing and transmission media. Network security: fundamentals of cryptography, secret and public key algorithms, authentication protocols.

Suggested Lab work

The lab involves several projects to gain hands-on experience with network devices, programming and tools. More specifically, it provides students with the opportunity to: Setup various servers such as DNS, DHCP, Web Servers on Windows/Linux platforms; Develop simple client/server network applications using sockets; Create simple web pages; Simulate network; Analyze various protocols by capturing packets; Measure network utilization under varied situations; Use various network-related commands; Configure switches and routers.

Textbooks

1. Behrouz A. Forouzan, *Data Communications and Networking*, McGraw Hill, 2004.
2. Andrew Tanembaum, *Computer Networks*, 4th Edition, Prentice Hall, 2003.

COSC409 Professional and Social Aspects of Computing

Prerequisite: COSC206

Professional aspects; professions and the professional; professional institutions; professional ethics and responsibilities; the computer professional as expert witness. Standards, best practice. Legal background, sources of law; civil and criminal law. Intellectual property rights, software copyright, patents, designs, trade marks and passing off; copyright and webpages, Internet domain names, protection of computer imagers and icons, jurisdiction; confidentiality. Data protection law; freedom of movement of personal data; privacy in telecommunications. Computer crime; fraud; computer misuse; viruses; threatening emails; pornography; grooming in chat rooms. Social aspects of the workplace/society at large. The impact of IT on society.

Textbooks

1. David Bainbridge, *Introduction to Information Technology Law*, 6th Edition, Longman, 2007.
2. George Reynolds, *Ethics in Information Technology*, Course Technology, 2006.

COSC411 Operating Systems

Prerequisite: COSC301

Fundamentals of operating systems design and implementation. Hstory and evolution of operating systems; Types of operating systems; Operating system structures; Process management: processes, threads, CPU scheduling, process synchronization; Memory management and virtual memory; File systems; I/O systems; Security and protection; Case-study.

Suggested Lab work

Implementation of user-defined utilities/commands for UNIX by writing systems programs using different types of system calls including those for file/directory management, process management, signal management, and client/server management. Also involve practice on various aspects of shell environment and shell programming.

Textbooks

1. Brian Stuart, *Operating Systems: Principles and Application*, Course Technology, 2008.
2. Avi Silberschatz, Peter Baer Galvin, Greg Gagne, *Operating System Concepts*, 7th Edition, John Wiley & Sons, Inc., 2004.
3. A S Tanenbaum, *Modern Operating Systems*, Prentice Hall, 2001.
4. H M Dietel, P J Dietel and D R Choffnes, *Operating Systems*, 3rd Edition, Prentice Hall, 2004.

COSC413 Computational Science and Numerical Methods

Prerequisite: MATH209

History and importance of computational science, overview of application areas, review of required skills. High-performance computing: processor architectures, memory systems for high performance, input/output devices, pipelining, parallel languages and architectures. Scientific visualization: presentation of results, data formats, visualization tools and packages. Application of high-performance computing to scientific and engineering problems.

Textbooks

1. Barry Wilkinson and Michael Allen, *Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers*, Second Edition, Prentice-Hall, 2005.
2. Michael J. Quinn, *Parallel Programming in C with MPI and OpenMP*, *First Edition*, McGraw-Hill, 2003.

400-Level Second Semester Courses

COSC402 Formal Methods in Software Development

Prerequisite: COSC212

Mathematical foundations for formal methods. Formal languages and techniques for specification and design, including specifying syntax using grammars and finite state machines. Analysis and verification of specifications and designs. Use of assertions and proofs. Automated program and design transformation.

Textbooks

1. Jonathanh Bowen, *Formal Specification and Documentation using Z: A Case Study Approach*, International Thomson Computer Press (ITCP), 1996.
2. Huth, M. and Ryan, M. *Logic in Computer Science: Modelling and Reasoning about Systems*. Cambridge University Press. 1999.
3. Cliff B. Jones, *Systematic Software Development Using VDM*, 2nd Edition, Prentice Hall, 1990.
4. Useful Resources:
    a. http://www.cs.chalmers.se/Cs/Grundutb/Kurser/form/
    b. http://www.freetechbooks.com/forum-28.html

COSC404 Network Design and Management

Prerequisite: COSC205

Overview of network design and management; Design methodologies; Network management strategies; Network configuration management; Network management protocols: SNMP, and RMON; Network management tools and systems; Network management applications; Desktop and web-based network management; Network troubleshooting.

Suggested Lab Work

A closed lab with hands-on exercises using state-of-the-art tools in the design, analysis and troubleshooting computer networks.

Textbooks

1. James D. McCabe, *Network Analysis, Architecture and Design*, 2nd Edition, Morgan Kaufmann, 2003.
2. Rachel Morgan and Henry McGilton, *Introducing Unix System V*, McGraw-Hill Book Company, 1987

COSC406 Advanced Database Systems

Prerequisite: COSC309

Advanced data models. Conceptual Database design. Concurrency control techniques. Recovery techniques. Query processing and optimization. Integrity and security. Client-server architecture. Distributed database systems. Current trends in database systems.

Textbooks

1. Ramez Elmasri and Shamkant B. Navathe, *Fundamentals of Database Systems*, 5th Edition, Addison-Wesley, 2007.
2. Carolyn Begg and Thomas Connolly, *Database Systems: A Practical Approach to Design, Implementation and Management*, 4th Edition, Prentice Hall, 2004.

COSC408 Compiler Construction

Prerequisite: COSC212

Design and implementation of compilers, principles of languages translation. Each student implements a complete compiler for a small but substantial language. The stages of a compiler. Boot-strapping a compiler. Lexical analysis, regular expressions, finite state machines. Syntactic analysis, context free grammars, parsers. Semantic analysis, type checking, symbol tables. Syntax-directed translation. Data flow analysis, peephole optimization. Code generation.

Textbooks

1. Andrew W. Appel, *Modern Compiler Implementation in Java, 2nd Edition*, Cambridge University Press, 2002.
2. ACM//IEEE. Computing Curricula 2001. Electronic version available at http://www.acm.org/sigcse/cc2001/.
3. NUC BMAS. Benchmarks and Minimum Academic Standard (Science), Published by the National Universities Commission, April 2007.
4. Career Space is a European Consortium of over 20 universities all over Europe. They established a working group on ICT curriculum development. Information about this can be reached at http://career-space.com/cdguide/
5. M.R.K. Krishna Rao, S. Junaidu, T. Maghrabi, M. Shafique, M. Ahmad and K. Faisal (2005), Principles of curriculum design and revision: a case study in implementing computing curricula CC2001, Proc. of the ACM Special Interest Group on Computer Science Education Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE'2005).

COSC416 Simulation Methodology

Prerequisite: STAT202

Introduction and comparison with other techniques,discrete simulation model, generation of pseudo random numbers, statistical testing. Implementation of queing theory, simulation languages and packages. System Models, System Studies, Techniques of System simulation, continous system silulation, introduction to GPSS.

Text Books

1. System Simulation, Gordon G., Prentice Hall
2. Introduction to Simulation, Payer T.A., McGraw Hall

STAT412 – Operations Research (3 Credit Units).

Prerequisite – MATH311

Classical methods of optimization, Maxima and minima, Lagranges' multipliers. Linear programming: Convex sets and functions, simplex and revised simplex methods, duality theory, applications. Linear programming applications to diet problems, transportation problems, manufacturing problems, Network Analysis, etc.

Text Books

1. Operations Research, Sharma, J.K., Macmillan India.
2. Operations Research, Swaroop, Gupta, P.K. and Mohan, M., Sultan Chand and Sons, New Delhi, India.

Service Courses

COSC264 – Fundamentals of Data Processing (2 Credit Units).

Prerequisite – O/L MATHS

Data processing cycle & Operations, Developments in Data processing, storage media, punched-card recording & processing, electronic data processing, communicating with the computer, computer codes & arithmetic, flowcharts & programming techniques, data structure.

Text Book

1. Data processing by Martim M. Lipshutz and Seymour Lipshutz, McGraw-Hill book company, Singapore, 1982.

COSC265 – Introducing Computer (2 Credit Units).

Prerequisite – O/L MATHS

Computer (definition, types generation, history)
Computer (structure, components, number system)
Computer Software (type, application, systems, packages, languages, machine, symbolic high level languages, most popular languages)
Networks Topology; star, ring mesh, bus
Popular packages (database, spreadsheet, word processing, Dos windows with pracrice on informationretreival using data based management system commands)
Computer applications in Library and Nursing

Text Book

1. A Guide to FORTRAN Programming 2nd Edition by Daniel D McCrackken, John Wiley & Sons, Inc., New York, 1965

COSC344 – Computer Knowledge and FORTRAN Programming (3 Credit Units).

Prerequisite – O/L MATHS

Binary, Octal and Hexanedecimal number systems, conversion complement of numbers. Reperesentation of negative numbers, Digital computers, main functional elements of a computer (memory, central and arithmetic units, input-output devices; backing storages). Information in the core store.

Binary coded decimal, fix and floating point representations, programming languages (short summary of the machine code. Assembly, machine and problem oriented languages). The flow

chart language, Loops, interaction. The basic FORTRAN Numerical data, arithmetic, arrays, input-output, control statements, sementation of programmes, statement function, function and subroutine segments. Common, equivalence statements.

Text Book

1. A Guide to FORTRAN Programming 2nd Edition by Daniel D McCrackken, John Wiley & Sons, Inc., New York, 1965

General Matters

The following procedures are to be strictly followed under the appropriate situation.

Illness

While on campus, a student who falls sick should seek for immediate medical attention at the University Sick Bay. When necessary, the Sick Bay may refer serious cases to the Teaching Hospital for further specialist treatment. Whenever the medical condition of a student necessitates absence from academic activities, the Department (HOD) should accordingly be notified in writing and upon resumption for normal academic work, appropriate medical report must be presented. Any student who falls ill during an examination should immediately seek medical attention at the Sick Bay and has to obtain appropriate medical report and forward it to the Department (HOD) as soon as possible. If the sick student must seek for further medical assistance outside the University Health Services, the Department (HOD) must be formally informed in writing before leaving the University or Zaria. Outside the University Campus or Zaria (e.g. while at home on holidays) if as a result of ill-health, a student is likely to be late for registration, the Department must be informed early enough. Upon resumption, supporting evidence(s) (e.g. medical report which has to be authenticated by the University Health Services) must be presented.

Deferment of Semester/Session

A student who for a good cause wishes to defer a semester or a whole session must put a formal application to the Dean of the Faculty of Science through the Head of Department (HOD) for consideration and approval. This must be done in good time for such request to be tendered for consideration and final approval.

Warning, Probation and Withdrawal:

The academic standing of a student is determined by the Cumulative Grade Point Average (CGPA). The minimum tolerable CGPA is 1.50 for classified first degree Programmes and 2.40 for non-classified first degree programmes. B.Sc. Computer Science Degree is classified.

I. **Warning**

A student is warned if his/her CGPA drops below the minimum tolerable level for the first time. This warning is usually in the form of verbal advice by the Level Coordinator and the student should be made to be fully aware of the implication of dropping below the minimum tolerable CGPA in the next semester examinations.

II. **Probation**

A student is placed on probation if his/her CGPA drops below the minimum tolerable level for two consecutive semesters i.e. (CGPA less than 1.5).

III. **Withdrawal**

Withdrawal of a candidate from his/her programme is recommended to the Faculty Board of Examiners from the Department where the CGPA of the candidate drops below the minimum tolerable level (CGPA <1.5) for four (4) consecutive semesters. The Faculty Board usually ratifies this recommendation and communicates same to the University Senate for approval. Withdrawal from a programme can also be made on grounds of absence. A student who fails to register for two consecutive sessions without permission, automatically loses his/her admission on this basis.

Transfer Cases

The Course Credit System permits inter Departmental and inter faculty transfers. For this to be possible however, the candidate must satisfy the requirements of the intended Department or Faculty.

Notification of Results

After the Faculty Board has decided on the recommendations to be made to Senate, the Dean may publish them to the students as provisional examination results subject to Senate approval. The Head of Department may notify the students of the letter grades and CGPA they had obtained. Formal transcripts of examination results may only be issued on request by the student on payment of the prescribed fee to the University. Certificates of the award of degrees approved by the Senate shall be issued to successful graduates.

Discipline

The Examination regulations set out on page 9 bind all students, the breach of which carries serious punishments prescribed below:

Expulsion from the University

The following offences shall carry the punishment of expulsion.

a. Impersonation at examinations. This may involve exchange of examination number, name/answer sheets or the intentional use of someone else‘s examination number.
b. Exchange of relevant materials in examination hall which may involve: The exchange of question paper containing relevant jottings and materials collaboration/copying from each other.
c. Exchange of answer scripts.

Rustication for one Academic Year

The following offences shall carry the punishment of rustication for one academic session.

a. Non-submission or incomplete submission of answer scripts.
b. Introduction of foreign materials to the examination hall.

Written Warning

The following offences shall attract a written warning:

a. Speaking/conversation during examination.
b. Writing on question papers/scripts.

Details on examination rules and regulations may be obtained from the University Calendar published by Academic Planning and Monitoring Unit.

Computer Laboratories

The Department has five Computer laboratories available for conducting practicals for Computer Science Students, Mathematics Students and Statistics Students.

The laboratories are well-equipped with 125 computers. The laboratories are networked using Star topology via two twelve port switches. The Department is fully connected to the Internet through wired and wireless connections. There are six graduate assistants available in the laboratories coordinating along with assistant laboratory coordinator who is responsible for the overall lab management. The laboratory coordinator is always available throughout the working hours for any problem encountered by students. Each laboratory is taken care of by a senior laboratory operator. The operator can also be contacted for any problem.

Software related to Windows programming, Internet programming, Web design, graphic and animation design are installed on specific machines. There are both Windows XP and Fedora Core 2 operating system environments available on these computers. There are also the following software packages used by Mathematics students and Statistics students; SPSS, STATISTICA, Graphica, MINITAB, MATLAB and EXCEL, etc.

Enquiries

Enquiries from students could be routed through their Level Coordinator to the Head of the Department. Enquires from all other quarters should be addressed to the Head of Department.