NATIONAL BOARD FOR TECHNICAL EDUCATION

HIGHER NATIONAL DIPLOMA (HND)

IN

SURVEYING AND GEOINFORMATICS

CURRICULUM AND COURSE SPECIFICATIONS

2006

PLOT 'B' BIDA ROAD, PM.B. 2239, KADUNA - NIGERIA

1.0 CERTIFICATE AND TITLE OF THE PROGRAMME:

The Certificate to be awarded and the programme title shall read: "NATIONAL DIPLOMA (ND) IN SURVEYING AND GEO-INFORMATICS" and "HIGHER NATIONAL DIPLOMA (HND) SURVEYING AND GEO-INFORMATICS" respectively. A transcript showing all the courses taken and grades obtained shall be issued together with the certificate.

2.0 GOALS AND OBJECTIVES:

2.1 National Diploma Programmes:

The National Diploma Programme in Surveying and Geo-Informatics is aimed at producing diplomates that can demonstrate sound understanding of the methods and instruments used in Geo-Informatics. On the completion of this programme, the diplomate should be able to:

1. Interpret spatial measurements from various sources;
2. Operate Geo-Informatics instruments;
3. Carry out cadastral survey to define boundaries of land;
4. Apply the basic principles of surveying and method in Geo-Informatics;
5. Interpret imageries;
6. Compile maps at various scales from imageries; and
7. Carry out cartographic processes for presentation of Geo-Informatics.

2.2 Higher National Diploma Programme:

The Higher National Diploma Programme in Surveying and Geo-Informatics is aimed at producing diplomates with a good mastery of the methods and instrumentation used in Geo-Informatics. On completion of this programme, the student should be able to:

(i) Operate various Geo-Informatics equipment;
(ii) Use land administration procedures in various cadastral system
(iii) Carry out engineering surveys for physical developments such as roads, railways, dams, pipelines, large industrial sites, utilities, etc.
(iv) Carry out geodetic and topographical surveys for controlling all survey works and for geo-informatics production;
(v) To acquire spatial data using photogrammetric and remote-sensing techniques.
(vi) Carry out Cartographic process for Geo-Information production;

(vii) Carry out hydrographic survey;
(viii) Apply the basic principles of management in solving, at appropriate level, management and supervisory problems related to Geo-Informatics environment.
(ix) Apply geo-information technology in environmental mapping, monitoring and protection; and
(x) Manipulate a geographic information system for geo-information production.

3.0 ENTRY REQUIREMENTS:

3.1 National Diploma Programme:

Applicants with the following qualifications may be considered for admission into the National Diploma Programme by direct entry:

(i) SSCE or its equivalents with credit passes in Mathematics and Physics and any other two subjects from the following: Statistics, Further Mathematics, Chemistry, Technical Drawing, Basic Surveying, Geography, Economics, Biology/Agricultural Science and at least a pass in English Language at not more than two sittings.

(ii) Four credit passes in relevant subjects as stated in (i) above obtained at the final examination of an NBTE recognised preliminary ND Programme offered in Polytechnic or similar post-secondary technical institution.

OR

(iii) NTC in Building Trades in relevant subjects as stated in (i) above

3.2 Higher National Diploma Programme:

Applicants with all the following qualifications may be considered for admission in the Higher National Diploma Programme by direct entry:

(i) The entry requirements or the National Diploma Programme in 3.1 above.
(ii) National Diploma in Surveying and Geo-Informatics with a minimum of lower credit pass; and
(iii) A minimum of one year Post-National Diploma cognate work experience in the field of Surveying and Geo-Informatics.

4.0 **CURRICULUM:**

4.1 **The curriculum of all ND and HND programmes consists of four components These are:**

(i) General Studies/Education
(ii) Foundation Courses
(iii) Professional Courses
(iv) Supervised Industrial Work Experience Scheme (SIWES)

4.2 **The General Education component shall include courses in Art and Humanities** English Language, Communication, History.

These are compulsory. **Mathematics and Science** (for non-science based programmes) **Social Studies** - Citizenship (the Nigerian Constitution) Political Science, Sociology, Philosophy, Geography, Entrepreneurship, Philosophy of Science and Sociology are compulsory. The General Education component shall account for not more than 15% of total contact hours for the programmes

4.3 **Physical and Health Education** (one semester credit only).

4.4 **Foundation Courses** include courses in Economics, Mathematics, Pure Sciences technical drawing, descriptive geometry, statistics, etc.

The number of hours will vary with the programme and may account for about 10 -15% of the total contact hours.

4.5 **Professional Courses** are courses which give the student the theory and practical skills he needs to practice his field of calling at the technician/technologist level. These may account for between 60 - 70% of the contact hours depending on programme.

4.6 **Supervised Industrial Work Experience Scheme (SIWES)** shall be taken during the long vacation following the end of the second semester of the first year. See details

5.0 **CURRICULUM STRUCTURE:**

5.1 **ND Programme:**

The structure of the ND programme consists of four semesters of classroom, laboratory and workshop activities in the college - and a semester (3-4 months) of supervised industrial work experience scheme (SIWES). Each semester shall be of 17 weeks duration made up

as follows: 15 contact weeks of teaching, i.e. lecture, recitation, and practical exercises, etc.; and 2 weeks for tests, quizzes, examinations and registration. SIWES shall take place at the end of the second semester of the first year.

5.2 **HND Programme**:

The structure of the programme is similar to that of the ND save that the SIWES at the end of the first year is not compulsory.

6.0 ACCREDITATION:

Each programme offered either at the ND or HND level shall be accredited by the NBTE before the diplomates can be awarded either of the diploma certificates. Details about the process of accreditating a programme for the award of the ND or HND are available from the Executive Secretary, Programme Department, National Board for Technical Education, Plot B, Bida Road, P.M.B. 2239, Kaduna, Nigeria.

7.0 CONDITIONS FOR THE AWARD OF THE ND/HND:

Institutions offering accredited programmes will award the National Diploma to candidates who successfully completed the programme after passing prescribed coursework, examinations, diploma project and the supervised industrial work experience. Such candidates should have completed a minimum of between 72 - 80 semester credit units depending on the programme.

8.0 GUIDANCE NOTES FOR TEACHERS TEACHING THE PROGRAMME:

8.1 The new curriculum is drawn in unit courses. This is in keeping with the provisions of the National Policy on Education which stress the need to introduce the semester credit units which will enable a student who so wish to transfer the units already completed in an institution of similar standard from which he is transferring.

8.2 Undesigning the units, the principle of the modular system by product has been adopted; thus making each of the professional modules, when completed provides the student with technician operative skills, which can be used for employment our poses.

8.3 As the success of the credit unit system depends on the articulation of programmes between the institutions and industry, the curriculum content has been written in behavioural objectives, so that it is clear to all, the expected performance of the student who successfully completed some of the courses or the diplomates of the programme. There is a slight departure in the presentation of the performance based curriculum which requires the conditions under which the performance expected to be carried out and the criteria for the acceptable levels of performance.

It is a deliberate attempt to further involve the staff of the department teaching the programme to write their own curriculum stating the conditions existing in their institution under which the performance can take place and to follow that with the criteria for determining an acceptable level of performance. Departmental submission on the final curriculum may be vetted by the Academic Board of the institution. Our aim is to continue to see to it that a solid internal evaluation system exists in each institution for ensuring minimum standard and quality of education in the programmes offered throughout the polytechnic system.

8.4 The teaching of the theory and practical work should, as much as possible, be integrated. Practical exercises, especially those in professional courses and laboratory work should not be taught in isolation from the theory. For each courses, there should be a balance of theory to practice in the ratio of 50:50 or 60:40 or the reverse.

9.0 GUIDELINES ON SIWES PROGRAMME:

For the smooth operation of the SIWES the following guidelines shall apply:

9.1 Responsibility for Placement of Students

(a) Institutions offering the ND programme shall arrange to place the students in industry. By April 30th of each year, six copies of the master list showing where each student has been placed shall be submitted to the Executive Secretary, NBTE which shall, in turn, authenticate the list and forward it to the Industrial Training Fund, Jos.

(b) The Placement Officer discuss and agree with industry on the following:

(i) A task inventory of what the students should be expected to experience during the period of attachment. It may be wise to adopt the one already approved for each field.

(ii) The industry-based supervisor of the students during the period, likewise the institution based supervisor.

(iii) The evaluation of the student during the period. It should be noted that the final grading of the student during the period of attachment should be weighted more on the evaluation by his industry-based supervisor.

9.2 Evaluation of Students During the SIWES

In the evaluation of the student, congnisance should be taken of the following items:

(a) Punctuality
(b) Attendance
(c) General Attitude to Work
(d) Respect for Authority
(e) Interest in the field/technical area
(f) Technical competence as a potential technician in his field.

9.3 Grading of SIWES

To ensure uniformity of grading scales, the institution should ensure that the uniform grading of students' work which has been agreed to by all Polytechnics is adopted.

9.4 The Institution Based Supervisor

The Institution-based supervisor should initial the log book during each visit. This will enable him to check and determine to what extent the objectives of the scheme are being met and to assist students having any problems regarding the specific assignments given to them by their industry-based supervisor.

9.5 Frequency of Visit

Institution should ensure that students placed on attachment are visited within one month of their placement. Other visits shall be arranged so that:

(1) There is another visit six weeks after the first visit, and
(2) A final visit in the last month of the attachment.

9.6 **Stipend for Students in SIWES**

The rate of stipend payable shall be determined from time to time by the Federal Government after due consultation with the Federal Ministry of Education, the Industrial Training Fund and the NBTE'

9.7 **SIWES As a Component of the Curriculum**

The completion of SIWES is important in the final determination of whether the student is successful in the programme or not. Failure in the SIWES is an indication that the student has not shown sufficient interest in the field or has no potential to become a skilled technician in his field. The SIWES should be graded on a fail or pass basis. Where a student has satisfied all other requirements but failed SIWES, he may only be allowed to repeat another four months SIWES at his own expense.

National Board for Technical Education,
Kaduna.

HIGHER NATIONAL DIPLOMA IN SURVEYING AND GEO-INFORMATICS

YEAR ONE:

Semester One

Code No	Course	L	T	P	CU	CH	Pre-requisite
SUG 301	Cadasral Surveying IV	1	0	2	3	3	
SUG 303	Survey Instrument	1	0	2	3	3	
SUG 305	Geodetic Surveying I	2	0	2	4	4	
SUG 307	Topographical Surveying	1	0	2	3	3	
SUG 309	Physics III (Electro-Magnetism; Terrestrial and Planimetry Physics)	2	0	2	4	4	
MTH 311	Mathematics I	2	0	0	2	2	
GIT 301	Element of Photogrammetry	2	0	2	4	4	
GNS 302	Communication Skills III	2	0	0	2	2	
SUG 311	Fundamentals of Computer	2	0	3	5	5	
	Total	15	0	15	30	30	

Semester Two

Code No	Course	L	T	P	CU	CH	Pre-requisite
SUG 302	Astronomy III	1	0	3	4	4	SUG
SUG 304	Engineering Surveying	2	0	3	5	5	SUG
SUG 306	Geodetic Surveying II	2	0	2	4	4	SUG
SUG 308	Adjustment Computation I	2	0	2	4	4	-
SUG 310	Physics IV (Physical Optics; Atomic & Nuclear Physics)	2	0	2	4	4	SUG
MTH 312	Mathematics II	2	0	0	2	2	MTH 111
SUG 312	Computer Applications	1	0	2	3	3	SUG 311
GIT 304	Principles of Geoinformatics	1	0	2	3	3	-
	Total	13	0	16	29	29	

YEAR TWO:

Semester One.

Code No	Course	L	T	P	CU	CH	Pre-requisite
SUG 401	Cadastral Surveying V	2	0	0	2	2	
SUG 403	Hydrographic Surveying	1	0	2	2	3	
SUG 405	Adjustment Computation II	2	0	2	4	4	
GIT 401	Analytical & Digital Photogrammetry	2	0	3	5	5	
GIT 403	Digital Mapping	2	0	3	5	5	
GIT 405	Automated Suyveying	2	0	3	5	5	
GIT 407	Geographic Information System Tools	2	0	3	5	5	
GIT							
GNS							
	Total	13	0	16	29	29	

Semester Two

Code No	Course	L	T	P	CU	CH	Pre-requisite
SUG 402	Management in Surveying	2	0	0	2	2	
GIT 402	Digital Cartography	2	0	3	5	5	
SUG 404	Elements of Environmental Studies	2	0	3	5	5	
SUG 406	French for beginners	2	0	0	2	2	
GNS 320	Outline History of Africa	2	0	0	2	2	
GNS 321	International Relations & Elements of Nigerian Law	2	0	0	2	2	
SUG 214	Final Projects	0	2	6	4	8	
	Total	12	2	12	26	26	

CADASTRAL AND GEODETIC SURVEYING COURSES
(SUG 301, 401, 307, AND 308)

CADASTRAL SURVEYING IV

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Cadastral Surveying IV			**COURSE CODE:** SUG 301		**CONTACT HOURS:** 60 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the Principle and regulations governing the demarcation and survey of boundaries.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Demarcation and Surveys of Boundaries. 1.1 Carry out the demarcation of cadastral boundary in accordance with the regulations. 1.2 Explain the principle governing the creation of boundaries of each property. 1.3 Set out boundaries to any given specifications, e.g. contiguous boundaries. 1.4 Carry out the survey of the boundary, using Geoinformatics methods.			1.1 Set out boundaries to any give specifications e.g. contiguous boundaries. 1.2 Carryout the survey of the boundary using Geoinformatics methods. 1.3 Use computational means to detect errors in observation or computation of traverse. 1.4 Carryout actual field measurements to confirm the detected observational errors. 1.5 Carryout surveys of judgments boundary. 1.6 Calculate scale fees for clients.		

	General Objective: 2.0 Know how to detect gross errors in traverse.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Error detection in Traverses. 2.1 Detect gross traverse errors due to misplacement of ΔN and ΔE. 2.2 Detect gross traverse errors due to transposition of ΔN and ΔE. 2.3 Detect gross traverse errors resulting from use of a wrong distance. 2.4 Detect gross traverse errors resulting from use of an erroneous bearing. 2.5 Detect gross field observation error in one distance measurement. 2.6 Detect gross field observation error in an angular measurement. 2.7 Carry out actual field measurements to confirm the detected errors.					

	General Objective: 3.0 Know the procedure to be followed in dispute surveys.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Land Dispute Surveys. 3.1 Explain the legal implications in land dispute surveys. 3.2 Explain the various requirements of dispute surveys as regards assembly and examination of representatives of disputing parties; impartiality of the surveyor and security. 3.3 Carry out surveys of disputed boundaries. 3.4 Carry out surveys of judgments boundary.					
	General Objective: 4 .0 Understand the process of Registration of and professional conduct of surveyors.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Professional Conduct of Surveyors. 4.1 Define the various legal terms. 4.2 Explain the roles of the					

	surveyors' council and the its committees. 4.3 Explain the surveyors' qualifications. 4.4 Calculate scale of fees for clients. 4.5 Explain the roles and duties of the surveyors. 4.6 Explain the survey co-ordination act and its amendments.					

CADASTRAL SURVEYING V

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Cadastral Surveying V			**COURSE CODE:** SUG 401		**CONTACT HOURS:** 60 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the Nigeria Land Tenure systems.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Nigeria Land Tenure Systems. 1.1 Trace the historical background to the various land tenure laws of Nigeria. 1.2 Interpret the laws and regulations governing land tenure. 1.3 Define the basic terms used in connection with land tenure. 1.4 Interpret the land use decree, 1978.			Nil		
	General Objective: 2.0 Know the various land registration systems.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Land Registration Systems. 2.1 Trace the historical background to the land					

	registration systems in Nigeria. 2.2 List the various types of registration systems in common use world-wide. 2.3 Outline the mode of operation of each of the registration systems conveyance, deeds, title. 2.4 Describe in detail the Torrents title registration system as applicable in various parts of the world. 2.5 Compare the various registration systems in common use. 2.6 Explain the functions of the land registries.					
	General Objective: 3.0 Understand the methods of land administration in Nigeria.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Land Administration in Nigeria. 3.1 Trace the historical background to the land administration laws of Nigeria. 3.2 Explain the procedure					

	to be adopted for the acquisition of land for public, private and other purposes. 3.3 Explain the role of site boards. 3.4 Determine the amount and form of compensation payable in the event of loss of right. 3.5 Define terms used in connection with land administration e.g. statutory right of occupancy, customary right of occupancy, way-leaves and vested lands. 3.6 Explain how the control of settlements and protection of venerated areas is effected.					
	General Objective: 4.0 Know the modes of keeping survey records by the survey organization.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Modes of Keeping Survey Records. 4.1 Explain the numbering systems of cadastral					

	beacons. 4.2 Distinguish between the methods of keeping co-ordinate lists for property beacons and corner beacons. 4.3 Keep co-ordinate registers. 4.4 Define the role of intelligence charts. 4.5 Explain the mode of preservation of intelligence charts. 4.6 Prepare and keep beacon descriptions. 4.7 Explain the mode of preserving beacon description records. 4.8 Interpret the content of the survey file. 4.9 Explain the mode of keeping survey files.					
	General Objective: 5.0 Know how to interpret the Town Planning Law as it affects the surveyor.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Urban and Regional Law 5.1 Trace the historical background to the Nigerian, Urban and Regional Planning Law.					

	5.2 Define the basic terms used in planning law. 5.3 Explain the role of the planning authority. 5.4 Outline those aspects of the planning law which affect the surveyor e.g. planning proposals, clearance and approval, building-line, and master plans.					

GEODETIC SURVEYING I

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Geodetic Surveying I			**COURSE CODE:** SUG 307		**CONTACT HOURS:** 60 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the characteristics of and relationships between the three geodetic surfaces and the basis of geodetic computation.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Geodetic Computation 1.1 Identify the three basic geodetic surfaces - the earth's surface, the geoid and the reference ellipsoid. 1.2 Describe the main characteristics of the three surfaces and their relationships to each other. 1.3 Explain what is meant by deviation of the `vertical'. 1.4 Illustrate the basis of geodetic computation - computation on the ellipsoid and on projections of the spheroid.			1.1 Carryout first-order geodetic leveling. 1.2 Carryout the determination of heights of intersected and resected points from vertical angles.		

	General Objective: 2.0 Know the need for a geodetic framework and the various forms it can take and the orders of precision.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Geodetic Framework. 2.1 State the objects of a geodetic framework. 2.2 Explain the classification of geodetic framework surveys into different orders of accuracy. 2.3 Outline the respective accuracy criteria. 2.4 Describe the several forms which the geodetic framework may take. 2.5 Explain their relative utility and merits. 2.6 Explain the system of classification and enumeration of geodetic framework surveys adopted in Nigeria. 2.7 Describe the general layout of the Nigeria national geodetic framework. 2.8 Outline its historical evolution.					

	General Objective: 3.0 Understand the objects and underlying principles of geodetic height measurement.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Geodetic Height Measurement 3.1 State the objects of height measurement in geodesy. 3.2 Identify various types of height systems- dynamic, orthometric and normal height systems. 3.3 Distinguish between geoidal heights and ellispsoidal heights. 3.4 Compare the different methods of determining geodetic heights by spirit/electronic levelling, theodolite vertical angels, from satellite observations, by hydrostatic levelling.					
	General Objective: Understand the principles and practice of geodetic levelling (spirit/electronic levelling).			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Geodetic Levelling 4.1 Distinguish between the different classes of					

	geodetic levelling. 4.2 Enumerate their respective accuracy criteria. 4.3 Explain the principles involved in laying out a geodetic levelling network - use of tidal stations, density of net, factors affecting location of level lines (accessibility), stability, preservation, utility of benchmarks). 4.4 Describe the various sources of systematic errors in geodetic levelling. 4.5 Evaluate the methods adopted to minimize their effect. 4.6 Describe the methods of single and double levelling. 4.7 Identify their relative merits. 4.8 Justify the Federal Survey procedure of first order geodetic levelling. 4.9 Explain how to effect `river-crossings' by spirit levelling.					

	4.10 Carryout first order geodetic levelling.					
	General Objective: 5.0 Understand the principles and practice of Geodetic heights from theodolite vertical angles.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Geodetic Heights from Theodolite Angle. 5.1 Demonstrate the mathematical basis of determining the difference in geodetic height between two stations from reciprocal vertical angles. 5.2 Evaluate for the effects of refraction on vertical angles. 5.3 Correct for the effects of refraction on vertical angles. 5.4 Evaluate the effects of diurnal changes in refraction on vertical angles. 5.5 Identify optimal times of observation for vertical angles. 5.6 Describe the observing procedure.					

	5.7 Carry out the determination of heights of intersected and resected points from vertical angles. 5.8 Explain how to effect 'river crossings' of geodetic levels using theodolite vertical angles.					

GEODETIC SURVEYING II

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Geodetic Surveying II			**COURSE CODE:** SUG 308		**CONTACT HOURS:** 60 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the principles of laying out secondary triangulation and how to reconnoitre, design and beacon a secondary triangulation network.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Secondary Triangulation 1.1 Describe the principles of design of secondary triangulation types and strengths of figures; lengths of lines; connections to primary control; scale and azimuth control; use of intersected, resected, and eccentric points; use of towers and tall buildings. 1.2 Carry out the reconnaissance and final design of a secondary triangulation network. 1.3 Emplace secondary triangulation beacons in different types of ground.			1.1 Carryout the reconnaissance and final design of a secondary triangulation network. 1.2 Emplace, number, describe and preserve secondary triangulation beacons. 1.3 Observe secondary traverses with particular reference to: a. Connections to primary control. b. Observation of horizontal angles. c. Measurement of distances using EDM. d. Azimuth control. e. Heighting by: (i) vertical angles (ii) vertical angles		

	1.4 Number beacons in 1.3 above. 1.5 Describe beacons in 1.3 above. 1.6 Preserve beacons in 1.3 above. 1.7 Describe the different types of opaque and luminous signals suitable for secondary triangulation and how to erect and use them.			1.4 Layout of typical township control networks based:- (i) purely on traverse. (ii) triangulation-cum-traverse. 1.5 Re-establish township beacons which have been disturbed or destroyed. 1.6 Compute NTM or UTM coordinates of: (i) Secondary triangulation (ii) Secondary traverse (iii) Township control networks. 1.7 Determine the heights of primary traverse station by: (i) Spirit and digital leveling (ii) Vertical angles (trigonometric height) (iii) Total station (iv) GPS 1.8 Carryout trilateration using: (i) Total station, and (ii) EDM		

	General Objective: 2.0 Know the accuracy criteria and how to observe secondary triangulation.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Accuracy Criteria 2.1 State the accuracy requirements for horizontal angles in secondary triangulation. 2.2 Describe the different systems of observing horizontal angles method of rounds, method of directions, method of angles, Schreiber's method, broken rounds. 2.3 State the requirements regarding the numbers of pointing, sets, measures and zeros when observing horizontal angles. 2.4 Identify the optimal observing conditions and time of day for observing horizontal and vertical angles. 2.5 Verify the positions of primary stations to					

	which connection is being made. 2.6 Observe resected, intersected and eccentric stations.					
	General Objective: 2.0 Know the accuracy criteria for secondary traverses and how to carryout reconnaissance beacon and observe them.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Accuracy for Secondary Traverses 3.1 State the accuracy criteria for secondary (EDM) traverses with special reference to Federal Survey specifications. 3.2 Identify the factors influencing the location of secondary traverses and the siting of their permanent stations. **3.3** Observe secondary traverses, with particular reference to (a) connections to primary control (b) observation of horizontal angles (c) measurement of traverse distances using EDM (d)					

	azimuth control (e) heighting by (i) spirit/electronic levelling (ii) vertical angles.					
	General Objective: 4.0 Know how to design and survey township control networks.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Township Control Networks 4.1 State the objects of township control surveys and their influence on the layout of the control network. 4.2 Layout typical township control networks based purely on traverse. 4.3 Layout typical triangulation-cum-traverse township networks. 4.4 Identify the relative merits of traverse and triangulation for township control. 4.5 State the factors affecting the siting of township control stations. 4.6 Describe the types of beacons and the system of enumeration used for					

	township control. 4.7 Connect surveys to the national framework. 4.8 Describe the methods of making such Connections. 4.9 Justify the accuracy criteria for township control surveys. 4.10 Describe the observing procedures for (a) township traverses (b) township triangulation (c) heighting by (i) spirit/electronic levelling (ii) vertical angles. 4.11 Describe the (obsolescent) systems of `township co-ordinates'. 4.12 Explain the current methods of converting (old) township co-ordinates to UTM co-ordinates. 4.13 List the various records to be maintained in respect of township control systems. 4.14 Describe the steps taken to preserve township control beacons. 4.15 Re-establish township beacons which have					

	been disturbed or destroyed.					
	General Objective: 5.0 Understand the mathematical basis of survey Projections with particular reference to the transverse mercator projection.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	5.1 Explain the basic principles of plane projections of the sphere-scale factor, orthomorphism, convergence, arc-to-chord corrections. 5.2 Describe the distinguishing features of the Transverse Mercator projections and use of the formulae for converting geographical co-ordinates to grip and vice-versa, point scale factor, line scale factor and (t-T) corrections. 5.3 Describe the UTM system.					
	General Objective: 6.0 Understand the basis of computing surveys in UTM co-ordinates.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	Computing Surveys in UTM Co-ordinates 6.1 Compute convergence using the basic formulae. 6.2 Obtain UTM bearings. 6.3 Compute (t-T) corrections using the basic formulae and tabulated parameters for the Clarks 1880 spheroid. 6.4 Deduce plane grid angles from observed angles. 6.5 Convert geographical coordinates to UTM co-ordinates and vice-versa using the basic formulae and tabulated parameters for the Clarke 1880 spheroid. 6.6 Compute scale corrections for long lines using the formulae for line scale factor and tabulated point scale factors. 6.7 Justify the stage-by-stage procedure for computation in UTM co-ordinates of (a) secondary					

	triangulation (b) secondary traverse (c) township control networks.					
	General Objective: 7 .0 Know how to lay out primary triangulation and its accuracy criteria and special requirements.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Lay Out Primary Triangulation 7.1 Compare the two main types of triangulation network-continuous net and chains. 7.2 State the different types of triangulation figures and criteria for well-conditioned figures. 7.3 Determine the factors affecting the lengths and locations of primary triangulation lines and the siting of primary stations. 7.4 Describe the types of beacons and signals used in primary triangulation. 7.5 Explain the need for					

	towers in primary triangulation and the main types used. 7.6 Enumerate the requirements as to the accuracy and spacing of measurements to control the scale of new primary triangulation scheme. 7.7 Explain the need for Laplace stations in primary triangulation and their accuracy and spacing requirements. 7.8 Specify the accuracy criteria for horizontal angles in primary triangulation. 7.9 Describe the refinements in instrumentation and observing procedures needed. 7.10 Undertake the field checks used to verify the reliability of horizontal angle-preliminary station, figural and Laplace azimuth closures.					
	General Objective: 8.0 Know the factors governing the location of primary traverses and their accuracy criteria and special requirements.			**General Objective:**		

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	Location of Primary Traverses 8.1 Analyse the impact of modern instruments on the nature and location of primary traverses and their importance in the primary framework. 8.2 Determine the factors affecting the length and location of primary traverse legs, the siting of permanent stations and the use of observing towers. 8.3 Specify the accuracy criteria for traverse distance measurements. 8.4 Analyse the requirements for accuracy and spacing of Laplace azimuths. 8.5 Specify the accuracy criteria (including allowable misclosures between azimuth) for horizontal angles and the refinements in instrumentation and observing procedure					

	needed. 8.6 Undertake the field checks used to test the reliability of horizontal angles. 8.7 Enumerate the Federal Surveys specifications for primary traverse with particular reference to: length of traverse legs; beaconing, enumeration, description and preservation of permanent stations; use of towers; types of signals; horizontal angles; azimuth control; traverse distances; heighting. 8.8 Describe the methods used to determine the heights of primary traverse stations by spirit/electronic levelling (i) vertical angles (ii) total station, (iii) GPS.					
	General Objective: 9.0 Know how to lay out and observe trilateration.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	Lay Out and Observe Trilateration 9.1 Describe the type of network best suited to trilateration. 9.2 Compare the strength of a trilateration net with that of a triangulation or traverse net. 9.3 Describe the field procedure for observing trilateration. 9.4 Carry out trilateration using total station or EDM.					
	General Objective: 10.0 Understand the mathematical basis of computation on the spheroid.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Computation on the Ellipse 10.1 Justify the use of the ellipse as the reference surface for geodetic computation. 10.2 Explain the terms: meridian ellipse, semi-major axis, semi-minor axis, eccentricity, flattening. 10.3 List the ellipsoid in					

	current use together with their principal parameters. 10.4 Define geodetic and astronomical latitude, longitude and azimuth. 10.5 Distinguish between geodetic and astronomical latitude, longitude and azimuth. 10.6 Deduce the Laplace azimuth equation. 10.7 Explain its significance. 10.8 Show that the area of the meridian ellipse is Πab. 10.9 Deduce expressions for the values of the radii of curvature of the ellipsoid (i) in the plane of the meridian ellipse (ii) at right angles to this plane. 10.10 Deduce an expression for the radius of curvature of the ellipsoid at a given point on the ellipsoid. 10.11 Deduce an expression for the radius of curvature of the ellipsoid at any azimuth (Euler's theorem). 10.12 Deduce expressions for					

	distances along a meridian and along a parallel. 10.13 Deduce the expressions for the lengths of the normal section and the geodetic on the spheroid. 10.14 Deduce Legendre's theorem relating the angles of a spherical triangle to those of a plane triangle having the same sides. 10.15 Deduce Delby's heorem giving the convergence of the meridians between the ends of a line. 10.16 Evaluate the corrections needed to reduce observed angles to ellipsoid angles. 10.17 Deduce the expressions for convergence, difference longitude and difference latitude which together constitute the Gauss Mid-Latitude (Topographical) Formula. 10.18 Explain the form and utility of other formulae for geodetic position and					

	reverse azimuth. 10.19 Explain the form and utility of various formulae for the `reverse computation' (mutual distance and azimuth for two points of known geodetic positions) e.g. the Topographical formula, the USC and GS formula.					
	General Objective: 11.0 Know the basis of computing primary triangulation, traverse and trilateration on the spheroid.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Computation of Primary Triangulation, Traverse and Trilateration: 11.1 Solve the spheroidal triangle using Legendre's theorem when one side and three angles are known. 11.2 Compute geodetic positions for successive traverse stations or through a `route' in a traingulation or trilateration net using the Mid-Latitude formula					

	with Laplace-adjusted spheroidal angles. 11.3 Compute mutual distance and azimuth of successive stations using one of the `reverse' formula e.g. the topographical formulae.					
	General Objective: 12.0 Know the relative merits of triangulation, traverse and trilateration for primary framework purposes.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Relative merits of triangulation, traverse and trilateration. 12.1 Analyse the feasibility of triangulation and traverse in different types of terrain and ground cover. 12.2 Compare the results in 12.1 above. 12.3 Compare the organisational, logistic and equipping requirements of primary triangulation, traverse and trilateration. 12.4 Compare the accuracy,					

	accessibility and utility of primary control established by triangulation, traverse and trilateration respectively. 12.5 Assess the relative importance of triangulation, traverse and trilateration in modern framework surveys in various countries.					

ENGINEERING AND TOPOGRAPHICAL SURVEYING
(SUG 306 AND 309)

ENGINEERING SURVEYING

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Engineering Surveying			**COURSE CODE:** SUG 306		**CONTACT HOURS:** 45 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the principles of setting out compound and reverse curves.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Setting out of Compound and			1.1 Set out reverse curves.		

	Reverse Curves 1.1 Describe the characteristics of compound curves consisting of two or more circular curves. 1.2 Explain the use of formulae to compute setting out data. 1.3 Compute data needed to set out reverse curves. 1.4 Set out reverse curves using 1.3 above.			1.2 Set out composite i.e. curves consisting of circular and transition curves. 1.3 Design a vertical curve and set out data given length of curve, gradients of the interesting slopes and the reduced level of at least one known point. 1.4 In site surveys, set out specified levels from control levels and establish a permanent survey control system on completion of the major construction. 1.5 Use relevant Geoinformatics instruments for:- (i) Route selection (ii) As-built surveys etc. 1.6 Transfer azimuth and height from surface underground and vice-versa. 1.7 Survey mine passages using traverse methods. 1.8 Use any of the survey methods to monitor horizontal deformations. 1.9 Use precise leveling in measuring vertical		

				deformations. 1.10 Establish micro-geodetic control systems e.g. tunnel surveys of precise large structures (radio telescopes, particle accelerators, large ships, etc.).		
	General Objective: 2.0 Know the principles and methods of setting out transition curves.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Transition Curves 2.1 Explain how the need for transition curves arises. 2.2 Describe the geometric characteristics of transition curves. 2.3 Explain the use of formulae to compute setting-out data. 2.4 Set out composite curves i.e. curves consisting of circular and transition curves. 2.5 Calculate chainage from the initial point to the end of a route consisting of various types of curves.					

	General Objective: 3.0 Understand the principles of design and setting out of vertical curves.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Vertical Curves 3.1 Explain the purposes of vertical curves. 3.2 List the types of curves used. 3.3 Identify the principal factors governing the length of vertical curves 3.4 State the properties of the parabola as the curve normally adopted for vertical curves. 3.5 Derive formulae for computing data for a vertical curve. 3.6 Describe methods of setting out vertical curves. 3.7 Design a vertical curve and set out data given length of the curve, gradients of the intersecting slopes and the reduced level of at least one known point					
	General Objective: 4.0 Know the principles and methods of construction site surveys.			**General Objective:**		

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	Site Surveys 4.1 Establish rectangular grid control for construction site surveys. 4.2 Describe other forms of control suitable for construction site surveys. 4.3 Explain suitable self-checking setting out methods for large construction sites with many large structures. 4.4 Set out specified levels from control levels. 4.5 Establish a permanent survey control system on completion of the major construction. 4.6 Explain how to overcome specific setting out problems due to impediments, destruction of control beacons, water obstacles, etc.					
	General Objective: 5.0 Understand the application of modern instrumentation and techniques in engineering			**General Objective:**		

	surveys.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Engineering Surveys 5.1 Use modern survey instruments in setting out and surveying route and structures. 5.2 Carry out the application of photogrammetry in route selection, earthwork calculations, measurement of deformations of structures, as - built surveys, etc. 5.3 Explain the uses and advantages of digital ground models in route surveys. 5.4 Carry out some applications of micro-computers in engineering surveys e.g. in curve design and setting out, computing setting out data for large structures, creation of digital terrain models etc.					

	General Objective: 6.0 Understand the principles and methods of mining surveys.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Principles and Methods of Mining Surveys 6.1 Explain the essential differences between surface and underground surveys. 6.2 Explain the technique of transferring bearings and coordinates from a surface baseline to an underground base line. 6.3 Use gyro-theodolite in mining surveys. 6.4 Describe the methods of transferring height from the surface to underground. 6.5 Survey mine passages using traverse methods.					
	General Objective: 7.0 Understand the methods of surveying underground installations such as pipelines, cables, conduits, channels, etc.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Underground Installations 7.1 Explain the need for					

	surveying underground installations. 7.2 Describe the methods of locating underground installations e.g. by using detector instruments. 7.3 Describe the method of surveying underground installations applying normal surface methods e.g. traversing with radiation and offsets.					
	General Objective: 8.0 Understand the principles of measurement of deformations and small movements with particular reference to monitoring the movements of dams.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Measurement of deformations and Small Movements 8.1 Explain the differences between deformations					

	and small movements of structure. 8.2 Explain why measurement of deformations should be carried out e.g. monitor the deformation of dams. 8.3 Describe methods to be adopted in establishing control for measurement of deformations. 8.4 Describe survey methods for monitoring horizontal deformations. 8.5 Use precise levelling in measuring vertical deformations. 8.6 Describe the application of photogrammetry in the measurement of deformations.					
	General Objective: 9.0 Understand the principles and methods of engineering geodesy.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Engineering Geodesy					

	9.1 Explain the scope of engineering geodesy (precise engineering surveys). 9.2 Identify the distinguishing features of engineering geodesy - geodetic accuracy but limited extent, precise centering, use of precision instruments. 9.3 Specify the accuracy requirements of engineering geodesy and the instrumentation and observational procedures to achieve them. 9.4 Describe special computational methods used in precise engineering surveys. 9.5 Outline typical procedures for establishing micro-geodetic control systems e.g. for tunnel surveys, surveys of precise large structures (radio telescopes, particle accelerators, large ships, etc) and subsequent setting-out procedures					

TOPOGRAPHICAL SURVEYING

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Topographical Surveying			**COURSE CODE:** SUG 309		**CONTACT HOURS:** 45 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Know further methods of making contour surveys using digital equipment.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Digital Tachometry.			1.1 Carryout topographical surveys at various scales		

	1.1 Explain the use of reduction tacheometers for contour surveys. 1.2 Carry out contour surveys using digital tacheometers. 1.3 Explain the scope of Digital tacheometry. 1.4 Carry out topographical surveys at various scales using tacheometers.			using digital tachometers. 1.2 Fix photo-points suitable for medium and small-scale mapping e.g. using EDM rays, theodolite resection, altimetric heights, trigonometric heights and GPS. 1.3 Use Geoinformatics equipment map revision. 1.4 Carryout DTM exercise using available DTM software.		
	General Objective: 2.0 Know the methods of heighting by altimetry.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Heighting by Altimetry 2.1 Explain the need for heighting by altimetry. 2.2 Outline the general principles of economy of this method. 2.3 Explain the methods of heighting by altimetry single based, double base, multiple base, leap frog, etc. 2.4 List the corrections to be applied to barometric observations in all the					

	methods of altimetry. 2.5 Carry out barometric observations for meteorological factor. 2.6 Reduce barometric observations for meteorological factors. 2.7 Explain the application of aneroid barometric heights in small-scale surveys and as height control in air mapping. 2.8 State the accuracy attainable in all the methods of barometric heighting.					
	General Objective: 3.0 Know the methods of photo-pointing for medium and small scale mapping.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Photo-Pointing 3.1 Identify examples of appropriate photo-points for medium and small-scale mapping.					

	3.2 Describe the photo-points. 3.3 Fix photo-points suitable for medium and small-scale mapping e.g. using EDM rays, theodolite resection, altimetric heights, trigonometric heights, and GPS.					
	General Objective: 4.0 Know the methods of map revision by ground methods.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Map Revision by Ground Methods. 4.1 Evaluate the need for map revision. 4.2 Explain ground methods of revising township mapping, e.g. using plane tabling, chain survey methods, compass rays, etc. 4.3 Explain ground methods for revising medium and small scale mapping using compass traverse, stadia traverse with compass theodolite, EDM					

	tacheometry, etc.					
	General Objective: 5.0 Know the methods of map revision from air photographs.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Map Revision from Air Photographs 5.1 Explain how to use the sketch master for map revision. 5.2 Explain the process of revising maps using Geoinformatics equipment. 5.3 Use Geoinformatics equipment for map revision. 5.4 Describe methods of map revision using with proportional dividers.					

HYDROGRAPHIC SURVEYING AND ASTRONOMY
(SUG 403 AND 303)

HYDROGRAPHIC SURVEYING

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Hydrographic Surveying			**COURSE CODE:** SUG 403		**CONTACT HOURS:** 45 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the basic problem and need for hydrographic surveys.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	Need for Hydrographic Surveys 1.1 State the basic problems in surveying the land hidden under water. 1.2 Explain the essence of hydrographic surveying. 1.3 Explain the various phases of work involved in a typical hydrographical operation.			1.1 Use the echo-sounder in depth measurement. 1.2 Operate automatic recorders. 1.3 Use cableways in current measurement. 1.4 Monitor the rate of sedimentation of a reservoir.		
	General Objective: 2.0 Know the various methods of establishing horizontal control for water bodies.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Horizontal Control for Water Bodies 2.1 Describe methods of establishing control for water bodies by traversing, triangulation and trilateration. 2.2 Explain methods of computation, adjustment and plotting of the control framework in UTM co-ordinates.					

	General Objective: 3.0 Know the various methods of fixing plan positions afloat.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Fixing Plain Positions Afloat 3.1 Describe, with diagram, the plotting of fixes observed with sextant. 3.2 Compute the three-point problem given the angles observed with sextant. 3.3 Explain the method of fixing with theodolites set up ashore. 3.4 Describe with diagram the method for obtaining distance by angle of depression below a sea horizon. 3.5 Describe the formulae for 3.4 above. 3.6 Explain the method of fixing by tautwire. 3.7 Describe the method of fixing with distance lines. 3.8 Describe the fixing procedure by radar. 3.9 Draw the hyperbolic					

	curves, indicating the fixings by lambda. 3.10 Construct the constant angle lattices. 3.11 Describe the satellite-fix systems with the aid of a diagram. 3.12 Use acoustic beacons. 3.13 Describe the effects of sky noise on electronic fixing.					
	General Objective: 4**.0 Know the various methods of measuring depths**.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Depth Measurements 4.1 Describe the methods of depth measurement by using the leadline and sounding pole. 4.2 Use the echo-sounder in depths measurement. 4.3 Describe different types of echo-sounders. 4.4 Describe how to calibrate echo-sounders. 4.5 List the accuracies attainable with various methods of depth measurements. 4.6 List causes of false					

	echoes and how they can be avoided. 4.7 Explain the methods of sweeping and diving to supplement soundings to detect pinnacle obstructions dangerous to navigation.					
	General Objective: 5.0 Understand the tidal phenomenon and determination of mean sea level.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Tidal Phenomenon and Mean Sea Level. 5.1 Describe the relevance of tide to hydrographic surveying. 5.2 Prove mathematically that the tide generated by the forces of moon and sun varies inversely as the cube of the distance from the earth. 5.3 Draw suitable diagrams to elaborate the equilibrium theory of the tide. 5.4 Construct tide curves graphically by suitably combining some pure trigonometrical curves.					

	5.5 Show how fourier series is adopted for the analysis and prediction of tides. 5.6 Extract necessary information from tide tables. 5.7 Compare the suitability of tide poles and automatic tide guages. 5.8 Explain the methods of determination of means sea level from continuous tidal observation for a number of years, say 19 years.					
	General Objective: 6.0 Know the methods of staff guage measurements.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Staff Guage Measurements 6.1 Describe the uses of staff guage.					

	6.2 Explain the necessity of multiple staff guages. 6.3 Operate automatic recorders. 6.4 Explain the reduction of water level to either land levelling datum (M.S.L.) or tidal datum.					
	General Objective: 7.0 Know how to measure currents and flow rates.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Currents and Flow Rates 7.1 Describe the working principle of the current meter. 7.2 Explain the necessity of a rating curve. 7.3 Use a cableway in current measurements. 7.4 Describe other methods of flow measurements. 7.5 Mention factors affecting discharge measurements.					
	General Objective: 8.0 Know the various applications of hydrography.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	Application of Hydrography 8.1 Explain the use of hydrography in estimating the capacity of lakes and reservoirs. 8.2 Describe how it can be applied to monitor the rate of sedimentation of a reservoir. 8.3 Explain its uses in shipping industry, petroleum-gas explorations, port management, fishing, water supply, irrigation, river channel improvement, hydropower dams, etc.					

FIELD ASTRONOMY III

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Field Astronomy III			**COURSE CODE:** SUG 303		**CONTACT HOURS: 7**5 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand methods of timing observations with stop-watch and chronometer.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning**	**Specific Learning Objective**	**Teachers Activities**	**Learning**

			Resources			**Resources**
	Timing with Stop-Watch and Chronometer 1.1 Describe the method of timing observations with stop-watch and chronometer. 1.2 Compare the chronometer with radio time-signals using a stop-watch. 1.3 Convert UTC values (from the time-signal) to UT values using bulletin values of DUT.			1.1 Determine the azimuth of a line by hour-angle method of E-W stars near elongation. 1.2 Determine the latitude of a station by circum-meridian altitude of N & S stars. 1.3 Determine latitude and longitude of a station by timed altitudes of quadrantal starts (Astro-fix).		
	General Objective: 2.0 Understand the basis of determination of azimuth by hour-angle of E-W stars near elongation.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Determination of Azimuth by Hour-Angle of E-W Stars near Elongation					

	2.1 State the cot formula for A in terms of latitude, declination and hour-angle. 2.2 Deduce the full-circle value of A from the value of cot A. 2.3 Prove that the error in A caused by an error in altitude is given by; SA=SinA. tanh Sϕ for hour angle observations and show that the effect of an error in latitude is minimised by meaning E-W observations paired for latitude. 2.4 Establish the optimum range of altitude appropriate to the hour-angle method. 2.5 Evaluate the effect on A of an error in UT and hence establish the need for accurate timing and correcting for DUT. 2.6 Select E-W stars near elongation using the formula for elongation azimuths and at suitable altitudes for hour-angle observations.					

	General Objective: 3.0 Know how to observe and compute azimuth by hour-angle of E-W stars.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Observation and Computation Of Azimuth 3.1 Select an E-W star at approximately 15'/30' altitude. 3.2 Observe a preliminary round. 3.3 Identify the star in the field. 3.4 Take at least 4 rounds of observations to each identified E-W star pairing for altitude. 3.5 Process field observation. 3.6 Verify that the means of E-W azimuths pairs fall within a range of 10". 3.7 Convert the final true bearing to MTM or UTM bearing.					
	General Objective: 4.0 Understand how to use the polynomial coefficients for the sun contained in the star almanac.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	The use of Polynomial Coefficients 4.1 Explain how to compute the interpolating factor x from the UT observation. 4.2 Compute O declination and E from the polynomial using the tabulated monthly coefficients. 4.3 Write and use a computer program for computing O declination and E using the polynomial coefficients.					
	General Objective: 5.0 Understand the basis of the determination of latitude by circum-meridian altitudes of North and South Stars.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Latitude by Circum-Meridian Altitudes 5.1 State the basic formula					

	for latitude in terms of the N and S Meridian altitudes and N and S declinations. 5.2 Explain how an accurate latitude can be obtained from observations to N and S stars taken on one face only. 5.3 Explain the basic concept of the method i.e. to use a series of circum-meridian observations to obtain a refined value of meridian altitude. 5.4 Prove the formula for the reduction of circum-meridian altitudes to meridian altitude. 5.5 Demonstrate that the timing of circum-meridian altitudes to 1 sec suffices to give meridian altitude values accurate to 1" 5.6 Justify a suitable observing procedure for the N-S pair - all observations on FL: UT to 1 sec; vertical angles to 1", observations say, 5 minutes before and 5					

	minutes after transit (say, 10 observations before 10 after transit); pressure and temperature readings. 5.7 compute the UT of transit of any given star to an accuracy of 0.1 sec in UT by first computing the R.A. corresponding to transit at a given (precise) UT e.g. $18^h\ 00^m\ 00.0^s$ 5.8 Convert a series of timed circum-meridian altitudes to meridian altitudes using the factors A and M tabulated in the star almanac.					
	General Objective: 6.0 Know how to prepare a programme for circum-meridian observations to pairs of N-S stars.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Programme for Circum-Meridian Observations 6.1 Compute the ranges of R.A. and declination for					

	N and S stars to transit at a given station on a given date within the optimal range of altitude and observing period i.e. between altitude 30^o and 45^o approximately and within the chosen period. 6.2 Make a tabulation of N and S star almanac stars transiting within the optimal altitude range and time period under the following headings: star No; magnitude; R.A.; declination; UT of transit (nearest minute): transit altitude (nearest degree). 6.3 Select from the tabulations pairs of N and S stars balanced for altitude with suitable times of transit to allow observation of each star for 5 minutes before and 5 minutes after transit. 6.4 Compute for each selected N-S pair the UT of transit accurate to 1 sec and the meridian					

	altitude accurate to 1'.					
	General Objective: 7.0 Know how to make the observations and computations needed to determine latitude by circum-meridian altitudes of N-S stars			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	7.1 Orient the theodolite horizontal circle on true north e.g. using known bearing and picking up the first star of a N-S pair some 10 minutes before transit using the tabulated altitude to locate the star. .2 Make about 10 observations before transit and 10 after transit, all on FL - time to 1 sec. altitude to 1", occasional barometer and thermometer readings. 7.3 Reduce the vertical circle reading. 7.4 Apply the correction to the circum-meridian altitude to obtain separate values of meridian altitude. 7.5 Correct the mean meridian altitude for					

	refraction as precisely as possible rejecting any anomalous members of the separate values before taking the mean. 7.6 Compute latitude from the basic formula using the N and S meridian altitude obtained as described and the N and S declinations extracted from the star almanac as precisely as possible (or from the apparent places of fundamental stars, if available).					
	General Objective: 8.0 Understand the basis of the determination of longitude by ex-meridian altitudes of east and west stars.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Determination of Longitude 8.1 Prove the basic formulae:					

	cost = sinh. Secϕ secδ - taϕnϕ. tanδ λ = t+RA - (UT+R) 8.2 Prove that the effect on the value of longitude of an error in h is a minimum when the star is on the prime vertical. 8.3 Show that an error in longitude caused by an error in h has opposite signs for E and W stars and hence that refraction errors tend to cancel from the mean of balanced E-W observations taken within a short time of each other. 8.4 Evaluate the required accuracy in h to get t (and hence longitude) accurate to 0.1 sec in Nigerian latitude at various displacements from the prime vertical. 8.5 Prove that the effect on the value of the longitude of an error in assumed latitude is a minimum when the star is on the prime vertical. 8.6 Compute the allowable					

	error in ϕ to get t (and therefore longitude) accurate to O.1 sec, for various displacements from the prime vertical. 8.7 Show that the effect of an error in ϕ will not generally cancel from the mean of E and W observations and therefore that a good value of ϕ is needed.					
	General Objective: 9.0 Know how to select pairs of E-W stars for longitude determination.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Selection of Pairs of E-W Stars 9.1 Show that on the prime vertical: $\sin\delta = \sin\phi.\sin h$ and hence how to compute the range of declination for stars to cross the prime vertical within the altitude range 20^o - 45^o. 9.2 Show that on the prime vertical: $\cos t = \cot\delta \tan\delta$ and hence how to compute values of t for stars crossing the prime					

	vertical at the extremes of the declination range and, using these values of t, how to deduce ranges of RA for prime vertical observations for the chosen period. 9.3 Use the computed ranges of declination and RA to select suitable E-W pairs.					
	General Objective: 10.0 Know how to make the observations and computations needed to determine longitude from timed altitudes of E-W stars.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Observations and Computation of Longitude 10.1 Orient the horizontal circle on a known bearing using the predicted values of azimuth and altitude to pick up first star of a pair. 10.2 Observe a preliminary round 10.3 Identify the star by programmed calculator (not needed if following a definite star					

	programme). 10.4 Make observations of E and W stars - at least 4 FL then 4 FR precise vertical angles timed to O.1 sec. UT: pressure and temperature readings. 10.5 Compute longitude for each star from mean altitude and mean UT of observation. 10.6 Take mean of E and W values to obtain the final longitude.					
	General Objective: 11.0 Understand the basis of the simultaneous determination of latitude and longitude by timed altitudes of quardrantal stars (astro-fix).			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Simultaneous Determination of Latitude and Longitude					

	11.1	Draw a diagram showing the relationship between the zenith distances to a star from an assumed zenith and from the actual (observed) zenith and the increments in latitude and longitude from the assumed to the actual zenith.					
	11.2	Derive the equation relating the increments in latitude and longitude to the difference between the observed(ho) and calculated(hc) altitudes: CosA.x+ sinA.y = ho - hc where x = $\delta\phi$,y =$\delta\lambda$ cos ϕ;					
	11.3	Explain the need for an additional (unknown) term E, to allow for a systematic error in observed altitudes e.g. collimation error due to taking observations on one face only, so that the equation becomes: x.cosA+y sinA+E = h_o - $h_{c.}$					
	11.4	Define `Quadrantal star'					

	11.5 Explain (i) how, by observing a pair of balanced stars in diagonally opposite quadrants in succession, the term E is eliminated when subtracting one equation from the other, leaving an equation in two unknowns x and y. Therefore by taking observations to four quadrantal stars diagonally balanced for altitude, diagonally-opposite stars in succession (to minimise changes in refraction error) two such equations are obtained from which x and y can be obtained. (ii) how the use of quadrantal stars ensures large rise to strong values of the coefficients in the two final equations giving rise to strong values of x and y. 11.6 Prove the formulae used to obtain h_c: $t = UT + R + \lambda - RA$ $\sinh_c = \sin\delta.\sin\phi+\cos\delta$					

	cosϕ.cost and the formulae used to compute sinA and cosA; sinA = -coso.sint.sech; cosA = cos(sin-1 (sinA).					
	General Objective: 12.0 Know how to make the observations and computations to determine latitude and longitude by timed altitudes of quadrantal stars.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Observations and Computations of Latitude and Longitude 12.1 Select a pair of quadrantal stars in diagonally opposite quadrants balanced for altitude and in the altitude range 35º - 45º. 12.2 Make a preliminary round of observation into each star. 12.3 Identify with a programmed calculator to ensure both stars are in the stars almanac. 12.4 Take a set of precise					

	vertical circle readings to each star, all on FL and timed to 0.1 sec. 12.5 Read barometer and thermometer (say, sets of 5 readings per star). 12.6 Repeat these observations in 12.4 and 12.5 a pair of identified stars in the other two quadrants (balanced for altitude). 12.7 Compute the mean vertical angle. 12.8 Correct for refraction to obtain the mean altitude of each star to the nearest 1". 12.9 Compute the mean chronometer time. 12.10 Convert to UTC using a recent radio time - signal comparison 12.11 Convert to UT by applying DUT. 12.12 Compute t,hc.sinA and cosA for each star and then (h_o - h_c) for each star to the nearest 1" using good assumed values of latitude and longitude. 12.13 Write down the					

	equations corresponding to quadrants 1,2,3,4. 12.14 Obtain the two equations in x and y, only, by taking (1 minus 3) and (2 minus 4). 12.15 Solve the equations to obtain x and y. 12.16 Compute $\delta\phi$ and $\delta\lambda$. 12.17 Apply the differentials to the assumed values to obtain the final latitude and longitude. 12.18 Write computer programs for the main computations for the determination of (i) latitude from circum-meridian altitudes of N-S Stars (ii) longitude from timed altitudes E-W stars (iii) latitude and longitude by timed altitudes of quadrantal stars, using the following guidelines: Write out all formulae involved in form adapted to calculator programming;					

	specify all quantities to be stored and their store addresses distinguishing between invariants, variable (observed) quantities, evaluated and stored during the running of the program; when capacity is limited, a given store may be used for a second variable quantity once the first variable has been utilised.					

MATHEMATICS AND PHYSICS COURSES
(MTH, 312, SUG 311 and SUG 312)

MATHEMATICS FOR SURVEYORS

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS		
COURSE: Mathematics for Surveyors	**COURSE CODE:** MTH 312	**CONTACT HOURS:** 15 Hours
Course Specification: Theoretical Contents		**Practical Content**
General Objective: 1.0 Understand further concepts in spherical trigonometry.		**General Objective:**

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	Spherical Trigonometry 1.1 Derive the expression for the area of spherical triangle $A=E\ r_2$ where E = spherical excess 1.2 Explain the concept of polar triangle. 1.3 Relate the angles of the polar triangle to those of the spherical triangle to which it is polar. 1.4 Derive formulae for the solution of right-angle triangles. 1.5 Explain Napier's rules. 1.6 Prove formulae connecting half-angles and half-sides. 1.7 Prove Delambre's analogies. 1.8 Use the various results in spherical trigonometry to solve problems in field astronomy and geodesy					
	General Objective: 2.0 Know the use of 3-dimensional cartesian coordinates.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	3-Dimensional Cartesian					

	coordinates 2.1 Define right-handed orthogonal axes OX, OY, OZ. 2.2 Derive an expression for the length of the line joining (X_1, Y_1, Z_1) and (X_2, Y_2, X_2) 2.3 Define the direction cosines (l,m,n,) of a straight line. 2.4 Prove that $l^2+m^2+n^2 = 1$ 2.5 Prove that the equation of the plane making intercepts a,b,c, on the axis is k/a+y/b+z/c = 1 2.6 Prove the perpendicular form of the equation of a plane lx + my + nz = p 2.7 Prove that the equation of the straight line through (x_1,Y_1,z_1) having direction cosines l,m,n, is given by: (X-x_1/l = (y-y_1)/m = (z-z_1)/n. 2.8 Prove that the equation of the straight line through (x_1,Y_1,z_1) and (x_2,y_2,z_2) is: (x-x_1)/(x_1-x_2) = (y-y_1)/(Y_1 - Y_2) = (z-z_1)/(z_1-x_2)					

	2.9 Prove that the angle a between two straight lines is given by: cos a = $I_1 I_2 + m_1 m_2 + n_1 n_2$ Where I_1, m_1, n_1 and l_2, m_2, n_2 are the direction cosines of the two lines. 2.10 Explain the relationships between cartesian coordinates in 3-dimensions and conventional geodetic coordinates (latitude, longitude and height above spheroid) when the cartesian axes are suitably chosen in relation to the spheroid.					
	General Objective: 3.0 Understand angular motion and its application to gyroscopic measurements of bearing.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Gyroscopic Measurements of					

	Bearing 3.1 Explain the resolution of angular velocity into components. 3.2 Resolve components of the earth's angular velocity at a given latitude about the horizontal line in the plane of the meridian and about the vertical. 3.3 Resolve the components of earth's angular velocity acting on a gyroscope along the three axis; gyroscope axis being in the horizontal plane at a given latitude 3.4 Work out the equation for damped harmonic motion of the oscillations of a horizontally-constrained gyroscope about the meridian.					

TERRESTRIAL AND PLANETARY PHYSICS

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS			
COURSE: Terrestrial and planetary Physics		**COURSE CODE:** SUG 311	**CONTACT HOURS:** 60 Hours
Course Specification: Theoretical Contents		**Practical Content**	
	General Objective: 1.0 Understand simple harmonic motion and other	**General Objective:**	

	modes of oscillation.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Simple Harmonic Motion and Other Modes of Oscillation 1.1 Describe simple harmonic motion. 1.2 Show experimentally that for simple harmonic motion the acceleration is - w^2y where y is the displacement from the centre and w is the equivalent angular velocity in the circle. 1.3 Show experimentally and mathematically that the period of the simple harmonic motion is given by T = 2 and the frequency by f = 1 hertz. 1.4 Distinguish between free and damped oscillations experimentally and otherwise. 1.5 Explain with the aid of an experiment the interchange between					

	potential energy and kinetic energy in simple harmonic motion. 1.6 Explain the meaning of 'phase' of vibration. 1.7 Identify the mechanical and electrical modes of oscillation as means of wave propagation. 1.8 Explain the phenomenon of resonance. 1.9 Derive wave length, frequency and phase of wave-motion. 1.10 Explain the mathematical relation between wave length, frequency and velocity of waves. 1.11 Explain the Doppler effect.					
	General Objective: 2.0 Understand atmospheric pressure and altimetry			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Atmospheric Pressure and					

	Altimetry 2.1 Define (a) isothermal atmosphere (b) lapse-rate. 2.2 Derive (a) isothermal formula (b) lapse-rate formula for variation of pressure with height. 2.3 Use the isothermal and lapse-rate formulae in altimetry. 2.4 Explain how air temperature and humidity affect atmospheric pressure. 2.5 Explain the principle of the psychrometer. 2.6 Use the psychrometer accordingly. 2.7 Describe the modern standard (Fortin-type) barometer. 2.8 Describe the working principles of the aneroid barometer. 2.9 Distinguish between 'direct reading' and 'indirect reading' of aneroid barometer. 2.10 Describe the essential					

	features of the surveying aneroid used in precise altimetry. 2.11 Determine the altitude of various given heights using the surveying aneroid.					
	General Objective: 3.0 Understand atmospheric refraction.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Atmospheric Refraction 3.1 Define atmospheric refraction 3.2 Explain how refractive index varies with height 3.3 Derive a formula for 'celestial refraction' by considering refraction at successive layers of the atmosphere. 3.4 Describe the curvature of a horizontal ray of light in an atmosphere in which dn/dh is a constant. 3.5 Derive the formulae for vertical refraction for: (i) horizontal rays (ii) inclined rays 3.6 Evaluate refraction in					

	given cases.					
	General Objective: 4.0 Understand Kepler's Laws of planetary motion.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Kepler's Laws of Planetary Motion 4.1 Define planet 4.2 Describe the various planets in our solar system. 4.3 Classify the planets in our solar system in their two basic groupings, i.e. terrestrial and jovian planets. 4.4 Define satellites. 4.5 Explain Kepler's laws of planetary motion 4.6 Describe the methods of verifying Kepler's laws. 4.7 Show that Kepler's third law is consistent with the inverse square law for the force of gravity. 4.8 Deduce Bode's law from Kepler's third law 4.9 Describe Newton's deductions from Kepler's laws.					

	General Objective: 5.0 Understand Newton's Law of Gravitation.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Newton's Law of Gravitation 5.1 Define gravitation 5.2 Describe the gravitational attraction on the earth's surface. 5.3 Explain the Newton's law of universal gravitation. 5.4 Show that the gravitational force F exerted between two particles with masses m_1 and m_2 separated by a distance d is given by equation $F = G m_1 m_2/d^2$ where G is called the constant of gravitation. 5.5 Explain that bodies having spherically symmetrical distribution of mass attract each other as if all their mass were concentrated at their respective centre. 5.6 Prove that an object moving with velocity v					

	in a circle of radius r has an acceleration of v^2/r towards the centre. 5.7 Show that the force exerted by the earth on a small mass m near the earth's surface is given by $F = GE\ M/R^2$ and the acceleration of gravity on the earth's surface is given by $g = GE/R^2$ where E is the mass of the earth and R the spherically symmetrical radius. 5.8 Explain how the gravitational constant, G, is determined. 5.9 Show that Galileo's experiment confirms that G is a constant.					
	General Objective: 6.0 Understand planetary motions.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Planetary Motion					

	6.1 Explain the planetary configurations. 6.2 Explain what is meant by 'inferior conjunction' and 'superior conjunction'. 6.3 State the elements of planetary orbits for the various planets e.g. symbol, mean distance, sidereal period of revolution, synodic period, mean velocity, eccentricity, inclination, etc. 6.4 Illustrate the relationship between the apparent motion of a planet in relation to the orbital motion of the earth. 6.5 Deduce the true orbital motion of the planet in 6.4 above from the apparent motion of the planet in relation to the orbital motion of the earth. 6.6 Describe the elliptic motion of the various planets both geometrically and analytically.					

	6.7 Illustrate the seven orbital elements. 6.8 Explain how to determine the orbital elements in 6.6. above. 6.9 State the physical elements of the various planets, e.g. equatorial radius, ellipticity volume, mass, density, escape velocity, rotation period, inclination of axis, etc. 6.10 Illustrate the relationship between the mass of a planet, the mean distance of its satellite's orbit and its period of revolution. 6.11 Define perturbation in relation to planetary motion. 6.12 Explain the relationship between the mass of a planet and the perturbations it causes in the motions of other planets, comets and space probes. 6.13 Show that the surface gravity of a planet, $g=m/r^2$ and its mean					

	density relative to the earth, $P=m/r^3$ where m is the mass and r the radius of the planet respectively. 6.14 Define a projectile. 6.15 Show that the escape velocity V_1 that permits a projectile to leave the planet on a parabolic orbit is represented by $\sqrt{1}= (2Gm/r)^{1/2}$ 6.16 Describe the motion of a ballistic missile under gravity both geometrically and analytically. 6.16 Describe the four methods of determining the period of rotation of a planet along its axis.					
	General Objective: 7.0 Understand Satellite motions.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Satellite Motions					

	7.1 Describe satellite in relevance to astronomy. 7.2 State the early history of the satellites. 7.3 Describe the satellites distribution to the various planets in our solar system. 7.4 Explain the nature of these satellites. 7.5 Describe the motions of these satellites. 7.6 Illustrate the surface gravity of most of these satellites geometrically and analytically. 7.7 Relate the surface gravity of some of these satellites to their atmospheric density. 7.8 State the atmospheric composition and depth as well as surface temperature of some of these satellites. 7.9 Illustrate the perturbations that exist between the various planets and their attendant satellites. 7.10 Describe an artificial satellite. 7.11 Explain the uses of					

	artificial satellites, i.e. space probe, meteorological investigation, communication, earth resources survey, geodetic survey, pollution detection, military surveillance, space research, navigation, nuclear test research, etc. 7.12 Enumerate the differences between a celestial satellite and an artificial satellite. 7.13 Explain the fundamental rules of satellite motion. 7.14 Describe the movement of an artificial satellite from its launching pad to its orbit. 7.15 Illustrate the nature of a satellite's orbit. 7.16 Compute the velocity required to launch an artificial satellite into a circular orbit. 7.17 Show that further increment in this circular velocity will send the satellite into					

	elliptical, parabolic and hyperbolic orbit respectively. 7.18 Prove that the relationship between circular velocity and escape velocity is expressed by $V_{escape} = 2\ 1/2\ V_{circular}$. 7.19 Derive the formula for the velocity of the satellite in its orbit and the area swept out by radius vector in unit time. 7.20 Explain geo-stationary satellites. 7.21 Outline how satellites are used for terrestrial position fixing 7.22 Calculate the radius of the circular geo-stationary orbit of an artificial satellite. 7.23 Explain the phenomenon of 'weightlessness' 7.24 Solve simple problems in orbital and ballistic motion.					
	General Objective: 8.0 Know the structure, composition, and physical and chemical properties of the planets of the			**General Objective:**		

	solar system and their atmosphere and immediate cosmic environment.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Planetary Physics 8.1 Explain the historical and the scientific postulations about the origin of the condensed celestial bodies namely: planets, planet-like companions, and white dwarf stars. 8.2 State the characteristics of stellar bodies 8.3 Describe the characteristics of stars and planetlike companion bodies. 8.4 Show that the planets are not stellar bodies. 8.5 Explain why certain planets are called terrestrial planets and others called jovian planets enumerating their physical characteristics. 8.6 Relate the differences in the two classes of planets to their evolutionary history.					

	8.7 Explain how the characteristics of planetary interiors are deduced. 8.8 Illustrate the planetary interiors of the various planets in our solar system stating their chemical composition. 8.9 Explain how physical and chemical properties of planetary surfaces are determined. 8.10 State the physical and chemical properties of the various planetary surfaces. 8.11 State the surface temperatures of the various planets. 8.12 Explain the relationship between planetary surface temperature and their rotations. 8.13 Describe how the surface temperatures of the various planets are measured. 8.14 Show that these planets have an internal heat source. 8.15 Describe the three main					

	components of the electromagnetic radiation that emanate from a planet namely: (a) Planetary brightness (b) Thermal radiation (c) Non-Thermal radio emission 8.16 Explain the relationship between atmospheric gravity and surface temperatures. 8.17 State the principal constituents of the atmosphere of the various planets. 8.18 Describe how to investigate the nature and constituents of the various planetary atmospheres. 8.19 Prove that atmospheric motions are driven by temperature gradients. 8.20 State the effect of atmospheric motions on reducing the temperature differences along a planetary surface.					

	8.21 Explain how the solar radiation that gets to a planetary surface is affected by the planets atmospheric density and depth. 8.22 Explain the relationship between the constituents of the various planetary atmospheres and their climatic conditions. 8.23 Describe how the atmospheres of the terrestrial planets have modified their surface structure and rearranged the distribution of their surface materials. 8.24 Show that the existence and duration of an atmosphere depends on the escape rate of its components. 8.25 Prove that for a molecule escaping from a planetary atmosphere, $V_t = (3KT/u)^{1/2}$ provided $V_e = 5Vt$ where V_e is escape velocity V_t is thermal velocity, T is temperature in absolute degree, u is molecular					

	mass, and K is Boltzmann constant. 8.26 Illustrate the magnetic field and radiowave emmission of the various planets. 8.27 Describe how they have been deduced.					
	General Objective: 9.0 Understand the phenomenon of terrestrial tides.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Terrestrial Tides 9.1 Define terrestrial tides 9.2 Explain the relationship that exist between perturbations which exist between the various celestial bodies and the tidal movements on the planetary surfaces. 9.3 Show that the tide generating forces on the earth arise mainly from the gravitational action of the sun and the moon. 9.4 Illustrate the stresses that these tidal forces generate in all parts of					

		the earth including the solid earth, ocean and atmosphere.					
	9.5	Relate these earth's rotation to the alternating character of the periodicities of these tidal movements.					
	9.6	Relate these tidal movements to air movement and ocean currents.					
	9.7	Relate the difficulty in tidal prediction to the complicated shape of the ocean basins.					
	9.8	Describe the harmonic methods for determining tidal frequencies.					
	9.9	Explain the convolution method of tidal analysis and prediction.					
	9.10	Show that the magnitude of the lunar attraction on the earth's surface is proportional to the inverse square of the distance between the Moon's centre and the particle.					
	9.11	Show that the tide-generating force is proportional to the mass					

	of the disturbing body (Moon) and to the inverse cube of its distance. Prove that the tide-generating force, 9.12 $F = 3/2 \frac{CYMr^2}{C^3} (1/3 - \cos^2\lambda)$ where λ is the zenith distance of the moon, r is distance from the earth's centre, C is the distance between the centres of earth and moon, r is the gravitational constant and M is the mass of the Moon. 9.13 Show that elevation on Earth's surface due to tidal effects is given by B= -4/g + const where 4/g is 9 evaluated at the earth's surface and g is the acceleration of the Earth's gravity. 9.14 Explain the harmonic development of the tide. 9.15 Show that the equilibrium tide, $B = 3/4 (\ ) Ma^2/gc^3 [(3\sin^2 D-1) (\cos^2 - 1/3)$					

	+ $Sin^2D\ Sin^2O\ Cos\ (\propto + \partial) + Cos^2\ D\ Sin^2O Cos^2 (\propto + \partial)$ where O is co-latitude and ϕ is east longitude of a point on the Earth's surface, D the declination, and is west hour angle recorded from Greenwich of the moon. 9.16 Explain the nature of and the differences between long-tide, diurnal tide, and semi-diurnal tide. 9.17 Prove that the equilibrium tide is a summation of long-tide, diurnal tide, semidiurnal tide. 9.18 Prove that the equilibrium tide vary harmonically with time. 9.19 Illustrate the effect of the ellipticity and other irregularities of the lunar orbit on tidal waves. 9.20 Show that the solar tide is developed the same					

	way as the lunar tide. 9.21 Prove that the equilibrium tide at any place is the sum of both the solar and lunar tide. 9.22 Explain the reasons for the deviations between the tides in the ocean and equilibrium tide. 9.23 Show that ocean tides are sinusoidal. 9.24 Explain how the amplitude, wavelength, frequency and range of ocean waves are determined. 9.25 Explain the use of corange and cotidal charts and how they are made. 9.26 Explain how the principle of statics can be used to describe the bodily tide of the solid earth in contrast to tides in the oceans and atmosphere. 9.27 Relate the above principle of statics of periodic changes in gravity experimentally.					

	9.28 Relate oscillatory variation in atmospheric pressure at any place to atmospheric tidal changes experimentally. 9.29 Illustrate how to predict luni-solar tide. 9.30 Explain what is meant by tidal friction. 9.31 State the consequences of tidal friction.					

PHYSICAL OPTICS, ATOMIC AND NUCLEAR PHYSICS

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS			
COURSE: Physical Optics, Atomic and Nuclear Physics		**COURSE CODE:** SUG 312	**CONTACT HOURS:** 75 Hours
Course Specification: Theoretical Contents		**Practical Content**	
	General Objective: 1.0 Understand the nature of waves.	**General Objective:**	

WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Light Waves 1.1 Explain what is meant by wave motion. 1.2 Explain the importance of side-wave in physical optics. 1.3 Write equation of wave motion. 1.4 Write down the solution of wave equation. 1.5 Explain the terms: (i) phase (ii) phase difference. 1.6 Define (i) phase velocity or wave velocity (ii) intensity (iii) amplitude 1.7 Explain when it is appropriate to think of light as consisting of waves and when as consisting of rays. 1.8 Calculate the velocity, frequency and amplitudes of waves using					

	$V = f\lambda$ where V = Velocity f = Frequency λ= Wavelength 1.9 Describe properties of waves such as: (i) reflection (ii) refraction (iii) diffraction (iv) polarization 1.10 Explain wave packets 1.11 Determine the velocity of light by various methods (i) Romer's (ii) Fizeau's (iii) Michelson's					
	General Objective: 2.0 Understand the principle of superposition of waves.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Superposition of Waves 2.1 Add simple sinusoidal waves 2.2 Explain the superposition of many waves with Random phases. 2.3 Describe complex waves					

	2.4 Explain the use of Fourier Analysis in resolving complex wave patterns into simple components. 2.5 Explain group velocity.					
	General Objective: 3.0 Understand the interference phenomenon of waves.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Interference of Two Beams of Light 3.1 State Huygen's Principle 3.2 Explain coherent sources 3.3 Explain the principles of Young's slit experiment. 3.4 Measure wavelength of light using Young's double slits. 3.5 Describe intensity distribution in fringes system. 3.6 Explain the principle of Fresnel's Biprism. 3.7 Differentiate between functions of Loyd's mirror and Fresnel's mirror.					

	3.8 Describe Michelson's interferometer. 3.9 Differentiate between circular fringes and localized fringes 3.10 Describe white light fringes. 3.11 Explain visibility of fringes. 3.12 Describe the measurement of lenths using interferometer. 3.13 Explain the working of layman and green interferometer. 3.14 Explain the determination of index of refraction using interferometer. 3.15 Determine the wavelength of light if given the width of the fringe on the screen when a plane light falls on Fresnel's mirrors with an angle between them. 3.16 Explain why in Michelson's interferometer using yellow sodium line composed of two wavelengths, the						

	interference pattern varnished periodically when there is a translational displacement of one of the mirrors. 3.17 Describe reflection from a place-parallel film 3.18 Identify fringes of equal inclination. 3.19 Explain interference in transmitted light. 3.20 Explain fringes of equal thickness 3.21 Explain Newton's rings 3.22 Derive an expression for intensity function 3.23 Describe chromatic resolving power 3.24 Compare wave lengths using interferometer. 3.25 Explain channeled spectra (interference filter).					
	General Objective: 4.0 Understand diffraction of waves.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Fraunhofer Diffraction					

	4.1 Explain the term diffraction 4.2 Explain the relationship between Fresnel and Fraunhofer diffraction. 4.3 Explain diffraction by a single slit. 4.4 Explain chromatic resolving power of a prism. 4.5 Explain resolving power of telescope. 4.6 Explain brightness and illumination of star images. 4.7 Calculate resolving power of microscope. 4.8 Explain phase constrast. 4.9 Write equation for the intensity. 4.10 Explain the difference between single- slit and double-slit patterns. 4.11 Differentiate between interference and diffraction. 4.12 Explain position of the maxima and minima (missing orders) 4.13 Explain effect of finite of source slit. 4.14 Explain the effect of					

	increasing the numbers of slits. 4.15 Describe intensity distribution from an ideal grating. 4.16 Explain principal maxima 4.17 Differentiate between minima and secondary minima. 4.18 Explain formation of spectra by a grating. 4.19 Determine experimentally wave length of light with grating.					
	General Objective: 5.0 Understand scattering and absorption of light.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Absorption and Scattering 5.1 Differentiate between absorption and scattering. 5.2 Explain absorption by solids and liquids. 5.3 Describe absorption by gases. 5.4 Explain selective reflection (Residual					

	way). 5.5 Explain the relationship between absorption and reflection. 5.6 Describe scattering by small angle. 5.7 Explain theory of scattering. 5.8 Explain molecular scattering (blue colour of sky). 5.9 Explain the terms scattering index and refractive index.					
	General Objective: 6.0 Understand dispersion of light waves.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Dispersion 6.1 Explain the effects of absorption on dispersion. 6.2 Explain dispersion curve of a substance. 6.3 Derive the electromagnetic equations for transparent media. 6.4 Explain theory of dispersion.					

	6.5 Describe the nature of vibrating particles, and fractional forces.					
	General Objective: 7.0 Understand Polarization by reflection.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Polarization of Light 7.1 Explain polarization by reflection 7.2 Explain polarization angle and Brewster's law. 7.3 Explain polarization by a pile of plates. 7.4 Define law of Malus. 7.5 Explain polarization by dichromatic crystals. 7.6 Explain double refraction 7.7 Describe refraction by calcite prism. 7.8 Explain polarization by scattering. 7.9 Calculate: (a) the reflection coefficients (b) the degree of polarization of the reflected light using Fresnel equations when natural light falls at					

	Brewster angle on the surface of glass. 7.10 Construct, using Huygen's principle, wavefronts and the propagation directions of ordinary and extra ordinary rays in a positive uniaxial crystal whose optical axis: (a) is perpendicular to the incidence plane and parallel to the surface of the crystal. (b) lies in the incidence plane and parallel to the surface of the crystal.					

PHOTOGRAMMETRY AND REMOTE SENSING COURSES
(GIT 301 AND 403)

PHOTOGRAMMETRY AND REMOTE SENSING

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS		
COURSE: Photogrammetry and Remote Sensing	**COURSE CODE:** GIT 301	**CONTACT HOURS:** 75 Hours

Course Specification: Theoretical Contents				Practical Content		
	General Objective: 1.0 Understand the non-geometrical characteristics of aerial photograph as applied to image interpretation.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Non-Geometrical Characteristics of Photography 1.1 Describe the seven main characteristics of photo/ imagery that are recognised and utilised in interpretation e.g. tone, shadow, texture and other relevant ones. 1.2 Explain the application of the seven main characteristics of photo/ imagery to interpretation. 1.3 Comment on the efficacy of the method.			1.1 Compute scale of vertical photograph over a flat terrain. 1.2 Compute scale of vertical photograph over variable terrain at different points. 1.3 Compute average scale of vertical photograph over variable terrain. 1.4 Compute ground coordinates of a point on a vertical photograph. 1.5 Compute relief displacement. 1.6 Compute flying height of a photo. 1.7 Carryout photo interpretation with pocket and mirror stereoscope and parallax bar. 1.8 Determine parallax using stereoscope and parallax bar. 1.9 Compute elevation using parallax differences.		

				1.10 Carryout inner, relative and absolute orientations on a compete model. 1.11 Carry out aerial triangulation adjustment. 1.12 Carryout compilation of part of a map sheet using available stereoplotter.		
	General Objective: 2.0 Understand the procedure of photo-Interpretation.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	System of Photo-Interpretation 2.1 Identify the three main phases of photo-interpretation e.g. general examination, identification and classification. 2.2 Explain each of the phases. 2.3 Point out the deciding factors for the choice of suitable interpretation method. 2.4 Describe the basic equipment for photo-interpretation. 2.5 Relate the significance of the three phases to effective photo-					

	interpretation.					
	General Objective: 3.0 Recognise interpretation as a separate phase in photogrammetric mapping.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	The Place of Interpretation in Photogrammetric Mapping 3.1 Explain the terms topography and topographic map. 3.2 Distinguish between natural and cultural features. 3.3 Explain the main objectives of photo-interpretation in relation to photogrammetric mapping. 3.4 Explain the method and application of pre-annotation of data to be mapped. 3.5 Compare pre-annotation method with direct interpretation efforts of					

	the operator as regards photogrammetric mapping. 3.6 State the consequences of a chosen map scale on interpretation generally.					
	General Objective: 4.0 Apply knowledge of various landforms in interpretation of their photo imageries.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Landforms & Interpretation of their Photos/Imageries 4.1 Enumerate the points for consideration during geomorphological study of an area. 4.2 Explain the terms initial landforms, sequential landforms, relief, structure, erosion, transportation, deposition and agents of erosion. 4.3 Explain the cycle of erosion. 4.4 Describe the activities of the agents of erosion. 4.5 Explain the impact of fore-knowledge of the mapping area on easy interpretation work. 4.6 Interpret features like hills, steep slopes, cliffs,					

	rock tops, desert features, glacial features, coastal features, lake, drainage patterns and man-made features.					
	General Objective: 5.0 Recognise application of photo-interpretation to other discipline			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Photo-Interpretation and Other Disciplines 5.1 Give examples of professions that utilise. 5.2 Explain the significance of photo-interpretation to these disciplines. 5.3 Differentiate between the basic requirements of each discipline for use of aerial photo. 5.4 Outline the magnitude of success achievable through this system by each professional discipline.					
	General Objective: 6.0 Understand the principles and rationale of remote sensing.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Principle and Rationale of Remote Sensing					

	6.1 Describe briefly the impact of digital computer and pattern recognition on remote sensing technology. 6.2 Give examples of three major kinds of variation in conveying remote sensing information. 6.3 Give reasons why data values from the same class are not identical but tend to cluster or group themselves around some mean value. 6.4 Illustrate what happens when data from two spectral bands in multivariate space are presented. 6.5 Sketch a block diagram of a remote sensing system explaining each component.					
	General Objective: 7.0 Understand radiation and instrumentation in remote sensing e.g. EMR, solar radiation (SR).			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Radiation and Instrumentation in Remote					

	Sensing 7.1 Define EMR, Solar radiation (SR) and radiance. 7.2 Identify the units used for measuring light-photometric units; unit used to measure radiation-radio metric units. 7.3 State the wave-length ranges for: the (i) application of the spectrum (ii) the visible region (iii) the near-infrared regions. (iv) the reflective portion of the spectrum (iv) the emissive portion of the spectrum. 7.4 Give a physical interpretation of a black body. 7.5 Name the chief mechanisms by which the atmosphere interacts with EMR indicating what happens to the incident energy in each case.					

	7.6	Define "atmospheric window"					
	7.7	Describe how a radiation-sensing instrument could detect an object of known temperature T_t in the presence of background radiation having an equivalent temperature Tb.					
	7.8	Sketch thin-lens optical stop, speed of lens, field of view and thin lens formula.					
	7.9	State the relative advantages and disadvantages of multispectral scanners (MSS) and electron images.					
	7.10	Explain the contrast between characteristics of spectral data systems and image forming systems.					
	7.11	Draw the data flow block diagram for a remote sensing data collection mission.					
	7.12	State the design parameters of the four scanner systems available giving plausible reasons					

	to account for the design differences: i. the M-7 air borne scanner. ii. the Landstat multispectral scanner iii. the skylab/spacelab iv. the thematic mapper scanner.					
	General Objective: 8.0 Understand the fundamentals of pattern recognition in remote sensing.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Fundamental of Pattern Recognition in Remote Sensing 8.1 Define the term pattern with regards to designing machine for pattern recognition. 8.2 Define training pattern in terms of the role training patterns play in classifier design. 8.3 Sketch a block diagram or model of a pattern recognition system briefly describing the function of each block in remote sensing. 8.4 List three reasons why a statistical approach is					

	appropriate in applying pattern recognition for remote sensing data analysis. 8.5 Explain how the pattern recognition system can be made to detect many of the points in the area to be classified which actually are not represented by any of the training classes. 8.6 Distinguish between parametric and non-parametric statistical pattern recognition techniques and give at least one advantage and disadvantage of each. 8.7 Differentiate between temporal and spatial pattern recognition. 8.8 Explain the terms used in the maximum-likelihood decision rule relating the statistical expressions to physical phenomena which can be observed in remote sensing. 8.9 Give reasons why it is desirable to be able to estimate the probability of error of a classifier.					

	8.10 Describe three ways of estimating the probability of error of a classifier, giving the advantages and disadvantages of each.					
	General Objective: 9.0 Understand the techniques of remote sensing from space.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Remote Sensing from Space 9.1 Explain briefly the aim of remote sensing from space. 9.2 Identify the equipment commonly used for this purpose e.g. Landsat satellites, solar satellite, and seasat satellite. 9.3 Describe the characteristics of these satellites. 9.4 Explain the use of Landsat imagery in interpretation of vegetation and land-use mapping. 9.5 Explain the use of SLAR in interpretation and mapping of land-forms.					

	9.6 Explain the working principles of Landsat satellite with special regards to data reception, processing and distribution. 9.7 Explain the application of Landsat image interpretation to the fields of agriculture, botany, cartography, civil engineering, environmental monitoring, forestry, geography, geology, geophysics, and other relevant areas. 9.8 Explain the computer aided systems of classifying Landsat data. 9.9 Define the function of seasat satellite and space shuttle. 9.10 Explain the areas of application of the imageries obtained from seasat and space shuttle.					
	General Objective: 10.0 Understand Passive microwave systems in remote sensing.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Passive Microwave System in					

	Remote Sensing 10.1 Identify the elements of passive microwave sensing. 10.2 Differentiate between active and passive microwave sensors. 10.3 List the components of a passive microwave sensor. 10.4 Show diagramatically the components of a passive microwave signal. 10.5 Describe microwave radiometer with diagrams 10.6 Explain the applications of passive microwave sensing.					
	General Objective: 11.0 Know the differences between terrestrial and aerial photography.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Terrestrial and Aerial Photography 11.1 Explain the term horizontal photography 11.2 Explain the configuration of terrestrial photography 11.3 Design ground control points in terrestrial photography. 11.4 Show the difference					

	between metric and non-metric cameras. 11.5 Distinguish between terrestrial and aerial photography.					
	General Objective: 12.0 Know the methods of data reduction in terrestrial photogrammetry.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Terrestrial Photogrammetry 12.1 Explain the analogue and analytical methods of evaluating terrestrial photogrammetry. 12.2 Enumerate the instruments used for analogue and analytical terrestrial photogrammetry. 12.3 Carry out terrestrial photogrammetry. 12.4 Distinguish between the approximate and rigorous methods of analytical terrestrial photogrammetry 12.5 State the mathematical methods for both approximate and rigorous methods. 12.6 Illustrate the data					

	reduction and processing of a rigorous solution in analytical terrestrial photogrammetry using a flow diagram.					
	General Objective: 13.0 Understand the engineering applications of terrestrial and aerial photogrammetry.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Engineering Application of Terrestrial and Aerial Photogrammetry 13.1 Explain the terrestrial photogrammetric application in: (a) deformations and small movements in buildings. (b) dimensional control of bridge under static and dynamic loads. (c) Investigation of damaged parts of roads (d) area and volume computations of earth works. 13.2 Use terrestrial photogrammetry to perform (a) to (d) in 13.1					

	above. 13.3 Explain the aerial photogrammetric applications in: (a) route selection (b) route design (c) profiling (d) earthwork computations 13.4 Use aerial photogrammetry to perform (a) to (d) in 13.3 above.					
	General Objective: 14.0 Know the differences between independent model triangulation (IMT) and analytical triangulation.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Independent Model Triangulation (IMT) and Analytical Triangulation 14.1 Describe the main features of independent model triangulation (IMT) 14.2 Explain the different phases involved in IMT, e.g. (i) preparation (ii) initial settings of					

	the instrument (iii) inner orientation (iv) relative orientation (v) setting of counters and height scale (vi) observation of points (vii) computations. 14.3 Explain the computation processes in IMT. 14.4 Describe the different phases in analytical triangulation. 14.5 Explain the computation process in analytical triangulation 14.6 Describe the instrumentation for the two methods, i.e. stereo-plotters, mono and stereo-comparators. 14.7 Give their advantages and disadvantages.					
	General Objective: 15.0 Know the general methods of adjustment of aerial triangulation.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Adjustment of Aerial Triangulation					

	15.1 Recognise the errors in aerial triangulation and their propagation 15.2 Differentiate between graphical and polynomial methods. 15.3 Describe the graphical adjustment method as applied to aerial triangulation for x, y, z, separately. 15.4 Describe the theory of adjustment by polynomials. 15.5 Apply 15.4 to aerial triangulation. 15.6 Explain the principles of least squares adjustment. 15.7 Describe its application to aerial triangulation. 15.8 State the difference between strips, model and bundle adjustment of a block.					
	General Objective: 16.0 Know the requirements of control for strips and blocks.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Control for Strips and Blocks 16.1 Explain the term					

	'buildings distance' and its importance. 16.2 Show the classical pattern of ground control for a given strip on a diagram. 16.3 Show the optimum distribution of control for a given strip. 16.4 State the effect of close planimetric control along the perimeter of a block consisting of several strips. 16.5 Differentiate between the requirement of a planimetric and vertical control for a block. 16.6 Specify the requirements of control for a given block of aerial photographs. 16.7 Analyse the accuracy tests for strip, IMT, and bundle adjustment..					
	General Objective: 17.0 Understand the principles of rectification and the uses of rectified photographs.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Principles of Rectification 17.1 Outline methods of producing rectified					

	photographs, i.e. geometric condition in a rectifier, empirical rectification of flat terrain, a fine rectification. 17.2 Compare rectified air-photographs and maps. 17.3 State the uses of rectified photographs.					
	General Objective: 18.0 Understand the principles and uses of ortho-photos.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Ortho-photos & DTM 18.1 Outline methods of producing orthophotos, i.e. partial rectification; rectification by zones, facets, interpolation, differential rectification. 18.2 Outline methods of producing contoured orthophoto maps. 18.3 Compare orthophoto maps and conventional maps (line maps). 18.4 Explain the uses of orthophotos and orthophoto maps. 18.5 Outline the principles of					

	digital terrain model. 18.6 Apply digital terrain model in geoinformatics.					

ANALYTICAL AND DIGITAL PHOTOGRAMMETRY

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Analytical and Digital Photogrammetry			**COURSE CODE:** GIT 403		**CONTACT HOURS:**	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Know the historical development of analytical and Digital Photogrammetry.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Historical Development 1.1 Describe the properties of perspective images. 1.2 Mention the application of vectors in single and double resection in space and in formulation of relative and absolute orientation. 1.3 Trace the development in Europe and USA.					

	1.4 Explain the role of electronic computer in Analytical Photogrammetry (A.P). 1.5 List the special fields of application of A.P.					
	General Objective: 2.0 Know the principles of analytical Digital Photogrammetry			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Principles of Analytical Digital Photogrammetry 2.1 Define analytical photogrammetry. 2.2 Show the mathematical concept valued for all applications of analytical photogrammetry. 2.3 Give examples of departure from basic system. 2.4 Justify the need for analytical photogrammetry.					
	General Objective: 3.0 Understand the fundamental co-ordinate			**General Objective:**		

	system employed in analytical and Digital Photogrammetry.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Fundamental Co-ordinates System 3.1 Describe with the help of a diagram the photographic co-ordinate system. 3.2 Illustrate with diagrams different coordinate systems in object space, e.g. geocentric coordinate system, local space coordinate system, plane coordinate system. 3.3 Decide which coordinate system suits a given job in object space.					
	General Objective: 4.0 Know the other co-ordinate systems used.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Other Coordinate System 4.1 Sketch with diagrams the model coordinate system.					

	4.2 Sketch with diagram the strip coordinate system.					
	General Objective: 5.0 Know the instrumentation for analytical Digital photogrammetry.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Instrumentation for Analytical Photogrammetry 5.1 Explain the purpose of instrumentation. 5.2 List the types of instruments used in different phases of work. 5.3 Describe the characteristics of different mono and stereo-comparators and point transfer and marking devices. 5.4 Apply the operating principles of analytical plotters.					

	General Objective: 6.0 Understand various corrections to be applied to measured photo co-ordinates.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Corrections to Measured Photo Coordinates 6.1 Enumerate these correction e.g. identification, observation and recording errors, comparator errors, lens distortion, non-flatness of film, film deformation. 6.2 Explain each of them with mathematical formulae as applicable. 6.3 State why and which of these corrections are not applied in case of modern aerial cameras.					
	General Objective: 7.0 Know the corrections applied to co-ordinates in object space.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Corrections to Object Space Coordinates. 7.1 List the corrections e.g. atmospheric refraction,					

	earth's curvature, etc. 7.2 Explain each with the help of diagrams. 7.3 State in which system of coordinates earth curvature correction is not required.					
	General Objective: 8.0 Understand the basic mathematics involved in analytical Digital Photogrammetry.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Basic Mathematics in Analytical Photogrammetry. 8.1 Set up the transformation equations for linear conformal transformation in two dimensional space. 8.2 Differentiate between linear conformal and affine transformation in two dimensional space. 8.3 Explain the three dimensional similarity coordinate transformation. 8.4 List the properties of an orthogonal matric.					

	8.5 Construct a three dimensional rotation orthogonal matrix. 8.6 Linearise the three dimensional similarity transformation equations. 8.7 Derive the least square solutions for transformation parameters in different types of transformations. 8.8 Write down the computational procedures for different transformations.					
	General Objective: 9.0 Understand the different mathematical equations.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Mathematical Equations. 9.1 State the collinearity and co-planarity conditions. 9.2 Develop the collinearity and co-planarity condition equation. 9.3 Linearise these condition equations. 9.4 Explain their					

	applications, advantages and disadvantages. 9.5 Define the scale restraint condition. 9.6 Explain its application.					
	General Objective: **10. Know the basic steps to analytical triangulation.**			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Basic steps in Analytical Triangulation. 10.1 Enumerate the basic steps e.g. inner, relative and absolute orientation, strip and block formation. 10.2 Describe how each step is performed in analytical and analogue instruments. 10.3 Compare the analogue and analytical methods of transforming the information from the photographs into metric information about objects.					

	10.4 Determine three criteria used by Schut for classifications. 10.5 List the existing systems under these criteria.					
	General Objective: 11.0 Understand the analytical orientation procedures.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Analytical Orientation Procedures. 11.1 Describe the relationship between photo coordinates and comparator co-ordinate mono and stereo. 11.2 Define analytical orientation procedures. 11.3 Explain the purpose of inner orientation. 11.4 List the requirement of information about the camera parameters for inner orientation. 11.5 Explain the purpose and method of digital relative orientation.					

	11.6 Develop the mathematical model based on co-planarity condition. 11.7 Describe the method of computing model co-ordinates after relative orientation parameters have been determined. 11.8 Explain the purpose and method of digital absolute orientation. 11.9 Describe the iterative solution. 11.10 Specify the requirement of ground control for absolute orientation. 11.11 Explain how initial values for the parameters are obtained.					
	General Objective: 12.0 Understand strip formation from independent models.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Independent Model Strip Formation. 12.1 Specify the requirements for strip formation. 12.2 Differentiate between					

	the two cases: [a] models are independently observed on stero-plotters; [b] models are digitally constructed. 12.3 Write down the computations involved in proper sequence for both cases.					
	General Objective: 13.0 Know how to evaluate the different methods of adjustment			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Methods of Adjustment. 13.1 List the different methods. 13.2 Describe the procedures of sequential adjustment. 13.3 Describe the standard procedure of block adjustment by independent models. 13.4 Explain the "planimetry-height iteration" method.					

	13.5 Give the advantages of this "planimetry-height iteration" method. 13.6 State the application of independent model block adjustment. 13.7 Apply the extensions of the standard procedure of independent models to block adjustment. 13.8 State the procedure of simultaneous or bundle adjustment. 13.9 Derive the basic condition equations forming the basis of simultaneous adjustment method. 13.10 Evaluate the three methods of adjustment.					
	General Objective: 14.0 Know how to analyse the theoretical accuracy of analytical triangulation.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Accuracy of Analytical Triangulation. 14.1 State optimum bridging distance for a strip under given conditions. 14.2 Recognise the error propagation for a block.					

	14.3 Differentiate between the ground control configuration for planimetry and height. 14.4 Compare the results of investigations for independent models and bundle adjustments. 14.5 Explain the usefulness of the accuracy of results. 14.6 Analyse the theoretical accuracy of analytical triangulation.					
	General Objective: 15.0 Understand the basis of digital photogrammetry.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	15.1 Name the basic element of digital photogrammetry. 15.2 Define digital photogrammetry. 15.3 State the use and advantages of digital photogrammetry. 15.4 Describe the operation of a digital photogrammetry work station (DPW).					

MANAGEMENT COURSES AND PROJECT
(SUG 406 AND 408)

MANAGEMENT IN SURVEYING

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Management in Surveying			**COURSE CODE:** SUG 406		**CONTACT HOURS:** 15 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the basic functions of Management.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Functions of Management 1.1 Describe the nature of business management. 1.2 Formulate corporate plan. 1.3 Analyse the structure of an organisation. 1.4 Formulate appropriate leadership and motivational strategies. 1.5 Design appropriate managerial control					

	systems.					
	General Objective: 2.0 Know the general principles of organisation in relation to technical establishments.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Principles of Organisation 2.1 Analyse the manpower requirements of a survey establishment. 2.2 Explain the general principles underlying record keeping. 2.3 Explain the technical services required for field survey teams. 2.4 Explain the general principles of technical report writing. 2.5 Write a technical report. 2.6 Appraise the nature of the survey industry in Nigeria.					
	General Objective: 3.0 Understand the fundamentals of store control.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Store Control 3.1 Explain the general principles of store					

	control. 3.2 Explain the basic store procedures. 3.3 Explain the general principles of purchasing.					
	General Objective: 4.0 Know the basic principles of costing and estimating of survey work.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Costing and Estimating 4.1 Analyse current costs and overheads. 4.2 Evaluate client's requirements. 4.3 Estimate survey work including survey field work, photogrammetry, drawings and reproduction. 4.4 Explain the basic principles of book-keeping and budgeting procedures. 4.5 Prepare a budget for survey industry.					
	General Objective: 5.0 Understand **the policies and procedures that**			**General Objective:**		

	take account of the human factors in employment.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Human Factor in Employment 5.1 Explain the general nature of personnel management. 5.2 Analyse the basis of employee selection. 5.3 Analyse various safety, welfare and health provisions. 5.4 Analyse the factors influencing wages and salaries administration. 5.5 Analyse the various training methods. 5.6 Explain labour turnover and absenteeism.					
	General Objective: 6.0 Know the basic legal frame work relating to commerce and industry.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Legal Framework 6.1 Explain the law of contract, company law and law of tort. 6.2 Analyse the concept of contract.					

	6.3 Evaluate the contract of service and contract for services. 6.4 State liabilities of parties (i.e. employers and employees). 6.5 Explain the importance of welfare and compensation of workers in law. 6.6 Analyse the law relating to copyright. 6.7 Explain professional liability and indemnity.					
	General Objective: 7.0 Know the place of Personnel Department in an organisation and the use of organisational chart.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Personnel Department 7.1 Explain the place of the personnel department in an organisation. 7.2 Explain the functions of each section of the personnel department. 7.3 Explain the uses of organisation charts. 7.4 Draw organisation charts for various types of surveying and mapping orgaanisations.					

PROJECT

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Project			**COURSE CODE:** SUG 408		**CONTACT HOURS:** 150 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Articulate an aspect of Survey and Geoinformatics that is of interest.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Choice of Project Topic 1.1 Choose a project topic of interest for study. 1.2 Determine the project goal. 1.3 Prepare a proposal on how the project will be carried out. 1.4 State the kinds of data and equipment required for the project and how they can be gotten. 1.5 Project the cost					

	implication of carrying out the project.					
	General Objective: 2.0 Know how to procure, analyse and document data.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Data Collection and analysis 2.1 Collect necessary data relating to the chosen project. 2.2 Collate the information gotten in 2.1 above in accordance to standard survey procedures and regulations. 2.3 Analyse the collated information. 2.4 Synthesise the analysed information to ascertain if the intended goal is being achieved. 2.5 Compile the information in 2.4 above.					
	General Objective: 3.0 Know how to present compiled data.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Geoinformation Presentation 3.1 Present Geoinformation					

	with hard and or soft copy.					
	General Objective: 4.0 Know how to produce a standard report on the project explaining the theoretical and practical processes gone through.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Project Report 4.1 Prepare a report containing all the data collected and analysed, the data compiled on which basis the Geoinformation were produced and detailed analysis of all the processes gone through in achieving the project goal, giving images, tables, figures, and illustrations as necessary. 4.2 Submit typed and bound report along with					

	the original of data collected, process and presented were necessary.					

ADJUSTMENT COMPUTATIONS AND SURVEY INSTRUMENTS
(SUG 305, 310 AND 405)

ADJUSTMENT COMPUTATIONS I

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Adjustment Computations I			**COURSE CODE:** SUG 310		**CONTACT HOURS:** 90 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the basic concepts in the theory of errors.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Theory of Errors 1.1 Describe the general nature of errors. 1.2 Explain the normal law of errors and its properties. 1.3 Explain normal, average and probable errors. 1.4 Explain the importance of confidence levels. 1.5 Illustrate the uses of standard deviation as					

	providing the basis for rejection of observations.					
	General Objective: 2.0 Understand the principle of least squares.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Principles of Least Squares 2.1 State the principal purpose of adjustment. 2.2 Describe the concept of adjustment. 2.3 Define the principle of least squares. 2.4 Relate the theory of errors to the principle of least squares. 2.5 Illustrate graphically the principle of least squares. 2.6 Give a statistical illustration of the principle of least squares. 2.7 Solve simple numerical					

	problems applying the principle of least squares. 2.8 State the major techniques for least squares. 2.9 Compare the advantages and disadvantages of a least squares solution.					
	General Objective: 3.0 Understand the basis of the adjustment of surveys by least squares using observations and condition equations.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Adjustment of Surveys by Least Squares 3.1 Explain the differences between observation and condition equations. 3.2 Define independent equations. 3.3 Enumerate the various terms used to identify the method of indirect observations and direct observations. 3.4 Write down the general observations equation. 3.5 Indicate the dimension of matrices involved. 3.6 Derive the normal					

	equations from the observation equations and condition equations in least squares adjustments in metric notation. 3.7 Derive the observation equation for distances, bearings and angles. 3.8 Apply weight to observation equation. 3.9 Define internal and external consistency in geodetic control networks. 3.10 Differentiate between angle and side conditions. 3.11 State the formulae for determining the number of conditions in different geodetic networks. 3.12 Form condition equations for different simple network, e.g. brased qualdrilateral.					
	General Objective: 4**.0 Understand the use of normal equations in parametric adjustments.**			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	Parametric Adjustments 4.1 Differentiate between linear and non-linear equations. 4.2 Show how to linearise a non-linear equation. 4.3 Form normal equations for calculation of corrections to be applied to approximate quantities. 4.4 State the properties of normal equations. 4.5 Write down the normal equations using the Gaussian algorithms. 4.5 Solve the normal equations. 4.6 Use the final corrections and the adjusted values to calculate the residual Vector. 4.7 Use the residual vector and the degree of freedom (redundancy) to calculate posterior variance factor. 4.8 Form the equation to compute the variance-covariance matric 4.9 Use the variance-convariance matric to					

	compute the accuracies associated with individual parameters.					
	General Objective: 5.0 Know the procedure for adjusting secondary triangulation by least squares.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Adjustment of Secondary Triangulation 5.1 Determine the number of conditional equations in the network. 5.2 Deduce angle equations and side equations. 5.3 Carry out check on the formation of the condition equations (figural, centra, side) and observation equations.					
	General Objective: 6.0 Know how to carry out the computation and least squares adjustment of secondary traverse.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	Secondary Traverse 6.1 Explain how to determine the number of condition equations in a traverse 6.2 Explain how to form condition equations (angular/direction and two coordinates equations) 6.3 Form normal equations from the observation equations. 6.4 Solve normal equations using any known method e.g. triangulation, causidal siedel, jacobi, elimination. 6.5 Compute corrections to bearings and lengths to obtain adjusted coordinates. 6.6 Compute corrections to coordinates. 6.7 Adjust accordingly. 6.8 Compute the standard error of final adjusted values.					
	General Objective: 7.0 Know how to reduce geodetic levels and adjust levels nets by least squares.			**General Objective:**		

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	Geodetic Levels Reduction and Adjustment 7.1 Explain the computational principles of adjusting geodetic level net with consideration or orthometric and dynamic heights corrections. 7.2 Carry out all necessary corrections to level lines. 7.3 Determine the number of condition equations in level network 7.4 Form condition equations for a level network. 7.5 Compute the weights for all level lines in the network 7.6 Form normal equations from the condition equations. 7.7 Solve the normal equations to arrive at the corrections to be applied to each line. 7.8 Compute the final height for each station					

	in the network. 7.9 Assess the accuracy of determined values.					

ADJUSTMENT COMPUTATIONS II

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Adjustment Computations II			**COURSE CODE:** SUG 405		**CONTACT HOURS:** 90 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Know the full capabilities of programmable calculations.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Programmable Calculators 1.1 Describe the use of stack operation for storage of input in calculators. 1.2 State the direct and indirect storage and retrieval method. 1.3 Use subroutines, tests and return functions. 1.4 Write programmes to solve survey problems. 1.5 Write instructions to use					

	calculator programs.					
	General Objective: 2.0 Know how to improve the understanding of survey adjustments by least squares.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Adjustment by Least Squares 2.1 Adjust triangulation with measured angles. 2.2 Adjust triangulation with measured directions. 2.3 Adjust triangulation in phases 2.4 Adjust level network 2.5 Outline the adjustment of a trilateration network. 2.6 Outline the adjustment of a triangulation network. 2.7 Evaluate the accuracies of determined quantities from the variable-covariance matrix.					
	General Objective: 3.0 Understands the procedure of adjusting traingulation-cum-traverse network by least squares.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Triangulation-Cum-Traverse					

	Network 3.1 Reduce the observed data 3.2 Carry out the station adjustment. 3.3 Form the normal equations from condition equations. 3.4 Form the normal equations from observation equations. 3.5 Solve the normal equations. 3.6 Assess the accuracies of computed values.					
	General Objective: 4.0 Know how to compute and adjust large network.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Large Network Adjustment 4.1 Apply correction to the measured quantities in primary traverse, triangulation and triangulation 4.2 Explain the principles of computing by variation of co-ordinate. 4.3 Compute approximate					

	parameters. 4.4 Form observation or condition equation using computer program. 4.5 Form normal equation. 4.6 Solve the normal equation. 4.7 Adjust the network. 4.8 Form the residual vector. 4.9 Form variance co-variance matrix. 4.10 Carry out error analysis.					

SURVEY INSTRUMENTS II

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Survey Instruments II			**COURSE CODE:** SUG 305		**CONTACT HOURS:** 45 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the working principles, construction, adjustment and use of the precise levels and auxiliary equipment.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Precise and Digital levels 1.1 Explain the working principles of the parallel-plate micrometer. 1.2 Describe in detail the salient features of precise levels e.g. Zeiss N.1/Wild N3. 1.3 Adjust the precise level. 1.4 Explain the special features of a reversible			1.1 Carryout adjustment of the precise level. 1.2 Carryout adjustment of precise theodolite like Wil T3. 1.3 Carryout calibration of EDM. 1.4 Carryout measurement using EDM instruments. 1.5 Illustrate the calibration and use of the echo-sounder.		

	level. 1.5 Explain the working principles of the automatic level and digital level. 1.6 Evaluate the advantages of an digital level as compared with ordinary levels. 1.7 Describe the auxilliary equipment used in precise levelling.					
	General Objective: 2.0 Know how to distinguish between ordinary theodolites and geodetic theodolites.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Geodetic Theodolites 2.1 Explain the graduation of the horizontal and vertical circles of the geodetic theodolite e.g. Wild T3. 2.2 Explain how the micrometer readings of the circles are taken and angles deduced in the Wild T3 theodolite. 2.3 Carry out the adjustment of the Wild					

	T3 theodolite. 2.4 Outline the distinguishing features of the T3 theodolite as compared with T2 theodolite.					
	General Objective: 3.0 Understand the principles, adjustments and observational procedure of the astronomical theodolite.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Astronomical Theodolite 3.1 Explain the principles of the broken telescope design. 3.2 Explain the working principles of the astronomical theodolite e.g. Wild T4 Kern DKM3. 3.3 Describe in detail, specific features of the instrument e.g. the reticule system of fixed and movable plates, eye-piece micrometer, striding level, Horrebow level.					

	3.4 Set up an astronomical theodolite. 3.5 Describe the adjustments required in the instrument. 3.6 Carry out observations with the instrument.					
	General Objective: 4.0 Understand the principles and classification of EDM instruments.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Electromagnetic Distance Measurer 4.1 Give an account of the historical background of EDM instruments. 4.2 Explain the classification of EDM instrument into MDM, EODM. 4.3 Explain the basic physical principles of EDM carrier signals/signal/modulation (AM/FM) polarisation/demodulation. 4.4 Explain the working of signal radiators and					

	receivers. 4.5 Explain the processes of signal reflection and amplification. 4.7 Explain the principle of phase comparison. 4.7 Explain the measuring principles of various types of instruments. 4.8 Calibrate EDM. 4.9 Carry out measurements using EDM instruments. 4.10 Evaluate the advantages of Ga As as the light source in short distances.					
	General Objective: 5.0 Understand the special features of the Mekometer.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Mekometer 5.1 Identify the principal distinguishing features of the mekometer. 5.2 Describe the modulation system (polarisation). 5.3 Describe the phase measure procedure. 5.4 Explain the optical					

	principle. 5.5 Describe the measurement procedure. 5.6 Enumerate the advantages of the mekometer.					
	General Objective: 6.0 Understand the working principles of the prismatic astrolabe.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Prismatic Astrolabe 6.1 Explain the principle of the prismatic astrolabe (45_0). 6.2 Describe the instrument, identifying its different parts. 6.3 Explain the function of the attachments deflecting prisms, duplicating prism.					
	General Objective: 7.0 Understand the working principles, adjustments and use of a sextant.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Sextant					

	7.1 Explain the basic optical principle of the sextant. 7.2 Describe the construction and parts of a sextant. 7.3 Explain the use of true and artificial horizons.					
	General Objective: 8.0 Understand the working principles, and uses of the Echo-sounder.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Echo-Sounder 8.1 Explain the fundamental principles of the echo-sounder. 8.2 Distinguish between sonic and supersonic (ultrasonic) systems. 8.3 Illustrate the calibration and use of the instrument.					
	General Objective: 9.0 Understand the working principles, construction and operation of the Gyro-theodolite.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Gyro-Theodolite					

	9.1 Give an account of the historical background of the application of gyroscopes to surveying. 9 .2 Explain gyroscopic inertia and procession. 9.3 Describe the working principles of a gyroscope. 9.4 Explain the working principle of the gyro-theodolite. 9.5 Explain the operation of a gyro-theodolite i.e. method of setting up, running up, reasing and controlling the amplitude. 9.6 Describe the measuring operation (index with moving gyromesh and auxiliary scale), transit method. 9.7 Explain the attainable accuracy of different models. 9.8 Observe procedures of different models.					
	General Objective: 10.0 Understand the principles involved and equipment used in position-fixing by satellite.			**General Objective:**		

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	Position Fixing by Satellite 10.1 Give an account of the historical background of position-fixing by satellite. 10.2 Explain the Doppler shift of frequency and its use in position-fixing by means of satellite systems. 10.3 Describe the global positioning system. 10.4 Describe typical position-fixing equipment e.g. Magnavox MX 2502, the wild WM101, for recording and computing satellite data and display of 3 - dimensional fix results. 10.5 Explain the position-fixing technique, with special reference to: i] satellite signals:					

	stable frequencies for Doppler measurements, timing signal, predicted orbital parameters. ii] the Doppler measurement-minimum observations required for a fix.					
	General Objective: 11.0 Understand the use of lasers in surveying.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Lasers 11.1 Explain the historical background of the development of the laser. 11.2 Describe the special qualities of the laser beam i.e. intensity of power, small divergence, coherence and monochromatic. 11.3 State the principles of precision alignment by					

	laser and its advantages over the traditional method. 11.4 Describe current examples of laser theodolite and levels. 11.5 Explain the basic methods of distance measurement by laser. 11.6 Enumerate the safety regulation for laser instruments.					
	General Objective: 12.0 Understand the general characteristics, construction and operation of laser EDM equipment e.g. Geodimeter 8.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Laser EDM Equipment 12.1 Describe the general features of laser EDM instruments with particular reference to the range, accuracy, time required for observations, power consumption, etc. 12.2 Explain the use of laser beam in the geodimeter 8 and the function of the beam expander, cylindrical lens and the					

	optical filter in this connection. 12.3 Describe the construction of the geodimeter in detail:- i] built-in power unit; ii] optical unit - laser, modulation system, transmission optics, receiver unit, photo-electrical and phase-comparison unit; iii] electronic unit-sub-units, high voltage transmitter, reference oscillator, mixer, amplifier/detector; and iv] control unit.					
	General Objective: 13.0 Understand the working principles of electronic theodolites and total stations.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	Electronic Theodolites and Total Station 13.1 Describe the working principles of the electronic theodolite. 13.2 Give a detailed description of a current model of electronic theodolite. 13.3 Explain the significance of the term total station. 13.4 Describe the working principles and capability of current models of total stations. 13.5 Explain feature coding data logging and data transfer. 13.6 Use electronic theodolite to survey a given parcel of land.					
	General Objective: 14.0 Understand the basic working principles of inertial surveying equipment.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Principles of Inertial Surveying 14.1 Explain the basic principles upon which					

	inertial surveying depends. 14.2 Outline the working principles and performance of a typical model inertial surveying equipment.					

COMPUTER COURSES
(SUG 315 AND 316)

FUNDAMENTALS OF COMPUTER

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Fundamentals of Computer			**COURSE CODE:** SUG 315		**CONTACT HOURS:** 30 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Know the definitions of computer, bit and byte.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Define computer. 1.2 Define bit and bytes.					
	General Objective: 2.0 Know the history of Computer.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	2.1 Describe 1st generation computers. 2.2 Describe 2nd generation computer. 2.3 Describe 3rd generation computer.					

	General Objective: 3.0 Know types of computers.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	3.1 Describe micro/Desktop 3.2 Describe mainframe computer 3.3 Programmable calculatory					
	General Objective: 4.0 Know the structure of computer.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	4.1 Describe ALG 4.2 Describe CPU 4.3 Describe Memories 4.4 Explain MS-DOS Commands and winds					
	General Objective: 5.0 Know the application software.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	5.1 Explain word processing 5.2 Describe spread sheet 5.3 List statistical lications					
	General Objective: 6.0 Know Networking.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**

	6.1 Explain LAN 6.2 Explain WAN					

COMPUTER APPLICATIONS

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Computer Applications			**COURSE CODE:** SUG 316		**CONTACT HOURS:** 45 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Know BASIC, Fortran, and other Programming Languages.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Review Trigonometric function 1.2 Review Arithmetic functions 1.3 Review Relational expressions 1.4 Review Logical operators 1.5 Review constants and variables. 1.6 Explain random file access					
	General Objective: 2.0 Know dBASE			**General Objective:**		

WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	2.1 Explain control center 2.2 Explain Indexing 2.3 Explain Sorting 2.4 Structured query language 2.5 Dot prompt 2.6 State commands. 2.7 State Set Commands 2.8 State function 2.9 State system variables					
	General Objective: 3.0 Know programme writing for survey computation.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	3.1 Write programme for bearing computation 3.2 Write Programme for Area computation 3.3 Write programme for Traverse Computation 3.4 Write programme for geodetic 3.5 Write programme for transfer nation 3.6 Write programme deviation and standard 3.7 Write programme for tachometry 3.8 Write programme for					

	matrix multiplication inversion 3.9 Write programme for solving linear equations.					

ELEMENTS OF ENVIRONMENTAL STUDIES

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Elements of Environmental Studies			**COURSE CODE:** GIT 412		**CONTACT HOURS:** 30 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Understand the characteristics of population dynamics and impact on the environment.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Specific Objectives 1.1 Define population 1.2 Explain the relationship between biotic potential, environmental resistance, population growth and population density. 1.3 Explain the processes of evolution, natural selection and differential					

	reproduction. 1.4 Discuss factors affecting population size. 1.5 Discuss growth rate, rate of change, birth rate, death rate of population. 1.6 Discuss survivorship courses, fertility rate and its importance. 1.7 Discuss age pyramids and their significance. 1.8 Discuss health hazards of population pressures. 1.9 Explain the impact of low population density growth rate on the environment.					
	General Objective: 2.0 Understand the fundamental ecological concepts and climatic changes.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Ecological Concepts 2.1 Define ecology. 2.2 Explain the following terms: human ecology, bio diversity, cycle, community, energy, ecological niche, ecosystem, biosphere,					

	biotic and abiotic environmental. 2.3 Define system, open systems and cybernetic system. 2.4 Identify the relationship between systems sub-systems and super-systems. 2.5 Explain in what respect are all biological systems are both open and cybernetic systems. 2.6 Define weather, climate and its elements. 2.7 Discuss the science and development of climatology. 2.8 Explain climate change, climate system and satellite casting. 2.9 Discuss climate change on the environment. 2.10 Discuss the impacts of climatic changes on agriculture, industry, human health and other aspects of human endeavours (e.g. water bodies, vegetation, soil, land forms etc.).					

	General Objective: 3.0 Understand the basic principles of resources management .			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Principles of Resources Management 3.1 Define a resource. 3.2 Explain wild-life resources management. 3.3 Explain the management of energy resources. 3.4 Discuss water resources management. 3.5 Discuss the management of mineral resources. 3.6 Define environmental impact assessment. 3.7 Discuss the use of data in environmental impact assessment. 3.8 Discuss the contents of environmental impact assessment. 3.9 Explain the methods of assessing the environment. 3.10 Discuss hydrological resources management.					
	General Objective: 4.0 Understand the basic principles of Geographical			**General Objective:**		

	Information System and its application in Environmental Monitoring and Protection.					
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	Geographical Information System in Monitoring and Protection 4.1 Define Geographical Information System (GIS). 4.2 Define environmental monitoring 4.3 Discuss the basic principles of Geographical Information System. 4.4 Discuss the application of information technology in environmental monitoring 4.5 Discuss the basic elements of environmental monitoring. 4.6 Explain the use of GIS in environmental monitoring and protection.					

BASIC PRINCIPLES OF GEOINFORMATICS

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Basic Principles of Geoinformatics			**COURSE CODE:** GIT 304		**CONTACT HOURS:** 30 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Know the historical development of GIS.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Describe the evolution of GIS start from computer anoted mapp -DMS - GIS 1.2 Explain the additional functions added from one phase to the other e.g. DMS + DBMS – GIS					
	General Objective: 2.0 Know the components of GIS.			**General Objective:**		

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	2.1 List the components of a GIS 2.2 Describe the relationship using the components					
	General Objective: 3.0 Know the applications.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	3.1 List the main application of GISs. 3.2 Describe the benefits of GIS in each application.					
	General Objective: 4.0 Understand the nature of spartial object.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	4.1 Explain the component of spartial object. 4.2 Explain the acquisition of each component. 4.3 Describe the storage of each component in the database.					
	General Objective: 5.0 Know the components of a Database.			**General Objective:**		

WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	5.1 List the components of a database. 5.2 Describe the use of each component. 5.3 Describe the relationship among the components.					
	General Objective: 6.0 Understand the arrangement of date in the database.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	6.1 Describe data layer. 6.2 Explain justification for storing data in layers. 6.3 Explain concept of data integration. 6.4 Compare data layer approach with data integration approach.					
	General Objective: 7.0 Know the subsytems of a GIS.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	7.1 List the subsystems of a GIS. 7.2 Describe the function of each subsystem.					

	General Objective: 8.0 Understand Land information system.			General Objective:		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	8.1 Identify components of a Land information system. 8.2 Differentiate between LIS and GIS 8.3 Describe application of LIS.					

DIGITAL MAPPING AND CARTOGRAPHY

PROGRAMME: HIGHER NATIONAL DIPLOMA (ND) SURVEYING AND GEOINFORMATICS						
COURSE: Digital Mapping and Cartography			**COURSE CODE:** GIT 405		**CONTACT HOURS:** 60 Hours	
Course Specification: Theoretical Contents				**Practical Content**		
	General Objective: 1.0 Know the digital mapping system.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	1.1 Define digital mapping system. 1.2 Explain the components of digital mapping system. 1.3 List digital mapping input & output devices.			1.1 Carryout exercises with a digital mapping software e.g. KORK,Desktop Mapping System. 1.2 Create a topographic database with any GIS software.		
	General Objective: 2.0 Understand digital mapping software.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning**	**Specific Learning Objective**	**Teachers Activities**	**Learning**

			Resources			**Resources**
	2.1 List digital mapping software. 2.2 Explain the capabilities of digital mapping software. 2.3 Carry out exercise with digital software.					
	General Objective: 3.0 Understand the development of digital mapping data base.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	3.1 Create digital mapping data base. 3.2 Develop digital topography Database. 3.3 Carryout exercise on digital mapping system.					
	General Objective: 4.0 Know the digital cartographic system.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	4.1 Define digital cartographical system. 4.2 Explain the component of digital cartography system 4.3 List digital cartographic					

	input and output devices					
	General Objective: 5.0 Know digital cartographic software.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	5.1 List digital cartographic software 5.2 Explain the capability of digital cartographic software 5.3 Carryout exercise with digital cartographic software					
	General Objective: 6.0 Understand the production of maps.			**General Objective:**		
WEEK	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**	**Specific Learning Objective**	**Teachers Activities**	**Learning Resources**
	6.1 Describe the procedure for the production of maps & charts 6.2 Produce maps and charts at various scales & forms. 6.3 Explain the production of auto photo maps and mosaks. 6.4 Explain the production of image map.					
	General Objective: 7.0 Know the production of digital terrain model.			**General Objective:**		

WEEK	Specific Learning Objective	Teachers Activities	Learning Resources	Specific Learning Objective	Teachers Activities	Learning Resources
	7.1 Describe the component of DTM 7.2 Carryout exercises on various DTM.					